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From: Tom Ferraro, P.G.
Date: 8/15/97

PLEASE BE ADVISED WE ARE SENDING THE FOLLOWING: ☐ Enclosed ☐ Under separate cover via

☐ Draft Text
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☐ Written Comment Responses
☐
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NUMBER OF COPIES	DESCRIPTION
3	Former Griffiss Air Force Base Expanded Site Investigation (ESI) Work Plan Written Comments/Responses

THESE ITEMS ARE BEING TRANSMITTED:

☐ As requested
☐ Approved with corrections noted
☐ To submit for distribution
☐ To resubmit for approval
☐ Returned with corrections
☐ For your review and comments

Comments: Please find enclosed copies of the above-noted written responses to comments provided by the New York State Department of Environmental Conservation (NYSDEC) on July 23, 1997. Some of the responses are based on the discussions which occurred during the subsequent conference call held on July 29, 1997. These comment responses were inadvertently left out of the copies of the Draft ESI Work Plan sent to your office from Ecology and Environment, Inc. (E & E) on August 13, 1997. These copies may be inserted into the three- ring binders previously sent. E & E apologizes for any minor inconvenience this causes.

cc: Mr. Douglas Pocze (EPA Region II)

FORMER GRIFFISS AIR FORCE BASE
DRAFT EXPANDED SITE INVESTIGATION WORK PLAN
WRITTEN COMMENTS/RESPONSES
AUGUST 1997

On July 29, 1997, a conference call was conducted to discuss the written comments provided by the New York State Department of Environmental Conservation (NYSDEC) regarding the scope of work for the expanded site investigations (ESIs) at 12 areas of interest (AOIs) at the former Griffiss Air Force Base, in Rome, New York. Participating in the call were Mr. Jonathan Greco of NYSDEC, Mr. Douglas Pocze of the U.S. Environmental Protection Agency (EPA), Ms. Cathy Jerrard of the Air Force Base Conversion Agency (AFBCA), Mr. Frank McStay of the U.S. Army Corps of Engineers Kansas City District (USACE), and Mr. Tom Ferraro and Mr. Don Johnson of Ecology and Environment (E & E). These responses document the agreements that were reached during the call.

Comment Author:	**Jonathan Greco (July 23, 1997)**
Author's Organization:	**New York State Department of Environmental Conservation (NYSDEC)**

AOI 7: Former Base Firing Range Near the Sky Line Housing Development

Comment 1:
An internal review of the scoped work has revealed that analysis for additional compounds is needed.

If the firing range was used specifically for small arms then the contaminants of concern that should be analyzed are lead, copper, and phosphorus; if the range was used for more extensive training then other contaminants may be in the form of metallic salts, which have been identified as components of such items as tracer ammunition, ignitor compositions, incendiary ammunition flares, colored smoke and primer explosive compositions. In particular, barium nitrate, lead stearate, lead carbonate, and mercury fulminate are potential metal salts or complexes which are components of ammunition that may have been tested or disposed of at this range as well, based upon our experience with similar ranges.

The sampling of the appropriate analytes beyond lead can be done on a limited basis, e.g., 40% to 50% of the sampling locations.

Response 1:
As discussed during the July 29, 1997 conference call, review of historical aerial photographs of this former firing range indicates that the range was most likely used for small-arms practice only. Therefore, copper and phosphorus analysis will be performed at approximately 50% of the near-surface soil locations and on the samples from the temporary wells/borings. Lead analysis will be performed at all sampling locations.

leave question open.
Unless GAFB can say
definetly small arms, then
we need to push for more
analysis MC 8/19/97

AOI 9: Weapons Storage Area Landfill

Comment 1:
The seeps which were identified in the initial site walkover, but not sampled during the SI because they were dry, must be sampled during the ESI if present. The analytical suite must be full TCL TICs and TAL.

Response 1:
During the earlier confirmatory sampling (CS) at this site, all seeps that were present were sampled. An additional seep, if present, will also be sampled as part of the expanded site investigation (ESI).

Comment 2:
The sampling suite is too limited (i.e, VOCs only). While VOCs were the primary cause for concern in the initial SI, that data set is too limited to curtail the analytical suite. Metals were shown to be a problem in certain samples, while pesticides and PCBs were not analyzed (despite an August 1, 1995 letter which states that the full TCL would be analyzed for in groundwater). Because of the new information that this was once the site of two storage igloos which stored unspecified hazardous wastes, all sampling must be for the full TCL, TAL, TICs, and TRPH. Please ensure that detection levels for pesticides and PCBs are appropriate to enable a comparison with the NYS standards.

Response 2:
The analyses for the ESI at this AOI have been included as requested.

Comment 3:
Subsurface soil samples (i.e., 0 to 2-foot and 2 to 4-foot intervals) should be added to the plan for the southern-most igloo. These samples may be taken from the G009-MW02 monitoring well boring.

Response 3:
Subsurface soil samples at the intervals specified are included in the scope of the ESI at this AOI.

Comment 4:
All boring locations should have a shallow surface soil sample added to the plan (i.e., 0 to 3 inches) so direct contact scenarios may be assessed properly.

Response 4:
Shallow (0 to 3 inches BGS) soil samples have been included in the scope of the ESI at this AOI as requested.

AOIs 16 and 193: Pads 7 and 5

Comment 1:
Please contact me to discuss moving well G016-MW02 due east until just off the storage pad. I would also like to discuss moving G016-MW01 in a northwesterly direction until just off the storage pad, but still on the north side of the 66-inch storm drain.

Response 1:
As discussed in the 7/29/97 conference call, the planned location for permanent monitoring well G016-MW02 has been moved east off the storage pad as requested. The planned location for G016 will remain at the location originally proposed (southwest of LS01 and north of the 66-inch storm drain.

AOI 17: Former Disposal Area

Comment 1:
Please move G017-SS02-GW southwest to an area just north of the CE services road (roughly near the C of "CE Service..." on Figure 3-6).

Response 1:
Temporary well G017-SS02 will be drilled at the location requested providing the results of the geophysical survey indicate there is no fill present at that drilling site.

Comment 2:
As discussed in our June 24, 1997 meeting, the taking of soil samples in borings located adjacent to the site is to be avoided. In place of those samples, it was suggested that a minimum of six surface samples be collected.

Response 2:
The collection of surface (0 to 2 feet BGS) soil samples from the three temporary well borings has been removed from the scope. Six near-surface (0 to 0.25 foot BGS) soil samples will be collected from the cover of the landfill as requested.

Comment 3:
As discussed in the June 24, 1997 meeting, a minimum of three test pits should be dug at the site based upon the outcome of the geophysical survey. Each test pit should be sampled for full TCL, TAL, TICs, and TRPH.

Response 3:
As discussed during the 7/29/97 conference call, the excavation of test pits will be considered based on the entire results (geophysics and soil and groundwater quality) of the ESI. If deemed appropriate, test pits will be scoped as part of a subsequent investigation at this AOI.

Comment 4:
A study of the existing cover material is to be performed. It is my understanding that this will include a thorough document search for "as built" drawings of the cap (if applicable), as well as a visual inspection of the cover and, perhaps permeability testing of the existing cover.

Response 4:
As discussed in the 7/29/97 conference call, the search for as-built drawings of the cover for AOI 17 will be performed as requested. Descriptions of the cover based on visual inspection during near-surface sampling will also be provided in the ESI report. However, permeability testing of the cover will not be performed as part of the ESI.

AOI 24: CE Road Paint Dump Areas

Comment 1:
As discussed in our June 24, 1997 meeting, it would be better to take a greater number of samples using a less costly analysis (i.e., field analysis, XRF, etc.) than using a pre-established number of samples in an effort to define the area of lead contamination. Once the areal extent is known, confirmatory samples could be taken if risk assessment quality data is deemed necessary.

Response 1:
The number of near-surface (0 to 3 inches BGS) soil samples has been increased to 20 in southeast site and 24 in the northwest site to provide better areal coverage of these areas. Analysis for lead using the Inductively Coupled Plasma (ICP) analysis technology will be performed off site on each of these samples.

Comment 2:
For the purpose of establishing possible human health impacts, a significant number of the soil samples must come from the 0- to 3-inch range, as this is the depth of soils most encountered by residential recreational users.

Response 2:
The depth of the near-surface soil samples will be 0 to 3 inches (where practical) as requested. In certain instances, the composition of the upper 3 inches contain excessive rocks, organic material, and fill and may not be appropriate for analysis. A slightly deeper sample may be needed.

Comment 3:
Since "recreational use" is a poorly defined scenario, and since no discussion is made of deed restricting the groundwater, the NYSDEC must assume future groundwater consumption is a possibility. Since the initial groundwater sampling did indicate several metals at concentrations in excess of State and federal standards, monitoring wells need to be installed in an appropriate locations. These wells should be sampled for total metals (i.e., not filtered) volatiles, semi-volatiles and TICs. The preliminary sampling was sufficient to rule out potential contaminants.

Response 3:
As discussed during the 7/29/97 conference call, the groundwater results from the CS performed at this AOI did not indicate a significant concern regarding groundwater, therefore, no additional groundwater samples are planned as part of the ESI at this AOI.

Comment 4:
Several PAHs were found in excess of NYSDEC guidance in the limited sampling performed. <u>All</u> laboratory-analyzed soil samples must include semi-volatile analysis.

Response 4:
Analysis for polycyclic aromatic hydrocarbons (PAHs) will be performed on 50% of the near-surface soil samples collected at both of the areas to be sampled.

AOIs 58 and 101: P3 Building

Comment 1:
As discussed at the June 24, 1997 meeting, please do not take soil samples from borings located beyond the area of suspected disposal. Please place the six soil samples specified for this site within the boundary of disposal: three samples from the northern part of the AOI (in the 101/185 area) from the 0- to 2-foot depth; and three samples interspersed throughout the remainder of the site (two of those may be from G058-MW01, as originally planned).

Response 1:
Three shallow subsurface (2 to 4 feet BGS) soil samples will be collected at AOI 101, and three subsurface (2 shallow and 1 above groundwater interface) will be collected at AOI 58 as agreed to during the 7/29/97 conference call.

Comment 2:
Please move G058-MW01 to an area north of building 14.

Response 2:
The location of G058-MW01 has been moved north of building 14 as requested.

Comment 3:
Please sample 26MB-3 to see if it is the source of contamination seen at G058-SS01. This well will also provide useful hydrologic data for the site.

Response 3:
As agreed during the 7/29/97 conference call, well 26MB-3 will be sampled for TRPH as part of the ESI at AOI 58. Water level measurements will also be obtained from the three 26 series wells for use in determining groundwater flow direction in this area.

AOI 67: Building 700

Comment 1:
As discussed in our June 24, 1997 meeting the large spacing between sample locations, combined with the fact that two-thirds of the samples are <u>outside</u> the former storage area, is not sufficient for defining site contamination.

I suggest relocating the entire eastern-most column of sample points to an area <u>within</u> the former storage area. Also, several additional samples beyond those referenced above should be placed within the area to properly define contamination.

Response 1:
As discussed in the 7/29/97 conference call, the locations of the near-surface (0 to 6-inch BGS) samples at this AOI have been adjusted as requested.

Comment 2:
The limited groundwater sampling performed to date revealed contaminants above risk-based criteria. It is too early to be dismissing further investigation of the groundwater.

Response 2:
As discussed in the 7/29/97 conference call, three groundwater samples were collected at this AOI during the CS investigation. Levels of organics found in the groundwater were extremely

Response 1:
As discussed during the 7/29/97 conference call, the direction of groundwater flow at this AOI is uncertain because of the suspected presence of a groundwater divide nearby and a relatively flat groundwater flow gradient. As agreed to during the call, the planned locations of the three wells (directly north, east, and west of the former entomology building) will not change.

low, in fact, below NYSDEC guidance values. No groundwater samples will be collected during the ESI at this AOI.

AOI 100: Paint Staging Area

Comment 1:
Please add one monitoring well immediately downgradient of the drywells (near sample SS17).

Response 1:
The planned location for monitoring well G100-MW03 has been moved downgradient of the hand dug wells near SS17 as agreed to during the 7/29/97 conference call.

Comment 2:
Please move G100-MW02 to the former location of LS-13.

Response 2:
The planned location for the G100-MW02 well has been moved approximately 100 feet downgradient from the suspected paint dumping area as agreed to during the 7/29/97 conference call.

Comment 3:
Please move MW03 to the southwest side of the side of the circle (near SS19).

Response 3:
See response to comment 1 (AOI 100) above. There will not be a well on the southwest side of the concrete circle as agreed to during the 7/29/97 conference call.

Comment 4:
As discussed, too many of the soil samples are beyond the area thought to be impacted. Please reduce the sampling grid by a factor of two.

Response 4:
As agreed to in the 7/29/97 conference call, the soil sampling grid has been reduced to focus on the area where the paint dumping is thought to have occurred (based on aerial photo review).

Comment 5:
The upgradient well is very far from the site. Please move it closer so we can be certain the hydrologic data is meaningful (i.e, that there are no storm drains, culverts, etc., which may be influencing the groundwater level of one of the wells, but not the others).

Response 5:
The planned location for upgradient well G100-MW01 has been moved 150 feet southwest and closer to the site as requested. As discussed during the 7/29/97 conference call, there are no storm drains or culverts known to exist in this area.

AOI 102: Lindane Spill

Comment 1:
Please schedule a telephone conference call to discuss well placement for this site.

Field Sampling Plan, Health and Safety Plan, and Quality Assurance Project Plan for the Expanded Site Investigation Program at Griffiss Air Force Base, Rome, New York

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Table of Contents

Section Page

Acronym List xi

Executive Summary 1

1 Introduction 1-1
  1.1 Purpose and Goals 1-1

  1.2 Site Description 1-3

  1.3 Previous Studies 1-4

  1.4 Environmental Setting 1-5
    1.4.1 Local Topography and Geology 1-5
    1.4.2 Local Hydrogeology 1-6

2 Sampling Scheme and Rationale 2-1
  2.1 Identification of Data Quality Objectives 2-1

  2.2 Sitewide Sample Summary 2-3

3 Field Sampling Plan (FSP) Part I: AOI-specific Problem Definition and Sampling Rationale 3-1
  3.1 AOI 7: Southeast Skyline Housing Probable Landfill 3.1-1
    3.1.1 Site Background 3.1-1
    3.1.2 Physical Characteristics of Site 3.1-2
    3.1.3 Previous Study 3.1-2
    3.1.4 Confirmatory Sampling 3.1-2

  3.2 AOI 9: Weapons Storage Area (WSA) Landfill 3.2-1
    3.2.1 Site Background 3.2-1
    3.2.2 Physical Characteristics of Site 3.2-1
    3.2.3 Previous Confirmatory Sampling 3.2-2
    3.2.4 ESI Sampling 3.2-2

  3.3 AOI 16: Coal Storage and Debris Deposition Area West of Building 7 and AOI 193: Former Building P5 Tank Cleaning and Cutting Area . . . 3.3-1
    3.3.1 Site Background 3.3-1
    3.3.2 Physical Characteristics 3.3-1
    3.3.3 Previous Confirmatory Sampling 3.3-2

Table of Contents (Cont.)

Section Page

3.3.4 ESI Sampling 3.3-2

3.4 AOI 17: Disposal Area Northeast of Hardfill 49c 3.4-1
  3.4.1 Site Background 3.4-1
  3.4.2 Confirmatory Sampling 3.4-1

3.5 AOI 24: CE Road Paint Dump Areas 3.5-1
  3.5.1 Site Background 3.5-1
  3.5.2 Physical Characteristics 3.5-1
  3.5.3 Previous Confirmatory Sampling 3.5-1
  3.5.4 ESI Sampling 3.5-2

3.6 AOI 58: P3/Building 14 Railroad Loading/Unloading and Storage Area and AOI 101: Building 3 Fuel Dumping Area 3.6-1
  3.6.1 Site Background 3.6-1
  3.6.2 Physical Characteristics of the Site 3.6-2
  3.6.3 Previous Confirmatory Sampling 3.6-2
  3.6.4 ESI Sampling 3.6-3

3.7 AOI 67: Former Storage Area Beneath Building 700 . . . . 3.7-1
  3.7.1 Site Background 3.7-1
  3.7.2 Physical Characteristics 3.7-1
  3.7.3 Previous Confirmatory Sampling 3.7-1
  3.7.4 ESI Sampling 3.7-2

3.8 AOI 90: Industrial Soils Pad Area 3.8-1
  3.8.1 Site Background 3.8-1
  3.8.2 Physical Characteristics 3.8-2
  3.8.3 Previous Confirmatory Sampling 3.8-2
  3.8.4 ESI Sampling 3.8-2

3.9 AOI 100: Paint Staging Area Northeast of Former Engine Testing Facility 3.9-1
  3.9.1 Site Background 3.9-1
  3.9.2 Physical Characteristics 3.9-1
  3.9.3 Previous Confirmatory Sampling 3.9-2
  3.9.4 ESI Sampling 3.9-2

3.10 AOI 102: Lindane Spill Site 3.10-1
  3.10.1 Site Background 3.10-1
  3.10.2 Physical Characteristics 3.10-1
  3.10.3 Previous Confirmatory Sampling 3.10-2
  3.10.4 ESI Sampling 3.10-2

Table of Contents (Cont.)

Section				Page
4	Field Sampling Plan (FSP) Part II: Field Methodology			4-1
	4.1	Introduction		4-1
	4.2	Sample Tracking System		4-1
	4.3	Field Notebooks		4-3
	4.4	Geophysical Survey		4-4
	4.5	Near-Surface Soil Sampling		4-5
	4.6	Surface Water/Sediment Sampling Methods		4-7
	4.7	Subsurface Logging, Subsurface Soil Sampling, and Groundwater-Screening Sampling Methods		4-9
		4.7.1	Subsurface Logging and Soil-Sampling Procedures	4-9
		4.7.2	Hollow-Stem Auger (HSA) Methodology	4-12
		4.7.3	Groundwater Screening Sampling Methods	4-13
	4.8	Permanent Monitoring Well Installation Methodology		4-13
		4.8.1	Well Design and Construction	4-13
			4.8.1.1 Well Construction Materials	4-13
			4.8.1.2 Screen Location	4-14
			4.8.1.3 Filter Pack	4-14
			4.8.1.4 Bentonite Seal	4-14
			4.8.1.5 Plumbness and Alignment	4-15
			4.8.1.6 Grout Seal	4-15
			4.8.1.7 Well Completion Details	4-15
			4.8.1.8 Well Identification	4-16
		4.8.2	Well Development	4-16
	4.9	Groundwater Sampling at Permanent Monitoring Wells		4-18
	4.10	Sample Labeling, Packaging, and Custody		4-19
		4.10.1	Sample Labeling	4-19
		4.10.2	Sample Packaging	4-20
		4.10.3	Sample Custody	4-20
	4.11	Equipment Decontamination		4-21
	4.12	Disposal of Investigation-Derived Waste (IDW)		4-22
	4.13	Site Survey		4-23

Table of Contents (Cont.)

Section Page

5 References 5-1

Appendix

A Examples of Sample Tracking System (STS) Tables A-1

B Health and Safety Plan B-1

C Quality Assurance Project Plan C-1

List of Tables

Table Page

2-1 Summary of Field Investigations and Justifications 2-4

3-1 AOI 7: Southeast Skyline Housing Probable Landfill - Sample Listing 3.1-3

3-2 AOI 9 : Weapons Storage Area (WSA) Landfill - Sample Listing 3.2-4

3-3 AOI 16: Coal Storage and Debris Deposition Area West of Building 7 and AOI 193: Former Building P5 Tank Cleaning and Cutting Area - Sample Listing 3.3-4

3-4 AOI 17: Disposal Area Northeast of Hardfill 49C - Sample Listing 3.4-3

3-5 AOI 24: CE Road Paint Dump Areas - Sample Listing 3.5-3

3-6 AOI 58: P3/Building 14 Railroad Loading/Unloading and Storage Area and AOI 101: Building 3 Fuel Dumping Area - Sample Listing 3.6-4

3-7 AOI 67: Former Storage Area Beneath Building 700 - Sample Listing 3.7-3

3-8 AOI 90: Industrial Soils Pad Area - Sample Listing 3.8-4

3-9 AOI 100: Paint Storage Area Northeast of Former Engine Testing Facility - Sample Listing 3.9-4

3-10 AOI 102: Lindane Spill Site - Sample Listing 3.10-3

4-1 Drilling Water Source and Investigation-Derived Waste Sample Listing 4-24

4-2 Summary of Sample Containers, Amounts, Preservation, and Holding Times 4-25

List of Illustrations

Figure Page

1-1 Site Location Map 1-7

1-2 Griffiss Air Force Base - Locations of AOIs Where EISs and Two CS Investigations (AOIs 7 and 17) will be Performed (South Area) 1-9

1-3 Griffiss Air Force Base - Locations of AOIs Where EISs will be performed (North Area) 1-11

1-4 Expanded Site Investigation Field Adjustment Form 1-13

3-1 GAFB - Existing Site Plan Projected Over 1943 Aerial Photo (No. 64-824-433) Showing Former Base Firing Range at AOI 7 . . . . 3.1-9

3-2 Southeast Skyline Housing Probable Landfill (AOI 7) 3.1-11

3-3 Weapons Storage Area (WSA) Landfill (AOI 9) 3.2-7

3-4 Coal Storage and Debris Deposition Area West of Building 7 (P7) (AOI 16)/Former Building P5 Tank Cleaning and Cutting Area (AOI 193) 3.3-7

3-5 GAFB - Existing Site Plan Projected Over 1975 Aerial Photo (No. 266) Showing Former Disposal Area (AOI 17) 3.4-5

3-6 Former Disposal Area (AOI 17) 3.4-7

3-7a CE Road Paint Dump Areas (AOI 24 - Northwest) 3.5-7

3-7b CE Road Paint Dump Areas (AOI 24 - Southeast) 3.5-9

3-8 P3/Building 14 Railroad Loading/Unloading and Storage Area (AOI 58) and Building 3 Fuel Dumping Area (AOI 101) 3.6-7

3-9 Former Storage Area Beneath Building 700 (AOI 67) 3.7-7

3-10 Industrial Soil Pad (AOI 90) 3.8-7

3-11 Paint Staging Area Northeast of Former Engine Testing Facility(AOI 100) 3.9-7

List of Illustrations (Cont.)

Figure **Page**

3-12 Lindane Spill Site (AOI 102) 3.10-5

4-1 Hazardous and Toxic Waste (HTW) Drill Log Form 4-27

4-2 Proposed Construction for Standard Permanent Monitoring Wells 4-28

4-3 Well Development Record 4-29

Acronym List

AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
Al	aluminum
AOC	Area of Concern
AOI	Area of Interest
As	arsenic
ATSDR	Agency for Toxic Substance and Disease Registry
Be	beryllium
BGS	below ground surface
BNA	base/neutral acid extractable organic compound
Cd	cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund)
CLP	Contract Laboratory Program
Co	cobalt
COC	chain-of-custody
Cr	chromium
CS	confirmatory sampling
Cu	copper
DCE	dichloroethylene
DoD	Department of Defense
DOT	United States Department of Transportation
DQO	data quality objective
E & E	Ecology and Environment, Inc.
EBS	environmental baseline survey
EDD	electronic data deliverable
EM	electromagnetic
EOD	explosive ordnance detection
EPA	United States Environmental Protection Agency
Fe	iron
FS	feasibility study
FSP	field sampling plan
FTL	field team leader
GIS	Geographical Information System
GLDC	Griffiss Local Development Corporation
GMU	Griffiss Management Unit
gpm	gallons per minute
GW	groundwater
HASP	health and safety plan
HCl	hydrochloric acid

Hg	mercury
HSA	hollow-stem auger
HTW	hazardous and toxic waste
IAG	Interagency Agreement
ID	inner diameter
IDW	investigation-derived waste
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
ISP	industrial soils pad
LABMIS	Laboratory Management Information System
Law Environmental	Law Engineering and Environmental Services, Inc.
LSA	lead-screen auger
Lu Engineers	Joseph C. Lu Engineering and Land Surveying, P.C.
MCL	maximum contaminant level
Mg	magnesium
mg/kg	milligrams per kilogram
ml	milliliter
Mn	manganese
MRD	Missouri River Division
MSL	mean sea level
Na	sodium
NFA	no further action
NFS	no further study
Ni	nickel
NPL	National Priorities List
NS	near-surface soil
NYANG	New York Air National Guard
NYSDEC	New York State Department of Environmental Conservation
OD	outer diameter
OSWER	Office of Solid Waste and Emergency Response
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
Pest	pesticides
PM	project manager
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAPjP	quality assurance project plan
RAS	routine analytical services
RA	risk assessment
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
SAS	Special Analytical Services
SD	sediment
Se	selenium
SS	subsurface soil
STS	Sample Tracking System
SW	surface water

TAGM	Technical and Administrative Guidance Memorandum
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TRPH	total recoverable petroleum hydrocarbons
µg/L	micrograms per liter
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USCS	Unified Soil Classification System
UST	underground storage tank
VOC	volatile organic compound
WSA	weapons storage area
Zn	zinc

Executive Summary

Under contract to the United States Army Corps of Engineers (USACE), Kansas City District, Ecology and Environment, Inc., (E & E) will perform expanded site investigation (ESI) at 10 Areas of Interest (AOIs) at Griffiss Air Force Base (AFB) in Rome, New York. The ESI to be performed at these sites will consist of additional site investigation to further characterize sites where confirmatory sampling (CS) was performed so recommendations can be made regarding their future status. The purpose of the ESI program is to evaluate to what extent past activities at certain areas of Griffiss AFB may impact public health and the environment. These additional investigations are in response to a request by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (EPA) to continue the process of delisting sites as AOIs or identifying where remedial action may be needed. The results of this ESI will be used to determine which, if any, of these AOIs should be added to the current list of AOIs that require no further study (NFS), whether additional sampling should be performed, or, if significant contamination is found, whether remedial action is needed. As part of this ESI project, confirmatory sampling will be performed at AOIs 7 and 17, which have not been sampled previously.

AOIs included in this investigation are Group I and Group III AOIs. Group I AOIs were identified and investigated as sites that were thought to have the greatest potential for environmental impacts based on former use of these areas. The Group III AOIs include all AOIs in Griffiss Local Development Corporation (GLDC) (January 4, 1996) Priority Property Areas III, IV, and V, and Retained Land.

This document includes the field sampling plan (FSP), site-specific health and safety plan (HASP), and the quality assurance project plan (QAPjP) required to perform the ESI and CS. Wherever possible, previously accepted methodologies have been maintained, with exceptions as noted.

Based on the detailed review of the CS data available for each of the Group I and Group III AOIs investigated, ESI or CS (as noted) will be performed at the following sites:

Group I AOIs

1. AOI 7: Southeast Skyline Housing Probable Landfill (CS)
2. AOI 9: Weapons Storage Area (WSA)
3. AOI 16/193: Coal Storage and Debris Deposition Area West of Building 7/Former Building P5 Tank Cleaning and Cutting Area
4. AOI 24: CE Road Paint Dump Areas
5. AOI 90: Industrial Soils Pad
6. AOI 100: Paint Staging Area Northeast of Former Engine Testing Facility
7. AOI 102: Lindane Spill Site

Group III AOIs

1. AOI 17: Disposal Area Northeast of Hardfill 49C (CS)
2. AOIs 58/101: P3/Building 14 Railroad Loading/Unloading Storage Area/Building 3 Fuel Dumping Area
3. AOI 67: Former Storage Area Beneath Building 700

This program will consist of both field and nonfield activities. Field activities will include reconnaissance-type surveys (i.e., geophysics) where necessary; near-surface (NS) soil sample collection; soil boring, including collection of subsurface soil (SS) samples; installation of permanent and temporary wells, including collection of groundwater (GW) samples; and surface water (SW) and sediment (SD) sampling. Nonfield activities consisting of the in-house review of historical information, including drawings, aerial photos, and previous sampling data, were performed prior to the scoping of this investigation.

Upon further characterization of an AOI site, additional field investigations may be conducted to address any remaining data gaps and provide information needed to support a recommendation for NFS, long-term monitoring, or remedial action.

1 Introduction

Ecology and Environment, Inc., (E & E), under contract to the United States Army Corps of Engineers (USACE), Kansas City District, Contract DACW41-94-D-9001, Delivery Order No. 0022, was tasked to perform an expanded site investigation (ESI) at 10 Areas of Interest (AOIs) and confirmatory sampling (CS) at two AOIs at Griffiss Air Force Base (Griffiss AFB) (see Figure 1-1). These AOIs include Group I and Group III AOIs. Group I AOIs were initially investigated as sites that were thought to have the greatest potential for environmental impacts based on former use of these areas. The Group III AOIs include all AOIs identified by Law Engineering and Environmental Services, Inc. (Law Environmental 1994a) within Griffiss Local Development Corporation (GLDC) (January 4, 1996) Priority Property Areas III, IV and V, and Retained Land. After review of the previous results and negotiations with USACE, Griffiss AFB, and E & E, the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency (EPA) determined that ESI was warranted at seven Group I AOIs and three Group III AOIs. CS will be performed at one Group I AOI and at one Group III AOI. This field sampling plan (FSP) describes the methodologies that will be used to investigate these 12 AOIs (see Figures 1-2 and 1-3).

1.1 Purpose and Goals

The purpose of the ESI program at the 10 aforementioned AOIs is to further investigate and better characterize these sites to evaluate to what extent past activities at certain areas of Griffiss AFB may impact public health and the environment. These additional investigations are in response to a request by NYSDEC and EPA to continue the process of delisting sites as AOIs or identifying where remedial action may be needed. The results of this ESI will be used to determine which, if any, of these AOIs should be added to the current list of AOIs that require no further study (NFS) or to develop appropriate remedial plans, if necessary.

The ESI project will include additional investigation of the AOIs for specific parameters and locations of concern as identified during previous CS and better characterize the site to determine whether further action is required.

The ESI investigation primarily involves field activities which will include reconnaissance-type surveys (i.e., geophysics) where necessary; surface soil sample collection; soil boring, including collection of subsurface soil (SS) samples; installation of permanent and temporary wells, including collection of groundwater (GW) samples; and surface water (SW) and sediment (SD) sampling. The in-house review of historical information, including drawings, aerial photos, and previous sampling, was performed prior to the scoping of this investigation to determine what past operations may have occurred that could have impacted the site and the locations of these activities. Groundwater interpretation maps were reviewed to determine whether sufficient data existed to determine the approximate direction of groundwater flow at a particular AOI. An assessment of whether the groundwater at a particular AOI has been impacted by other site operations was also be made to aid in the interpretation of previous groundwater results and those to be generated during this investigation.

Coordination of the Investigation

The following are the primary contact personnel for this investigation:

- USACE Project Manager (PM):

  Commander
  U.S. Army Engineer District, Kansas City
  Attn: CEMKR-EP-EA (Mr. Frank McStay)
  700 Federal Building
  601 East 12th Street
  Kansas City, MO 64106-2896

- On-site point of contact:

  Ms. Catherine V. Jerrard
  Air Force Conversion Agency
  AFBCA/OL-X
  Environmental Section
  153 Brooks Road
  Rome, NY 13441-4105

- E & E delivery order manager:

  Mr. Thomas Ferraro, P.G.
  Ecology and Environment, Inc.
  368 Pleasant View Drive
  Lancaster, NY 14086

- E & E field team leader:

  Mr. Donald Johnson, P.G.
  Ecology and Environment, Inc.
  368 Pleasant View Drive
  Lancaster, NY 14086

The E & E delivery order manager will oversee the coordination of the investigation and will respond to instructions and questions from the USACE PM. The delivery order manager will also be responsible for submitting monthly progress reports and schedule updates to the USACE PM.

The field team leader will contact the USACE PM whenever a situation arises requiring a change in approved plan procedures as a result of unanticipated field conditions, equipment breakdown, or other reasons. Verbal approval for changes may be given by the USACE PM. The delivery order manager will also submit an abbreviated technical memorandum detailing any modifications and the reasons for the changes to USACE within five days of the verbal approval (see Figure 1-4).

1.2 Site Description

Griffiss AFB is a former United States Air Force (USAF) Air Combat Command installation located on the east side of the City of Rome in Oneida County, New York (see Figure 1-1). The base is bordered by the Mohawk River along part of its western boundary and by the New York State Barge Canal along its southern boundary. It consists of 3,539 acres, of which 3,278 acres were fee-purchased by the United States Government between 1941 and 1978, 257 acres (currently occupied by the base golf course) were donated by Oneida County in 1942 for initial base construction, and 4 acres (along the barge canal, south of the railroad tracks) are leased from New York State. In addition, the base has 345 acres of clearance easements at both ends of its runway, 45 acres of rights-of-way, and 5 acres of restricted easements adjacent to the former weapons storage area. Most of the base is designated as Tract 243.000-0001-001 by the Oneida County Tax Office (Tetra Tech 1994).

The base underwent closure on September 30, 1995. Existing organizations on the base (e.g., Rome Laboratory, New York Air National Guard [NYANG], and Defense Finance and Accounting Service) remained on government-retained land after that date; however, the remaining property will be available for transfer.

1.3 Previous Studies

The Department of Defense (DoD) established a program for evaluating the environmental impact of operations on their bases in 1981 called the Installation Restoration Program (IRP). Since that time, Griffiss AFB has been studied by several different contractors to determine the extent of site contamination and to prioritize and perform cleanup actions.

A Phase I records search was conducted by the USAF and Engineering-Science, Inc., in 1981. Nineteen sites were studied for potential contamination, and 15 were identified as AOCs. A Phase II study was performed by Roy F. Weston, Inc. in two stages, one in 1982 and one in 1985. During this study, 14 groundwater monitoring wells were installed, four surface water sampling stations were established, and ground-penetrating radar and resistivity surveys were conducted.

Hydro Environmental conducted a study of four specific AOCs in 1986, and Versar, Inc. reviewed the data on 15 AOCs in 1987 to determine whether sufficient data were available to conduct a feasibility study (FS) for these sites. It was determined that the data generated were insufficient for evaluation. In the summer of 1987, Griffiss AFB was put on the National Priorities List (NPL) of the federal Superfund program.

In 1995, the Agency for Toxic Substance and Disease Registry (ATSDR) studied five AOCs to determine whether a health assessment could be performed, but again the data were insufficient. Also in 1988, UNC Geotech was contracted to begin the process of determining which IRP sites could be designated for no further action (NFA) and which should be maintained on an active list of AOCs. Law Environmental, together with the USAF, USACE, and regulatory agency personnel, expanded this process in 1991 by studying 54 sites. It was determined that 31 of these sites were AOCs. A work plan, FSP, QAPjP, and several technical memorandums were produced by Law Environmental to study these 31 AOCs in an RI. Law performed RIs and risk assessments (RAs) at the 31 AOCs during 1994 and 1995 and submitted a draft RI report in August 1995. The report has been reviewed by the regulatory agencies, and Law Environmental is currently preparing a draft final RI report.

Quarterly groundwater sampling was initiated in the fall of 1992 at pre-RI well locations across the base.

Law Environmental also conducted a second basewide study to identify AOIs. This study resulted in a document listing 466 AOIs (June 1994). Following a review of the final AOI report, CS was performed at 30 of these AOIs to determine if any contamination was present, and if present, where it posed a potential threat to public health or the environment. Fifteen Group I AOIs, seven Group II AOIs, and 10 Group III AOIs from this list were investigated by E & E. The Group I AOI fieldwork was performed between June and October 1995, and the final report was submitted in November 1996. The Group II and Group III AOI fieldwork was performed in April and August 1996, respectively. The final Group II report was submitted in June 1997. The draft Group III report was submitted in January 1997. Finalization of the Group III report is not complete at this time.

A basewide EBS for Griffiss AFB was produced for the USAF (Tetra Tech 1994). The EBS, which summarizes much of the site work to date, was required for the realignment of the base, which took place on September 30, 1995. An EBS/AOI summary table was also generated by Tetra Tech on June 19, 1995.

E & E completed development of a Geographical Information System (GIS) prototype during 1995 to assist base personnel in the transfer of surplus real estate and to serve as a database for the accumulation and management of site-specific information (i.e., analytical data, environmental baseline survey [EBS] information) by base personnel. The development and implementation of a fully functional GIS is expected in 1996. Finally, E & E is currently performing supplemental investigations at the 31 AOCs studied under the RI program.

1.4 Environmental Setting

1.4.1 Local Topography and Geology

Griffiss AFB lies within the Mohawk Valley between the Appalachian plateau and the Adirondack Mountains. The topography across the base is relatively flat with elevations ranging from 435 to 595 feet above mean sea level (MSL). The highest elevations are to the northeast. A rolling plateau northeast of the base reaches an elevation of 1,300 feet. The New York State Barge Canal and the Mohawk River Valley south of the base lie below 430 feet above MSL.

Unconsolidated near-surface sediments at Griffiss AFB consist primarily of glacially derived till with minor quantities of clay and sand, and significant quantities of silt and gravel (Tetra Tech 1994). The thickness of these sediments ranges from 0 to 12 feet in the northern portion of the base to up to a maximum of 130 feet in one area of the southern portion. However, the average thickness of the unconsolidated sediments is 5 feet in the northern portion, 25 to 50 feet in the central portion, and 100 to 130 feet in the south and southwest portions of the former base.

The bedrock beneath the base is composed of Utica Shale. It is a gray and black carbonaceous unit generally dipping from northeast to southwest.

1.4.2 Local Hydrogeology

The aquifer of interest in this study is the shallow water table aquifer within the unconsolidated near-surface sediments. The depth to groundwater in the water table aquifer ranges from ground surface to about 60 feet below ground surface (BGS) (Tetra Tech 1994). The shallow groundwater generally flows across the base from the slight topographic high in the northeast to the Mohawk River and the New York State Barge Canal located southwest and southeast of the base, respectively. However, there are several surface water creeks that act as discharge areas for shallow groundwater, and drainage culverts and sewers that intercept surface water runoff are present.

This conclusion is supported by an on-base stream mechanics study that was performed during the RI. This study determined that both Threemile and Sixmile creeks are gaining streams within the base (Law Environmental 1996). Underground sewers and drainage culverts as wide as 9 feet (and 12 feet deep) may also influence groundwater flow directions during high water table conditions.

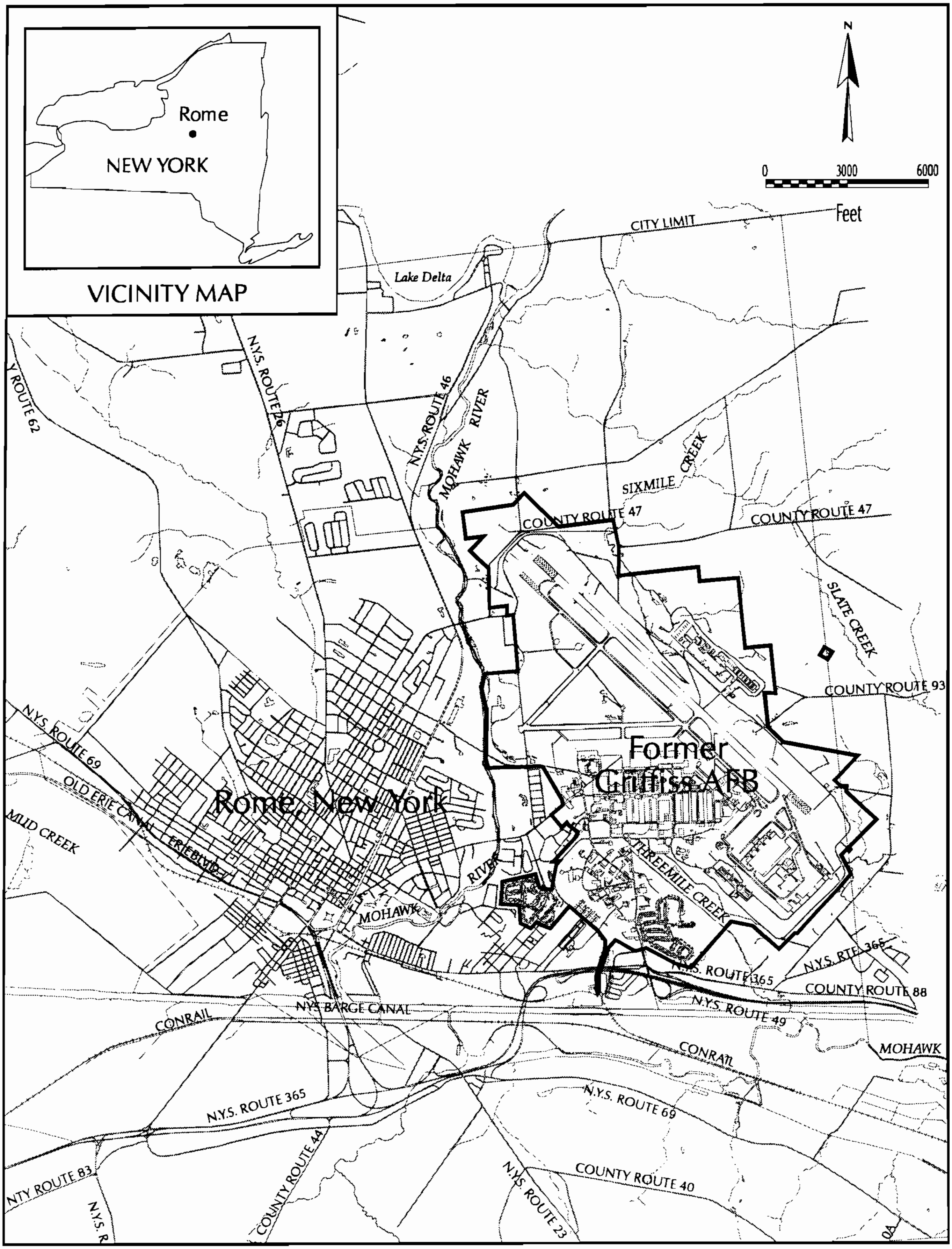

Figure 1-1 Griffiss AFB - Site Location Map

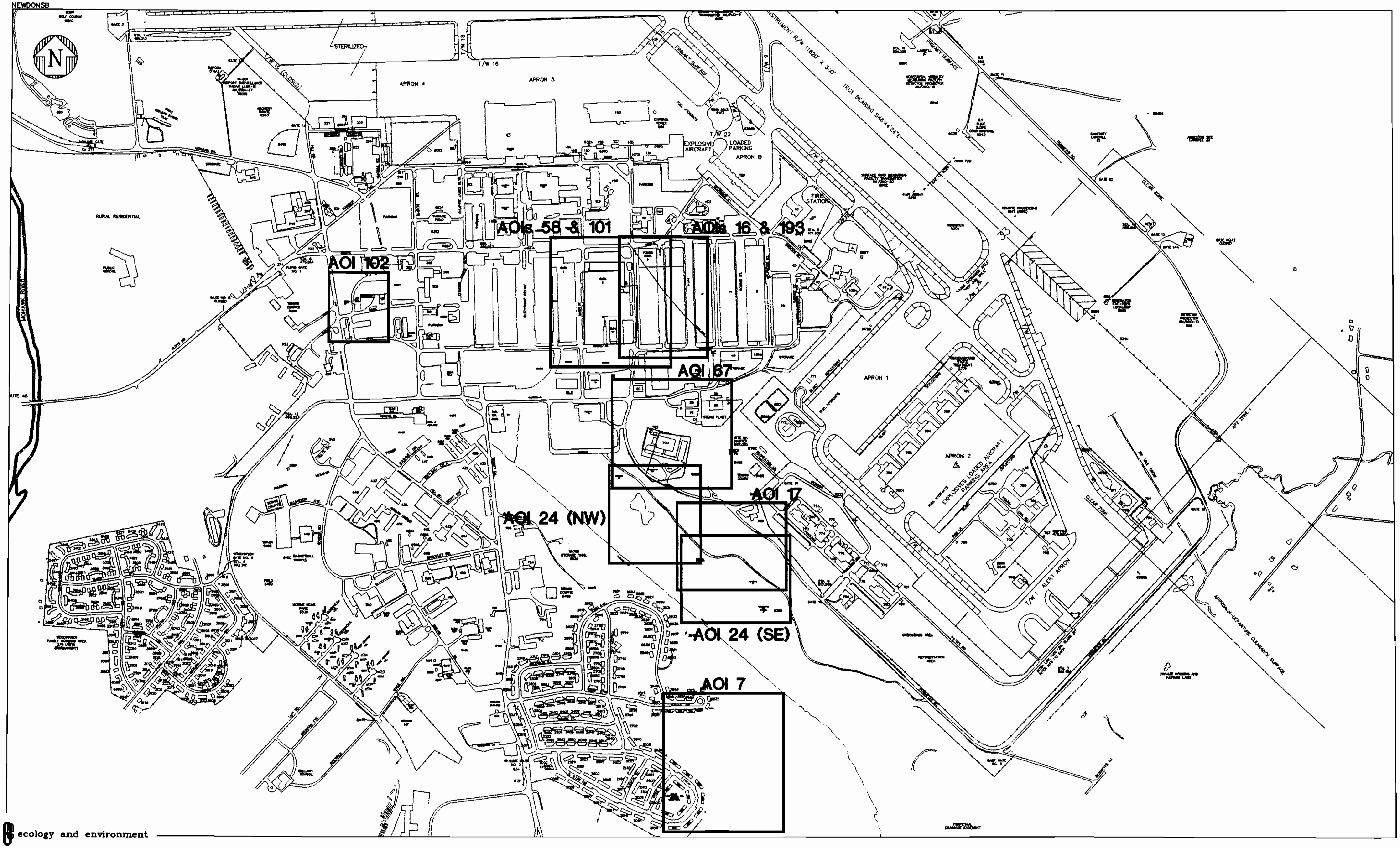

Figure 1-2 GRIFFISS AIR FORCE BASE LOCATIONS OF AOIs WHERE ESIs AND TWO CS INVESTIGATIONS (AOIs 7 AND 17) WILL BE PERFORMED. (SOUTH AREA)

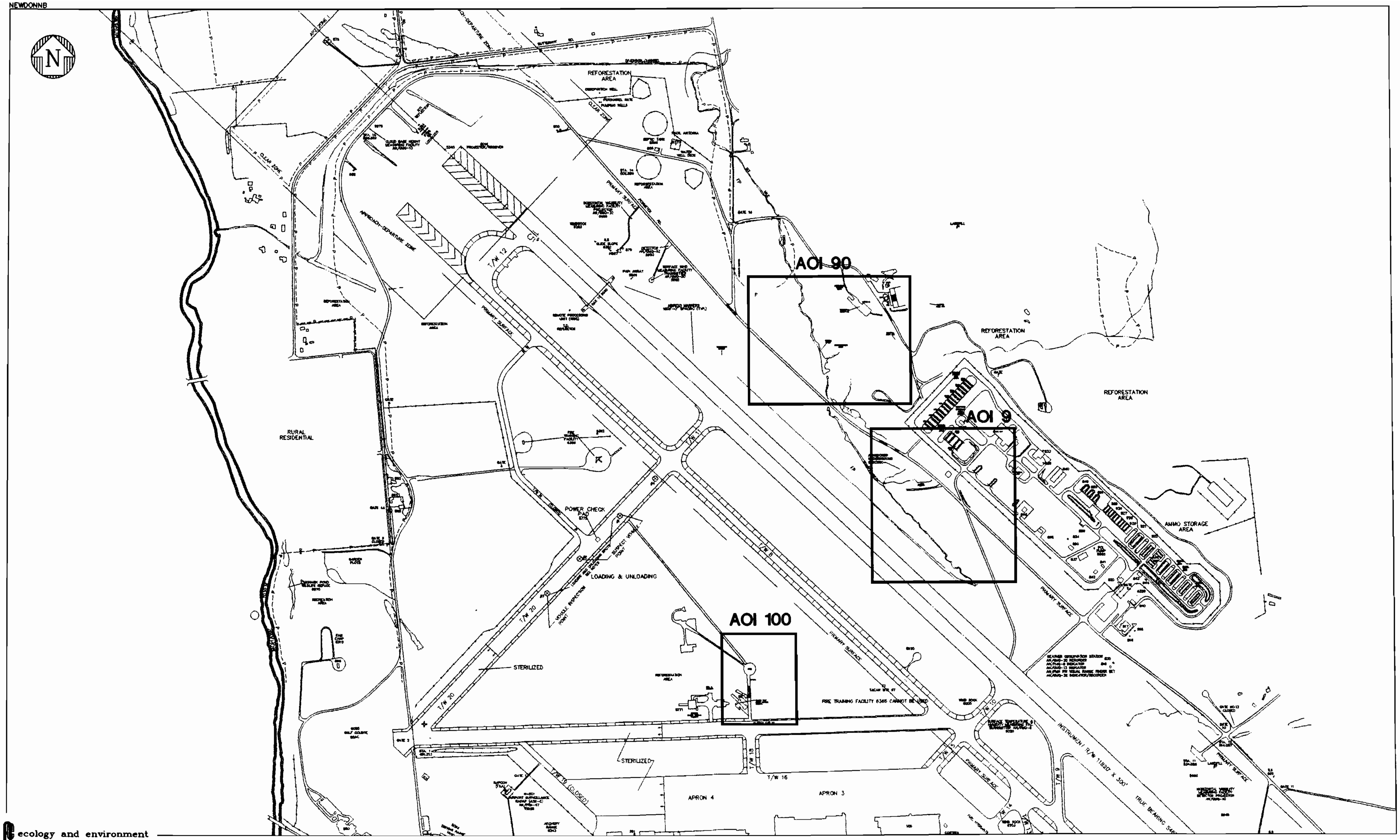

Figure 1–3 GRIFFISS AIR FORCE BASE LOCATIONS OF AOIs WHERE ESIs WILL BE PERFORMED (NORTH AREA)

EXPANDED SITE INVESTIGATION, GRIFFISS AFB
FIELD ADJUSTMENT FORM

To:	Mr. Douglas M. Pocze USEPA - Region 2 Federal Facilities Section 26 Federal Plaza New York, New York 10278 Fax: 212/637-4360 Office: 212/637-4432	Mr. Jonathan Greco NYSDEC Bureau of Eastern Remedial Action 50 Wolf Road Albany, New York 12233-7010 Fax: 518/457-1088 Office: 518/457-3976	DATE: TIME:
From:	Mr. Michael McDermott 416 CES/CEVR 153 Brooks Road Griffiss AFB, NY 13441-4105 Fax: 315/330-3410 Office: 315/330-2098		

NOTE: A. Please respond within 24 hours if you have questions or comments. If no response is received, fieldwork implementing this adjustment shall proceed.

References: ______________________________

AOC: ______________________________

SI Work Plan Section: ______________________________ Page: ______

Need for Field Adjustment: ______________________________

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FIGURE 1-4 EXPANDED SITE INVESTIGATION FIELD ADJUSTMENT FORM

2 Sampling Scheme and Rationale

2.1 Identification of Data Quality Objectives

Data quality objectives (DQOs) describe a process by which analytical data are gathered to define project objectives. The elements of DQOs—data, quality, and objectives—are described below.

Objectives

Project objectives are conceptualized during evaluation of existing data and then developed as part of the DQO process. For this ESI, these objectives are designed to provide sufficient data which, in addition to the information obtained during the initial CS, will be used to better characterize these sites and evaluate to what extent past activities at these sites may impact public health and the environment. Once potential risks are defined, either additional work will be recommended rectify the problem or the site will be proposed for NFS if no problem exists.

For the two AOIs where no previous CS has been performed (AOIs 7 and 17), the DQOs are designed to provide sufficient information to generally evaluate risks, if any, to environmental receptors. Once any potential risks are defined, either ESI will be recommended to determine the extent of the problem or the site will be proposed for NFS if no problem exists.

Data

Data needs are established to meet project objectives. In the strictest sense, these data are generally analytical by definition. From a pragmatic sense, however, other types of information, such as the physical description of soils or groundwater, would also be defined as data. Depending on the objective, data can be gathered to be interpretive in nature or to provide a statistical confidence level to meet the project objective. Statistical analyses are not planned for this task order.

Quality

Quality is defined by the level of analyses to which the data are subjected. EPA has identified five levels of analytical data quality (EPA 1987), which are summarized below:

- **Level I** — Field screening. This level is characterized by the use of portable instruments that can provide real-time data to assist in the optimization of sampling-point locations and for health and safety support. Data can be generated regarding the presence or absence of certain contaminants (especially volatiles) at sampling locations.

- **Level II** — Field analysis. This level is characterized by the use of portable analytical instruments that can be used on site or in mobile laboratories stationed near a site (close-support labs). Depending upon the types of contaminants, sample matrix, and personnel skills, qualitative and quantitative data can be obtained.

- **Level III** — Laboratory analysis using methods other than the Contract Laboratory Program (CLP) routine analytical services (RAS). This level is used primarily in support of engineering studies using standard EPA-approved procedures. Some procedures may be equivalent to CLP RAS, without the CLP requirements for documentation.

- **Level IV** — CLP RAS. This level is characterized by rigorous quality assurance/quality control (QA/QC) protocols and documentation, which provide qualitative and quantitative analytical data.

- **Level V** — Nonstandard methods. This level includes analyses that may require method modification or development or both. CLP Special Analytical Services (SAS) are considered Level V.

Most data to be generated during this ESI investigation will be obtained using Level III data quality analytical procedures. Groundwater data quality, however, will be classified as Level I at AOIs 7 and 17 because groundwater-screening samples at these AOIs will be collected at temporary sampling locations not permanent monitoring wells. However, laboratory analysis of groundwater will be performed according to Level III methods in all cases.

2.2 Sitewide Sample Summary

The scope of work for this ESI is shown in Table 2-1. The table contains a description of the justification for ESI or CS, and types of surveys and/or sampling, number of samples, and types of analyses. The sampling plan proposed in this table has been previously reviewed and approved by NYSDEC and EPA.

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1 No.	2 Group No.	3 Study Area	4 ID Number	5 Site Name	6 Figure No.	7 Dates of Operation	8 Justification for Further Investigation	9 Sample Type	10 No. of Locations	11 No. of Samples Per Location	12 Boring Depth[a] (feet BGS unless noted)	13 Sample Depth[b] (feet BGS unless noted)	14 STS Location Identification	15 Analytical Tests and Methods to be Conducted
7	1	37	ORD-725 EBS Tables B1 and G1	Southeast Skyline Housing Probable Landfill	3-1, 3-2	1943-1960 (approx.)	**Background.** This 9.5-acre site was initially identified by Law Environmental in 1994 as an AOI based on reports from Griffiss AFB personnel that indicated the presence of a landfill at this area in the 1950s. However, 1943 aerial photograph No. 64-824-433 shows the base firing range was located at this site (see Figure 3-1). No refuse or waste is visible in this or subsequent aerial photographs. In the 1943 aerial photo, several buildings are observed along the southwest border of the firing range, and an excavated slope is seen on the northeast border of the range. Uncovered partitions for the firing range can also be seen facing the excavated slope on the east side of the range, which was probably used as a back stop for projectiles. According to the records search conducted by Tetra Tech for the EBS, the general area was the base firing range from 1943 until it was torn down for the construction of the Skyline Housing Area in the late 1950s. The site now is vegetated with grass and sparsely distributed small trees. There is no exposed refuse, seepage, or stressed vegetation present in this area, which was probably used most recently for recreation by families that lived in the adjacent housing units.	NS	52	1	–	0-0.25	G007-NS01 to G007-NS52	Total lead (SW6010), and % solids (EPA 160.3)
								NS	26	1	--	0-0.25	G007-NS01 to G007-NS52 (even numbers)	Total copper (SW6010), total phosphorus (EPA 365.2), and % solids (EPA 160.3)
								SS	2	2	7	0-2 5-7 0-2 5-7	G007-SS01-Z1 G007-SS01-Z2 G007-SS02-Z1 G007-SS02-Z2	Total lead and copper (SW6010), total phosphorus (EPA 365.2), and % solids (EPA 160.3)
								SS	2	2	7	5-7 5-7	G007-SS03-Z2 G007-SS04-Z2	Same analysis as above (both filtered and unfiltered lead, copper, and phosphorus)

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
7 (cont.)							**Previous Confirmatory Sampling.** A confirmatory sampling investigation, which consisted of a background review, site reconnaissance, and geophysical survey, indicated this area was not used as a landfill. There were no steep geophysical gradients observed in the EM31 or magnetometer data that would be representative of buried metal debris or objects (E & E 1996). **ESI Sampling.** Although no landfilling occurred at AOI 7, elevated levels of lead, copper, and phosphorus may exist in the soils from the former firing range. Since this area was not sampled during the Group I CS investigation, confirmatory sampling will be performed during the program to determine if elevated levels of these analytes are present in the soil. The ESI will consist of the collection of near-surface soil samples, subsurface soil samples, and groundwater samples. Fifty near-surface (0 to 0.25 feet) soil samples will be collected from within a coarse grid (75-foot spacing) across the former range, and a finer grid (50-foot spacing) over the area where the backstop was located (see Figure 3-2). In addition, two background near-surface soil samples will be collected east and west of the site. All 52 near-surface soil samples will be analyzed for total lead and % solids. Twenty-six of these near-surface soil samples also will be analyzed for total copper and phosphorus. Analysis for metallic salts is not included because review of the aerial photos of this area indicates this area was used as a small arms range, not for practice with larger munitions. Four soil borings will be installed and completed as temporary monitoring wells. These borings will be drilled to a depth of 8 feet below the water table. Soil samples will be collected near the ground surface and directly above the water table interface at the well upgradient of the site and the well within the former firing range. Subsurface soil samples will only be collected at the groundwater interface in the two well borings downgradient of the site. The subsurface soil samples will be analyzed for total lead, copper, phosphorus, and % solids. The groundwater screening samples will be analyzed for total (unfiltered) and dissolved (filtered) lead, copper, and phosphorus.	GW	4	2	15	7-15 7-15 7-15 7-15	G007-SS01-GW G007-SS01-GW-F G007-SS02-GW G007-SS02-GW-F G007-SS03-GW G007-SS03-GW-F G007-SS04-GW G007-SS04-GW-F	

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
9	I	7	OTH-846 EBS Tables B1 and G3; and OTH-808 EBS Table G3.	Weapons Storage Area Landfill	3-3	1943-1960 (approx.)	**Background.** This site was the first landfill for the base. Aerial photograph No. 55-824-433, dated 1943, shows areas of disturbance along the southwest portion of what is currently the Weapons Storage Area (WSA), between Perimeter Road and Sixmile Creek, and to the north at Landfill 1. The site extended east to where Building 846 is now located in the WSA. Reportedly, during the construction of the Air Launch Cruise Missile facilities in the late 1970s in this area, some trash and other refuse was found during excavation. The site was used as a landfill from 1943 to at least 1957, but not later than 1960. The type of material buried here is unknown; however, base personnel reported that large quantities of landfill material were removed during construction of the WSA.	GS	49	1	—	—	G009-GS01 to G009-GS49	VOCs
								SS	1	2	4	0-0.25 0.25-2 8-10	G009-SS01-Z1 G009-SS01-Z2 G009-SS01-Z3	TCL VOCs (SW8260), TCL BNAs (SW8270), and Pest/PCBs (SW8081), TICs, TRPH (EW418.1), TAL metals (SW6010), and % solids (EPA 160.3)
								SS	4	2	13	0-0.25 0.25-2 8-10	G009-MW01-Z1 G009-MW01-Z2 G009-MW01-Z3	
							Previous Confirmatory Sampling. Confirmatory sampling (CS) was performed in 1995 at the grass-covered area that slopes southwest from the WSA facility between the fenceline and Sixmile Creek (see Figure 3-3). The portion of the former landfill that is now covered by the southwest part of the WSA was not investigated because of the extensive removal of landfill material and redevelopment that occurred at that area during the construction of this facility.					0-0.25 0.25-2 8-10	G009-MW02-Z1 G009-MW02-Z2 G009-MW02-Z3	
												0-0.25 0.25-2 8-10	G009-MW03-Z1 G009-MW03-Z2 G009-MW03-Z3	
							Results of the geophysical survey performed during the investigation indicated a strong magnetic and electromagnetic anomaly is present near a large mound of soil at the north end of the site. This mound is believed to be the remains of a berm that separated two former munitions storage igloos that were located at this site. One of these igloos (Bldg. 808) was reportedly used for storage of hazardous wastes. Otherwise, the geophysical gradient across the site is relatively flat, indicating that metallic material is not prevalent beneath the site.					0-0.25 0.25-2 8-10	G009-MW04-Z1 G009-MW04-Z2 G009-MW04-Z3	

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
9 (cont.)							Low levels of trichloroethane and tetrachloroethene detected in a groundwater screening sample collected at Lead Screen Auger boring LS05 may have resulted from a spill or leak at one of the former storage igloos at the north end of the site. Also, it is possible that waste solvent was disposed of in the north end of the former landfill.	GW	4	1	13	10-13	G009-MW01-GW G009-MW02-GW G002-MW03-GW G002-MW04-GW	Same analyses as above except filtered and unfiltered metals and no % solids
							ESI Sampling. An Expanded Site Investigation (ESI) will be performed at this site consisting of a passive soil gas survey and installation of five additional soil borings, of which four will be completed as permanent monitoring wells (see Figure 3-3). The results of the soil gas study will be used to identify if, and where, other elevated levels of chlorinated hydrocarbons or other volatile organic compounds exist in the vicinity of LS05. The soil borings/wells will be placed at locations, based upon the results of the soil gas study, to determine the extent of these solvents and/or other contaminants in the soil and groundwater at the site. Three soil samples will be collected from each well and soil boring, one near-surface soil sample at 0 to 0.25 feet, a shallow soil sample at 0.25 to 2 feet, and a deeper soil sample directly above the groundwater interface. The well screens will be set approximately 3 feet below and 2 feet above the water table. The soil and groundwater samples to be collected will be analyzed for TCL VOCs, BNAs, Pest/PCBs, TICs, TRPH, TAL Metals (filtered and unfiltered for groundwater) and % solids (soil only). Three surface water/sediment samples will also be collected on the north bank of Sixmile Creek to determine if groundwater adversely impacts the creek. If there is a seep present which has not been sampled previously, a surface water/sediment sample will be collected there also. The surface water/sediment samples will be analyzed for the same parameters specified above (no % solids for surface water).	SW/SD	4	1	—	—	G009-SW05 G009-SD05 G009-SW06 G009-SD06 G009-SW07 G009-SD07 G009-SW08 (seep, if present) G009-SD09 (seep, if present)	Same analyses as above except no % solids on surface water and no filtered metals

Table 2-I

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
16/193	1	22	OTH-5400-2 OTH-5400-1 EBS Tables B-1 and G-3	Coal Storage and Debris Deposition Area West of Building 7/ Former Building P5 Tank Cleaning and Cutting Area	3-4	1969-1995 (AOI 16) 1973-1980 (AOI 193)	**Background.** Both sites consist primarily of large concrete building foundations. At AOI 16, coal was stored on the concrete foundation from 1969 to 1975 (see Figure 3-4). Drums may also have been stored on the foundation. It was previously reported that the northern portion of the foundation (Lot 11) was used to store hazardous waste from 1983 until 1990. Closure of Lot 11 was completed under RCRA in 1995. In 1995, potentially contaminated soil, which came primarily from electrical substation B-27, was stored on the AOI 16 portion of the foundation. Sampling of this soil revealed PCBs at one location. The soil was subsequently disposed of appropriately.	SS	2	2	12	2-4 10-12 2-4 10-12	G016-MW01-Z1 G016-MW01-Z2 G016-MW02-Z1 G016-MW02-Z2	TCL VOCs (SW8260), PAHs (SW8270), and % solids
								GW	2	1	20	12-20 12-20	G016-MW01-GW G016-MW02-GW	Same analysis as above except no % solids
							At AOI 193, the concrete building foundation was used for the storage of equipment and cutting apart of USTs. These USTs were removed from other areas of the base prior to cutting (see Figure 3-4).							
							Previous Confirmatory Sampling. Confirmatory Sampling (CS) was performed at AOI 16 and 193 to determine if environmental impacts were caused by past use of the site. Ten subsurface-soil borings were drilled and sampled at each site. One groundwater screening sample was collected from each of two LSA borings at each site.	SS	3	2	12	2-4 10-12 2-4 10-12 2-4 10-12	G193-MW01-Z1 G193-MW01-Z2 G193-MW02-Z1 G193-MW02-Z2 G193-MW03-Z1 G193-MW03-Z2	TCL VOCs (SW8260), PAHs (SW 8270), and % solids (EPA 160.3)
							Results of the CS program for AOI 16 indicate that the PAHs benzo(a)pyrene and dibenzo(a,h)anthracene were present above RBCs in two subsurface soil samples collected at depths of 4 to 8 feet below the concrete surface. One PAH, naphthalene, was detected in one groundwater sample at a concentration above NYSDEC Class GA groundwater standards.	GW	3	1	20	12-20 12-20 12-20	G193-MW01-GW G193-MW02-GW G193-MW03-GW	Same analysis as above except no % solids
							Results of the CS investigation of AOI 193 indicated the presence of the PAH benzo(a)pyrene at concentrations above EPA Region III RBCs in three subsurface soil samples at depth ranging from 2 to 5 feet below the concrete. PAHs were not present in groundwater, however, TCE was found at LS16 (See Figure 3-4) at concentrations below NYSDEC class GA standards.							

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth^a (feet BGS unless noted)	Sample Depth^b (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
16/193 (cont.)							At both AOI sites, the PAHs appear to be limited to the shallow subsurface depth and the concrete foundation significantly limits any exposure to the soils. Redevelopment of the area will include demolition of the concrete pads. As much as eighteen inches (BGS) of soil may be removed during demolition. However, the existing soils are expected to be covered again by new buildings, paved areas, and/or clean fill and top soil. A soil screening-level risk assessment performed for the site concluded it does not pose a significant human health risk to construction workers engaged in the planned site improvement or redevelopment activities. **ESI Sampling**. The ESI sampling at AOIs 16 and 193 is expected to be performed after the concrete foundations are demolished. For AOI 16, two additional soil borings will be installed and completed as permanent monitoring wells to determine the extent of the naphthalene in groundwater at this AOI (see Figure 3-4). Two soil samples will be collected during the drilling of each monitoring well boring. A shallow soil sample will be collected from below the bottom of the concrete rubble, which is estimated to be 2-4 feet below the ground surface. A deeper soil sample will be collected directly above the groundwater interface. Each well screen will be set 2 feet above and 8 feet below the water table. Both the soil and groundwater samples will be analyzed for TCL VOCs and PAHs. For AOI 193, the extent of the TCE will be further evaluated as part of the ESI program. Three additional borings will be installed and completed as permanent monitoring wells (see Figure 3-4). Two soil samples will be collected from each monitoring well boring during drilling. A shallow soil sample will be collected below the bottom of the concrete rubble, which is estimated to be 2-4 feet below ground surface. A deeper soil sample will be collected directly above the groundwater surface. Each well will be set 8 feet below and 2 feet above the water table. Soil and groundwater samples will be analyzed for TCL VOCs.							

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1 No.	2 Group No.	3 Study Area	4 ID Number	5 Site Name	6 Figure No.	7 Dates of Operation	8 Justification for Further Investigation	9 Sample Type	10 No. of Locations	11 No. of Samples Per Location	12 Boring Depth[a] (feet BGS unless noted)	13 Sample Depth[b] (feet BGS unless noted)	14 STS Location Identification	15 Analytical Tests and Methods to be Conducted
16/193 (cont.)							Groundwater flow is generally towards the southwest at both AOIs. Water level measurements will be obtained from the 66-inch storm drain that transects the site (at accessible manholes) in proximity to the site to determine if the storm drain influences groundwater flow. These water levels will be compared with those in the wells to better define the direction of groundwater flow at this site.							
17	III	28/35	IRP-LF-09 IRP-LF-49C EBS Tables B1 and 3-1	Disposal Area Northeast of Hardfill 49C	3-5, 3-6	Unknown	**Background.** AOI 17 was described in the AOI Report as a disposal area north of Landfill 6 containing debris and refuse. The EBS/AOI Summary Table states this AOI is apparently an extension of Landfill 6 and Hardfill 49C is also listed under this AOI. Review of aerial photograph No. 266, dated 1975, clearly shows that landfilling occurred northwest of Landfill 6 (see Figure 3-5). However, since Landfill 6 operated between 1955 and 1959, the landfilling at AOI 17 was not part of the former operation. Since Hardfill 49C is located south of AOI 17 it is not part of this site. Neither of the investigations at Landfill 6 or Hardfill 49C characterized the potential landfill operations noted at AOI 17. Because of the relative locations of the three sites with respect to the southwest flow of groundwater beneath this area.	NS	6	1	-	0-0.25	G017-NS01 to G017-NS06	
								SS	3	2	44	16-18 34-36	G017-SS01 Z2 G017-SS01 Z3	TCL VOCs (SW8260), TCL BNAs (SW8270), Pest./PCBs (SW8081), TRPH (SW9060), and TAL metals (SW6010), (% solids [EPA 160.3], soils only; and both filtered and unfiltered metals for groundwater).
											44	16-18 34-36	G017-SS02 Z2 G017-SS02 Z3	
											44	16-18 34-36	G017-SS03 Z2 G017-SS03 Z3	
								GW	3	1	44	36-44	G017-SS01-GW G017-SS01-GW-F	

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1 No.	2 Group No.	3 Study Area	4 ID Number	5 Site Name	6 Figure No.	7 Dates of Operation	8 Justification for Further Investigation	9 Sample Type	10 No. of Locations	11 No. of Samples Per Location	12 Boring Depth[a] (feet BGS unless noted)	13 Sample Depth[b] (feet BGS unless noted)	14 STS Location Identification	15 Analytical Tests and Methods to be Conducted
17 (cont.)							**ESI Sampling.** Confirmatory sampling of AOI 17 will be performed because earlier investigations of Landfill 6 and Hardfill 49C did not include the investigation of this AOI. A geophysical survey using a magnetometer and EM31 will be performed to delineate the boundaries of the landfill at AOI 17 (see Figure 3-6). Once the landfill is delineated, three subsurface soil borings will be drilled on the north, southwest, and south sides of the fill area. The exact locations of the borings will be based on the results of the geophysical survey such that they are not drilled into the fill. Two soil samples will be collected in each boring, one at an intermediate depth and one directly above the soil/groundwater interface. The borings will be drilled to a depth of 8-feet below the water table, and a temporary well will be installed in each boring. The well screens will be set approximately eight feet below and two feet above the water table. A groundwater sample will be collected from each temporary well for screening purposes. The soil and groundwater samples will be analyzed for TCL VOCs, BNAs, pest./PCBs, TRPH, and TAL metals (% solids, soils only, and both filtered and unfiltered metals for groundwater). Six near-surface (0 to 0.25 feet BGS) soil samples will be collected from the landfill cover and analyzed for the parameters specified above. A preliminary study of the existing cover material will also be performed. A document search for "as-built" drawings of the cover will be conducted as well as a visual inspection. A description of the cover, based on the inspection of these soil samples, will be provided.					37-45 37-45	G017-SS02-GW G017-SS02-GW-F G017-SS03-GW G017-SS03-GW-F	

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
24	I	35	—	CE Road Paint Dump Areas	3-7a, 3-7b	NA	**Background**. During an anonymous interview, a former base employee stated that the fuel/paint mixture had been discharged in two locations along the CE Service road near Landfill No. 5. The northwest location is approximately 500 feet upgradient of Threemile Creek (see Figure 3-7a). The southwest location is approximately 300 feet upgradient of this creek (see Figure 3-7b). The diesel fuel was used to clean out truck mounted paint tanks which were used to paint buildings. Based on the interview it was estimated that 3,200 gallons of the diesel/paint mixture may have been disposed of over a forty year period. However, this estimate may be inaccurate and the frequency of disposal is unknown. **Previous Confirmatory Sampling**. A Confirmatory Sampling (CS) Investigation was performed at AOI 24. Five near surface soil samples (0 to 2 feet BGS) were collected in each of the two disposal areas. In the northwest area, two of these borings were continued down to the water table. In the southeast area, one boring was continued to the water table. In each of the deeper borings a saturated soil sample and groundwater sample were collected. The water table in this area is approximately five feet BGS. Results of the CS program showed the presence of lead in soil samples in the northwest area and lead and PAHs in soil samples in the southeast area. In the northwest area, lead was present above EPA RBCs in two soil samples collected at depths of 0 to 2 feet BGS. In the southeast area, three soil samples (0 to 2 feet BGS) contained benzo(a)pyrene at concentrations exceeding the EPA RBC. The concentrations of PAHs found are similar to those for soil in urban areas near traffic or other fossil fuel combustion sources. Groundwater does not appear to be adversely impacted at the sites.	NS (Northwest)	24	1	—	0-0.25	G024-NS31 to G024-NS55	ICP for lead (SW6010), and % solids (EPA 160.3)
									12	1	0.25	0-0.25	G024-NS32 to G024-NS54 (even)	PAHs (SW8270)
								NS (Southeast)	20	1	—	0-0.25	G024-NS56 to G024-NS76	ICP for lead (SW6010), and % solids (EPA 160.3)
									10	1	0.25	0-0.25	G024-NS56 to G024-NS76 (even)	PAHs (SW8270)

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
24 (cont.)							**ESI Sampling.** This area has been designated for future public/recreational development. Therefore, an Expanded Site Investigation (ESI) will be conducted at this AOI. Additional sampling to determine the extent of the lead in soils at the northwest area and PAHs and lead in the southeast area will be performed. Twenty-four near surface borings (0 to 0.25 feet BGS) are proposed for the northwest area as shown on Figure 3-7a. All soil samples will be analyzed for lead using inductively coupled plasma (ICP) analysis. At the southeast area, 20 near-surface borings will be performed. Soil samples from these borings will be analyzed for lead (using ICP) and PAHs. The near-surface soil sampling locations for the southeast area are shown on Figure 3-7b.							
58/101	III	21	OTH-003-1 to 3 POL-014 (AOI 58)	P3/Building 14 Railroad Loading/Unloading and Storage Area (AOI 58) and Building 3 Fuel Dumping Area (AOI 101)	3-8	1943-1984 (AOI 58) 1960s (AOI 101)	**Background.** AOI 58 was identified as an AOI in the final AOI report based on Aerial Photograph No. 51-824-433 and Drawing No. 7-C-11, both dated 1943. Chemicals were stored at what is now the south end of Building 3, and aircraft oil was stored directly southeast of Building 3 through 1984. The 1943 aerial shows this area was unpaved and that a variety of material and debris (possibly drums and coal) were stored there. By 1945, the site was an organized storage area. It was also used as a railroad load/unload area until 1954 when Building 3 was constructed (see Figure 3-8). AOI 101 is located at the north end of Building 3. Based on interviews with Griffiss AFB personnel in 1994, fuels and waste oils from vehicles were dumped onto the ground at the north end of Building 3 in the 1960s.	SS	1	2	16	2-4 6-8	G058-MW01-Z1 G058-MW01-Z2	TCL VOCs (SW8260), TCL BNAs (SW8270), PCBs (SW8081), TRPH (EW418.1), and % solids (EPA 160.3)
									1	1	4	6-8 2-4	G058-MW02-Z2 G058-MW04-Z1	
								GW	2	2	16	8-16 8-16	G058-MW01-GW G058-MW02-GW	Same analyses as above except no % solids

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
58/101 (cont.)							**Previous Confirmatory Sampling.** The Confirmatory Sampling (CS) investigation was combined at AOIs 58 and 101 because of their proximity to each other. Low levels of VOC contamination were detected in soil and TCE was found in groundwater at low concentrations at both AOIs. At AOI 58, TRPH was found in the deeper soil sample and in the groundwater sample boring/temporary well SS02 at 5,600 mg/kg and 31 mg/L, respectively. PCB-1260 was found in the groundwater at AOI 101 (SS02) at an estimated concentration of 0.25 µg/L.	SS	1	1	16	6-8	G101-MW01-Z2	TCL VOCs (SW8260), TCL BNAs (SW8270), PCBs (SW8081), TRPH (EW418.1), and % solids (EPA 160.3)
							ESI Sampling. To verify that the low levels of contamination identified during the CS investigation are not more extensive than current results indicate, an Expanded Site Investigation (ESI) will be conducted at AOIs 58/101. The ESI will consist of drilling seven subsurface soil borings, three of which will be completed as permanent monitoring wells (see Figure 3-8). One subsurface boring will be drilled within AOI 58, and three subsurface borings will be drilled at AOI 101, from which soil samples will be collected below the base of the asphalt (approximately 2 to 4 feet BGS). Soil samples will also be collected near the ground surface and directly above the groundwater interface in the G058-MW01 boring, which will be located within AOI 58; and directly above the groundwater interface in the G058-MW02 and G101-MW01 borings, located south of AOI 58 and southwest of AOI 101, respectively. The well borings will be drilled to a depth of 8 feet below the water table. The well screens will be set approximately 8 feet below and 2 feet above the water table. The soil and groundwater samples will be analyzed for TCL VOCs, TCL BNAs, PCBs, and TRPH. According to the E & E Groundwater Interpretation Map (1996), the existence of a groundwater divide is suspected in this area. Therefore, the direction of groundwater flow may be northeast or southwest in this area. The locations of the ESI monitoring wells in conjunction with existing monitoring points will be used to determine the extent of contamination and better define groundwater flow direction in this area.	SS	3	1	4	2-4 2-4 2-4	G101-SS03 Z1 G101-SS04 Z1 G101-SS05 Z1	Same analyses as above
								GW	1	1	16	8-16	G101-MW01 GW	Same analyses as above except no % solids

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth^a (feet BGS unless noted)	Sample Depth^b (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
67	III	26/27	OTH-700	Former Storage Area Beneath Building 700	3-9		**Background.** AOI 67 was identified as an AOI based on aerial photo AF-58-28-195 R-1 No. 44, dated 1960, and 1967 and Drawing No. 6-3, dated 1967. Review of aerial photos shows that vehicles and debris present at this site in 1955 and 1960; however, by 1967 the area was graded. Building 700, which houses the Northeast Air Defense Sector (NEADS), was built over the former storage area sometime around 1982 (see Figure 3-9). **Previous Confirmatory Sampling.** Confirmatory sampling was performed to determine if the former storage area had impacted soils and groundwater at the site. A high sensitivity metal detector (EM61) survey was performed and it was determined that buried metal objects were not prevalent beneath the site. An unexploded ordnance detection (EOD) survey was also performed prior to drilling and no such materials were found at the drilling locations. Groundwater samples showed no significant contamination, however, shallow soil samples collected from the 0 to 2 foot depth in each of the three soil borings contained levels of polychlorinated biphenyls (PCBs). No PCBs were detected in the deeper soil samples collected between 16 and 22 feet BGS. **ESI Sampling.** To determine the extent of PCBs in near-surface soils at this site, soil samples will be collected from 0 to 0.5 feet BGS as part of the ESI program. A near-surface soil sampling grid with varied station spacing will be established at AOI 67 to identify these sampling locations (see Figure 3-9). Portions of the soil sample locations will extend beyond the boundary of the former storage area to determine if any contaminated soil from AOI 67 was moved during the landscaping of the grounds for Building 700.	NS	35	1	—	0-0.5	G067-NS01 to G067-NS35	PCBs (SW8081) and % solids (EPA 160.3)
90	I	4	OTH-6024 IRP-SS-45 EBS Tables B1, G3, and 3-1	Industrial Soils Pad	3-10	1960-present	**Background.** The Industrial Soils Pad (ISP) was used for vehicle and equipment storage and as a refueling facility since 1960. From 1987 to the present, contaminated soils were temporarily stored on the ISP while awaiting disposal. Since 1993, these soils have been isolated within a covered storage building. Two 6-foot-deep by 9-foot-square vaults currently exist at this location, which were reportedly used to house transformers (see Figure 3-10).	NS	6	1	—	0-0.25	G090-NS01 through G090-NS06	TCL BNAs (SW8270), TRPH (SW9060), lead (SW6010), and % solids (EPA 160.3)

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
90 (cont.)							During a 1993 investigation performed at the ISP, high levels of lead contamination were detected in shallow soil sample ISPSS-12 (1700 mg/kg) on the west side of the site (see Figure 3-10). However, other soil samples near the ISPSS-12 samples did not contain elevated levels of lead. Elevated levels of lead were also found on the east side of the site at ISPSS-5 (120 mg/kg), but elsewhere at this site, lead concentrations in soil are close to background. Lead was found at a concentration of 2 µg/L in well LF1-P3 downgradient of the site. Elevated levels of TRPH (>200 mg/kg) were found in 2 of the 12 shallow (0-6 inch) soil samples collected during the previous investigation. TRPH was found at the southeast corner of the site at ISPSS-5 (1,000 mg/kg) and ISPSS-4 (210 mg/kg). Runoff from soils formerly stored at the site or localized spills are the likely cause of the elevated TRPH at ISPSS-5 and ISPSS-4.	SS	3	3	26	0-2 12-14 24-26	G090-SS01-Z1 G090-SS01-Z2 G090-SS01-Z3	Same analyses as above
											26	0-2 12-14 24-26	G090-SS02-Z1 G090-SS02-Z2 G090-SS02-Z3	
											26	0-2 12-14 24-26	G090-SS03-Z1 G090-SS03-Z2 G090-SS03-Z3	
							Previous Confirmatory Sampling. During the confirmatory sampling performed at the ISP site in 1995, high levels of lead, several PAHs and TRPH were found in the southeast vault. The scope of the 1995 CS investigation consisted of the vault sampling only. A soil sample, G090-SV-01, collected from the vault contained lead at a concentration of 2500 mg/kg (see Figure 3-10).	SS	1	2	26	0-2 24-26	G090-MW01-Z1 G090-MW01-Z2	Same analyses as above
									1	1	26	24-26	G090-MW02-Z2	
								MW	2	1	34	26-34	G090-MW01-GW G090-MW01-GW-F	Same analyses as above except no % solids, and both filtered and unfiltered lead for groundwater
												26-34	G090-MW02-GW G090-MW02-GW-F	

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1 No.	2 Group No.	3 Study Area	4 ID Number	5 Site Name	6 Figure No.	7 Dates of Operation	8 Justification for Further Investigation	9 Sample Type	10 No. of Locations	11 No. of Samples Per Location	12 Boring Depth[a] (feet BGS unless noted)	13 Sample Depth[b] (feet BGS unless noted)	14 STS Location Identification	15 Analytical Tests and Methods to be Conducted
90 (cont.)							**ESI Sampling.** To assess the extent of lead and petroleum hydrocarbon contamination southeast of the ISP, an Expanded Site Investigation (ESI) will be conducted. To assess the extent of shallow soil contamination north and south of the site, three near surface (0 to 0.25 feet BGS) soil samples will be collected from each of these areas. A total of six near surface samples will be collected. These near-surface samples will be analyzed for TCL BNAs, TRPH, and lead. The ESI will also include three 26-foot deep soil borings. Soil samples will also be collected from three 26-foot deep borings at shallow (0 to 2-foot), intermediate (12 to 14-foot), and deep (24 to 26-foot) depth intervals to profile potential contamination. Two additional soil borings will be installed 8 feet below the water table and will be completed as permanent monitoring wells to determine if elevated lead, and petroleum hydrocarbon contamination exists in the groundwater south and southeast of the ISP. Two soil samples will be collected in the well boring on the south side of the site: a shallow sample (0 to 2 foot BGS) and a water table interface sample (approximately 24 to 26 foot) BGS. A soil sample will also be collected at the water table interface in well located further away and southeast of the site. One groundwater sample will be collected from each of the permanent wells. The subsurface soil and groundwater samples will be analyzed for TCL BNAs, TRPH lead, and % solids (soils only). Because the level of lead in the southeast vault (2500 mg/kg) could be characteristically hazardous, an additional grab sample also will be taken from the bottom of this vault and analyzed for RCRA characteristics. This data will be used to determine an appropriate means of disposing of the material in the vault.	SG	1	1	-	0-12 inches below surface of soil	G090-SV02	TCLP lead (SW1311/6010) and % solids (EPA 160.3)

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1 No.	2 Group No.	3 Study Area	4 ID Number	5 Site Name	6 Figure No.	7 Dates of Operation	8 Justification for Further Investigation	9 Sample Type	10 No. of Locations	11 No. of Samples Per Location	12 Boring Depth[a] (feet BGS unless noted)	13 Sample Depth[b] (feet BGS unless noted)	14 STS Location Identification	15 Analytical Tests and Methods to be Conducted
100	I	6	OTH-5613 EBS Tables B1 and G3	Paint Staging Area Northeast of Former Engine Testing Facility	3-11	1975-1984	**Background**. The Paint Staging Area was reportedly used for waste paint disposal from 1975 to 1984. Most of the spills are reported to have occurred on the east side of the circular concrete pad (see Figure 3-11). The volume of spills is unknown.	NS	16	1	0-2	0-2	G100-NS01 to G100-NS16	TCL VOCs (SW8260), TCL BNAs (SW8270), TRPH (EW418.1), TAL metals (SW6010+), and % solids (EPA 160.3)
							Previous Confirmatory Sampling. A geophysical survey, performed as part of the confirmatory sampling (CS) investigation, indicated the presence of an anomaly caused by steel-reinforced concrete. The reinforced concrete was present at the surface in some areas, coincident with the observed anomaly (see Figure 3-11). No buried drums were present.	SS	3	3	0-12	0-2 4-6 10-12 0-2 4-6 10-12 0-2 4-6 10-12	G100-SS21-Z1 G100-SS20-Z2 G100-SS20-Z3 G100-SS21-Z1 G100-SS21-Z2 G100-SS21-Z3 G100-SS21-Z1 G100-SS22-Z2 G100-SS22-Z3	
							Analytical results from the Confirmatory Sampling (CS) Investigation indicate that lead and TRPH contamination is present in near-surface and subsurface borings east of the concrete pad. TRPH and lead contamination was also found in the soil sample HB02 taken from the bottom of the deeper pre-existing hand-dug well which is approximately 10 feet deep. It is possible that waste materials were placed into this hand-dug well. Lead was found at the highest levels in soil at the 0-2' interval and at the bottom of the hand-dug wells. Lead was not elevated in the deeper soil samples taken at 18-20 feet. Total chromium was also found above NYS standards in the two hand dug wells. LS13 and HB02 also have the highest total concentrations of organics as tentatively identified compounds (TICs). The majority of the TICs at AOI 100 are unknown hydrocarbons, but some of the TICs are PAHs. PAHs were found in nearly all the shallow samples at this site, with the highest elevations at LS13 and SS18. The presence of PAHs is not a major concern at this site since they are found across the base, near other airstrips, and along many highways at similar levels.	SS	3	2	30	0-2 20-22 0-2 20-22 0-2 20-22	G100-MW01-Z1 G100-MW01-Z2 G100-MW02-Z1 G100-MW02-Z2 G100-MW03-Z1 G100-MW03-Z2	
								GW	3	1	30	22-30 22-30 22-30	G100-MW01-GW G100-MW01-GW-F G100-MW02-GW G100-MW02-GW-F G100-MW03-GW G100-MW03-GW-F	Same analyses as above (both filtered and unfiltered samples for metals).

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth^a (feet BGS unless noted)	Sample Depth^b (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
100 (cont.)							**ESI Sampling**. Because the extent of contamination was not fully defined by the results of the CS investigation, an Expanded Site Investigation (ESI) will be performed. The ESI will consist of the installation of three subsurface borings which will be completed as permanent monitoring wells. One well will be located directly upgradient (northeast) of the site, one well will be approximately 100 feet downgradient (southwest) of the suspected paint spill area, and one well will be approximately 100 feet downgradient of the hand-dug wells (see Figure 3-11). Soil samples will be collected from the well borings. One shallow soil sample will be collected from 0 to 2 feet BGS and a deeper soil sample will be collected from directly above the groundwater interface. Groundwater samples will be analyzed for TCL VOCs, TCL BNAs, TRPH, and TAL metals (filtered and unfiltered). A near-surface soil sampling grid will also be established north and east of the pad as part of the ESI. Sixteen 0 to 2-foot soil samples will be collected from the grid and analyzed for the same parameters shown above to determine the extent of contamination in the shallow soils in this area where the results for previous borings and the aerial photo indicate disposal may have occurred. At three subsurface borings surrounding the hand dug wells, a shallow, an intermediate, and a deeper (at groundwater interface) soil sample will also be collected to determine if subsurface contamination that may have been associated with these wells has migrated. The near surface and subsurface soil samples will be analyzed for TCL VOCs, TCL BNAs, TRPH, and TAL metals.							

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
102	1	20	IRP-SS05	Lindane Spill Site	3-12	Spill occurred in 1957 or 1958	**Background.** The Lindane Spill Site was the former location of the Entomology Shop pesticide storage shed. A lindane spill occurred in this area during the summer of 1957 or 1958, wherein approximately 55 gallons of 45% lindane solution leaked from a storage drum over a 3 day period. As part of the site investigation for Interagency Agreement (IAG) Regulator chosen sites, four borings were augered at this site to a depth of 2 feet bgs. Two soil samples were collected from each boring and analyzed for pest./PCBs. Results of this investigation indicated the presence of chlordane, DDE and DDT in near-surface soils.	NS	4	1	—	0-2	G102-NS01 to G102-NS04	Pesticides (8081) and % solids (EPA 160.3)
								SS	3	3	22	0-2 8-10 12-14	G102-MW01-Z1 G102-MW01-Z2 G102-MW01-Z3	Same analysis as above
												0-2 8-10 12-14	G102-MW02-Z1 G102-MW02-Z2 G102-MW02-Z3	
							Previous Confirmatory Sampling. A confirmatory sampling investigation consisting of the drilling of one soil boring and one Lead Screen Auger (LSA) boring, was performed at this site. Two subsurface soil samples were collected from each boring and one groundwater screening sample was collected from the LSA boring for pesticide analysis. Although no lindane was found, chlordane, 4,4-DDE, and 4,4-DDT were detected above NYSDEC guidance values in the soil and above RBCs in the groundwater.					0-2 8-10 12-14	G102-MW03-Z1 G102-MW03-Z2 G102-MW03-Z3	
								GW	3	1	22	14-22	G102-MW01-GW G102-MW02-GW G102-MW03-GW	Same analysis as above except no % solids
								GW	1	1	existing well	15-25	LAWMW-14	

Table 2-1

EXPANDED SITE INVESTIGATION SAMPLING

AOI		EBS Designation						Proposed Investigations						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No.	Group No.	Study Area	ID Number	Site Name	Figure No.	Dates of Operation	Justification for Further Investigation	Sample Type	No. of Locations	No. of Samples Per Location	Boring Depth[a] (feet BGS unless noted)	Sample Depth[b] (feet BGS unless noted)	STS Location Identification	Analytical Tests and Methods to be Conducted
102 (cont.)							**ESI Sampling.** To determine the extent of the pesticide contamination an Expanded Site Investigation (ESI) will be conducted at this site. The ESI will consist of the collection and analysis of four near surface soil samples (0 to 2 feet BGS) and the installation of three monitoring wells (see Figure 3-12). All soil and groundwater samples collected during the ESI will be analyzed for pesticides. According to the E & E Groundwater Interpretation Map dated April 10, 1996, the existence of a groundwater divide with a north/south orientation is suspected in proximity to this site. Three soil samples will be collected in each well boring, one near the surface, one at an intermediate depth, and one directly above the groundwater interface to investigate the potential source of groundwater contamination, if found to exist. Because of the presence of this divide and the prominent hill just to the south of the site, the direction of groundwater flow at this location is not known. Permanent wells will be installed to a depth of 8 feet below the water table in the three subsurface borings. Groundwater samples will be collected and analyzed for pesticides. In addition, existing well LAWMW-14 will also be sampled and analyzed for pesticides including lindane, chlordane, 4,4-DDE, and 4,4-DDT. Results from these four groundwater samples will be used to determine the extent of groundwater contamination, and better define the direction of groundwater flow at this site.							

Table 2-1 (Cont.)

[a] Boring depths are approximate, based on assumed depth of the water table.

[b] Sample depths may vary, depending upon instrument screening (e.g., a soil sample will be collected at the most contaminated interval, based on instrument response, color, odor, etc.). If no contamination is detected, the first sample will be collected at the surface (0 to 2 feet BGS) unless otherwise specified; a second soil sample will be collected at either an intermediate depth or deeper depth (at the water table interface), based on the depth of the boring; if a third soil sample is collected, it will be taken at the groundwater interface.

1-15 Column Reference Numbers at top of each column.

Key:

AOI = Area of Interest.
BGS = Below ground surface.
BNA = Base/neutral and acid extractable organic compound.
CS = Confirmatory sampling.
EBS = Environmental Baseline Survey.
E & E = Ecology and Environment, Inc.
GAFB = Griffiss Air Force Base.
GS = Soil gas.
GW = Groundwater screening sample.
ICP = Inductively coupled plasma.
LSA = Lead screen auger.
MW = Monitoring well.
NS = Near-surface soil sample.
OTH = Other miscellaneous sites.
PAHs = Polycyclic aromatic hydrocarbons.
PCBs = Polychlorinated biphenyls.
Pest. = Pesticides.
RBCs = Risk-based criteria.
SD = Sediment.
SG = Soil grab sample.
SS = Subsurface boring.
SW = Surface water.
STS = Sample Tracking System.
TAL = Target Analyte List.
TCL = Target Compound List.
TRPH = Total recoverable petroleum hydrocarbons.
VOC = Volatile organic compound.
WSA = Weapons Storage Area.
— = Not Applicable.
Z1 = Shallow soil sample.
Z2 = Deeper soil sample of two to be collected.
Z3 = Deepest soil sample of three to be collected.

3

Field Sampling Plan (FSP) Part I: AOI-specific Problem Definition and ESI or CS Rationale

This section of the field sampling plan discusses in detail each of the AOIs where an ESI or a CS investigation will be performed. A brief description of the historical use of the site and the results of previous investigations of these areas is followed by the sampling rationale. An AOI-specific map and a Sample Tracking System (STS) table listing the samples and other details (i.e., sample, type, estimated depth, and analytical parameters) are included for each AOI to be investigated.

Each of the AOIs to be investigated are located on Figures 1-2 and 1-3, which are maps of the southern and northern portions of the base, respectively. The AOI locations were originally obtained from the *Final Report, Identification of Areas of Interest* (Law Environmental 1994a). In some cases, however, historical document review has indicated that some AOI locations were not accurate; consequently, their locations have been corrected when appropriate.

3.1 AOI 7: Southeast Skyline Housing Probable Landfill

The primary purpose of the additional investigation at AOI 7 is to determine whether elevated levels of lead, copper, or phosphorus may exist in the soils. Although no landfilling occurred at AOI 7, there is a potential that elevated levels of lead, copper, and phosphorus may exist in the soils at the former firing range. Since this area was not sampled during the Group I CS investigation, CS will be performed during this program.

3.1.1 Site Background

This area was identified as an AOI in 1994 based on reports from Griffiss AFB personnel that indicated the existence of a landfill in this area in the 1950s (Law Environmental 1994a). However, review of the 1943 aerial photograph No. 64-824-433 (see Appendix D) indicates the base firing range was located at the same location as the suspected Skyline Housing Landfill (see Figure 3-1). No refuse or waste is visible in this or subsequent aerial photographs. According to a recent records search conducted by Tetra Tech for the EBS, the general area (EBS Study Area 37/Item No. ORD-725) was the base firing range from 1943 until being torn down for the construction of the Skyline Housing Area in the late 1950s (Tetra Tech 1995a). In the 1943 photograph, three buildings were observed along the southwest border of the firing range, and an excavated slope was seen on the northeast border of the range. Uncovered partitions for firing can also be seen facing the excavated slope, which was probably used as a backstep for the projectiles. This aerial photograph does not show any impact features. It appears that the range was used for practice with small arms only. A 1960 aerial photograph shows that these structures were removed when the firing range was torn down, and that after the construction of the Skyline Housing Area, the area remained partially devegetated with no sign of debris or refuse. The area was visited during May 1994 as part of a preliminary environmental site characterization during the initial AOI identification program (Law Environmental 1994a). Several areas of vegetative stress were noted in the northwestern hill area that serves as a boundary for the site, but this was attributed to stormwater drainage. Also, an isolated area of stressed vegetation was noted at the southwestern corner of the site where neither surface drainage nor standing water was observed. No specific evidence of environmental release or landfilling was noted at that time. The site was estimated to be approximately 9.5 acres in area (see Figures 3-1 and 3-2).

3.1.2 Physical Characteristics of Site

During April 1995, this area was revisited during the reconnaissance of the Group I AOIs. The site was observed to be well vegetated with grass and sparsely distributed small trees. These trees were noticeably younger than those that border the site to the north, east, and west. No signs of exposed refuse, seepage, or stressed vegetation were observed at the site. The hillsides behind the Skyline Housing Area west and north of the site contained assorted litter and household debris. The area is a depression with no natural drainage. The area may have been a "borrow area" rather than a landfill. This entire area was evidently used for recreational purposes by families that lived in the adjacent housing units.

3.1.3 Previous Study

An investigation which consisted of a background review, site reconnaissance, and geophysical survey indicated this area was not used as a landfill. There were no steep geophysical gradients observed in the EM31 or magnetometer data that would be representative of buried metal debris or objects (E & E 1996).

3.1.4 Confirmatory Sampling

CS will consist of the collection of near surface soil samples, subsurface soil samples, and groundwater samples. Fifty near-surface (0 to 3 inches BGS where practical) soil samples will be collected from within a coarse grid (75-foot spacing) across the former range, and a finer grid (50-foot spacing) over the area where the backstop was located. In addition, two background soil samples will be collected to the east and west of the site. The soil samples will be analyzed for total lead, copper, phosphorus, and % solids.

Four soil borings will be installed and completed as temporary monitoring wells. These borings will be drilled to a depth of eight feet below the water table. Soil samples will be collected near the ground surface and directly above the water table interface. The subsurface soil and groundwater screening samples will be analyzed for the same parameters listed above; the groundwater samples will also be analyzed for dissolved (filtered) lead, copper, and phosphorus (% solids for soil only). Sample locations are shown on Figure 3-2. A list of sample identifications and analyses to be performed is presented on Table 3-1.

Table 3-1
AOI 7: SOUTHEAST SKYLINE HOUSING PROBABLE LANDFILL—SAMPLE LISTING

8/5/97

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ANALYSES

EB Study Area-AOI #	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 37 AOI- 7 (SSHL)	Group II-ESI	FIELDQC RB7NS1	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group II-ESI	FIELDQC RB7NS2	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group II-ESI	FIELDQC RB7NS3	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group II-ESI	FIELDQC RB7NS4	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group II-ESI	FIELDQC RB7NS5	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group II-ESI	FIELDQC RB7SS	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1										X						X									
	Group II-ESI	FIELDQC RB7W1	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1										X						X									
	Group II-ESI	FIELDQC RB7W2	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1										X						X									
	Group II-ESI	G007-NS01	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS01	9/15/97	ASC	Soil/QC Matrix	0 - 0.25	Y	O	MS1	X										X														
	Group II-ESI	G007-NS02	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS03	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS04	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS05	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS06	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS07	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS08	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS09	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS10	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS10/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X									X						X									
	Group II-ESI	G007-NS10/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X									X						X									
	Group II-ESI	G007-NS11	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS12	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS13	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS14	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									

Table 3-1 (Cont.)

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ANALYSES

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 37 AOI- 7 (SSHL)	Group II-ESI	G007-NS15	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS16	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS17	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS18	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS19	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS20	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS20/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X									X						X									
	Group II-ESI	G007-NS20/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X									X						X									
	Group II-ESI	G007-NS21	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS22	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS23	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS24	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS25	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS25	9/15/97	ASC	Soil/QC Matrix	0 - 0.25	Y	O	MS1	X										X														
	Group II-ESI	G007-NS26	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS27	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS28	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS29	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS30	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS30/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X									X						X									
	Group II-ESI	G007-NS30/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X									X						X									
	Group II-ESI	G007-NS31	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS32	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS33	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS34	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						[illegible]									

Table 3-1 (Cont.)

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React+2	Sb6010	TALMet	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 37 AOI- 7 (SSHL)	Group II-ESI	G007-NS35	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS36	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS37	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS38	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS39	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS40	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS40/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X									X						X									
	Group II-ESI	G007-NS40/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X									X						X									
	Group II-ESI	G007-NS41	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS42	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS43	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS44	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS45	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS46	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS47	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS48	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS49	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS50	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-NS50/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X									X						X									
	Group II-ESI	G007-NS50/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X									X						X									
	Group II-ESI	G007-NS51	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group II-ESI	G007-NS52	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X									X						X									
	Group II-ESI	G007-SS01 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X									X						X									
	Group II-ESI	G007-SS01 Z2	9/15/97	ASC	Soil	5 - 7	Y	O	N1	X									X						X									
	Group II-ESI	G007-SS01 GW	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X						X									

Table 3-1 (Cont.)

Page 4 of 5

8/5/97

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EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb 6010	Pb 7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 37 AOI- 7 (SSHL)	Group II-ESI	G007-SS01 GW-F	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X															
	Group II-ESI	G007-SS01 GW	9/15/97	ASC	Water/QC Matrix	7 - 15	Y	O	MS1										X						X									
	Group II-ESI	G007-SS02 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X									X						X									
	Group II-ESI	G007-SS02 Z1/D	9/15/97	ASC	Soil	0 - 2	Y	O	FD1	X									X						X									
	Group II-ESI	G007-SS02 Z1/S	9/15/97	MRD	Soil	0 - 2	Y	O	FR1	X									X						X									
	Group II-ESI	G007-SS02 Z2	9/15/97	ASC	Soil	5 - 7	Y	O	N1	X									X						X									
	Group II-ESI	G007-SS02 GW	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X						X									
	Group II-ESI	G007-SS02 GW-F	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X															
	Group II-ESI	G007-SS03 Z2	9/15/97	ASC	Soil	5 - 7	Y	O	N1	X									X						X									
	Group II-ESI	G007-SS03 GW	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X						X									
	Group II-ESI	G007-SS03 GW-F	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X															
	Group II-ESI	G007-SS03 GW-F/D	9/15/97	ASC	Groundwater	7 - 15	Y	O	FD1										X															
	Group II-ESI	G007-SS03 GW-F/S	9/15/97	MRD	Groundwater	7 - 15	Y	O	FR1										X															
	Group II-ESI	G007-SS03 GW/D	9/15/97	ASC	Groundwater	7 - 15	Y	O	FD1										X						X									
	Group II-ESI	G007-SS03 GW/S	9/15/97	MRD	Groundwater	7 - 15	Y	O	FR1										X						X									
	Group II-ESI	G007-SS04 Z2	9/15/97	ASC	Soil	5 - 7	Y	O	N1	X									X						X									
	Group II-ESI	G007-SS04 GW	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X						X									
	Group II-ESI	G007-SS04 GW-F	9/15/97	ASC	Groundwater	7 - 15	Y	O	N1										X															

Table 3-1 (Cont.)

Griffiss AFB

EB Study Area-AOI #-		Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	ANALYSES																								
											%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	Pest-PCB	Phosph	React-1	React-2	Sb6010	TALMetl	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 37	AOI- 7 (SSHL)	Group II-ESI	ZZZZ	9/15/97	ASC	Groundwater	0 - 15	Y	O	N1																									

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

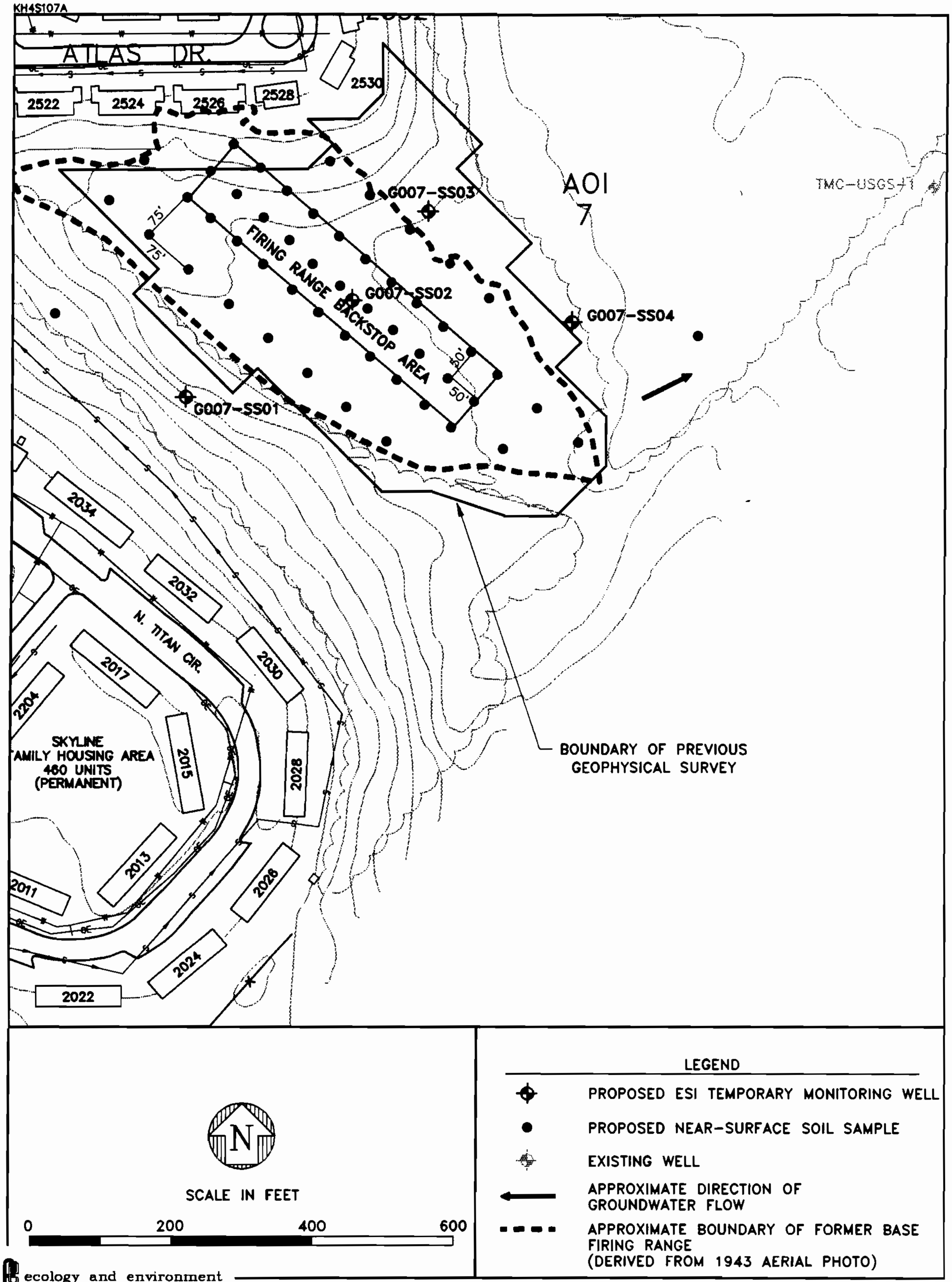
GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

Figure 3-1
GAFB - Existing Site Plan Projected Over 1943 Aerial Photo (No. 64-824-433) Showing Former Base Firing Range at AOI 7



ecology and environment

Figure 3-2 SOUTHEAST SKYLINE HOUSING PROBABLE LANDFILL (AOI 7)

3.2 AOI 9: Weapons Storage Area (WSA) Landfill

The purpose of the ESI investigation at AOI 9 is to determine if chlorinated hydrocarbons exist in the vicinity of lead-screen auger (LSA) boring LS05, where elevated levels of solvent compounds were previously identified in a groundwater screening sample.

3.2.1 Site Background

This site (EBS Study Area 7/Item No. OTH-846) was the original landfill for the base (Tetra Tech 1995a). Aerial photograph No. 55-824-433 shows areas of disturbance along the southwest portion of what is currently the Weapons Storage Area (WSA) between Perimeter Road and Sixmile Creek, and to the north at Landfill 1 (see Figure 3-3). The area was used as a landfill from 1943 to at least 1957, but no later than 1960. The type of material buried here is unknown; however, base personnel reported that large quantities of landfill material were removed during construction of the WSA. Low levels of chloromethane (2.1 μg/L) were detected in the groundwater in this area (well WSAMW-4) prior to the Group I AOI CS (Law Environmental 1995a).

3.2.2 Physical Characteristics of Site

The area between Perimeter Road and Sixmile Creek is gently sloping, and at the northwest end of this area, a fairly level plateau exists. There are several locations within the plateau where shallow groundwater discharges to the surface, and this water is clear in appearance. At the south end of this area, the topography exhibits a greater slope, and two bright orange seeps were observed. The volume of water discharged from the seeps is low even following rainfall, and the soils that surround the seeps are stained with the same orange color.

The subsurface logs for the four LSA borings drilled along the south side of the site indicate that subsurface soils consist predominantly of silt and clays with some sandy silt and sandy clay intervals from the ground surface to bedrock. The depth of the Utica shale bedrock ranges from 11.5 feet to 13.5 feet BGS at LS07 and LS06, respectively. The depth of groundwater at AOI 9 is approximately 4 feet BGS near Sixmile Creek and 10 feet BGS east of Perimeter Road. Groundwater flows to the southwest toward Sixmile Creek.

3.2.3 Previous Confirmatory Sampling

CS was performed in 1995 at the grass-covered area that slopes southwest from the WSA facility between the fenceline and Sixmile Creek (see Figure 3-3). The portion of the former landfill that is now covered by the southwest part of the WSA was not investigated because of the extensive removal of landfill material and redevelopment that occurred at that area during the construction of this facility.

An extensive reconnaissance of the former landfill site was performed. There were no stains, exposed wastes, or stressed vegetation indicative of landfilling inside the WSA facility or in the area between the WSA fence and Perimeter Road. The area southwest of the WSA fence is covered with grass and gently grades toward Perimeter Road. Monitoring well WSAMW-4 is located in this area, adjacent to a small (approximately 55 square feet) water retention pond. There was no fill material noted on the subsurface drilling log for WSAMW-4.

Results of the geophysical survey performed during the investigation indicated a strong magnetic and electromagnetic anomaly is present near a large mound of soil at the north end of the site. This mound is believed to be the remains of a berm that separated two former storage igloos that were used to store hazardous materials. Otherwise, the geophysical gradient across the site is relatively flat, indicating that metallic material is not prevalent beneath the site.

Four borings were drilled at the site. Temporary wells were installed in each boring to obtain groundwater samples. Low levels of trichloroethane, tetrachloroethene, and chlorobenzene detected in a groundwater screening sample collected at boring LS05 may have resulted from a spill or leak at one of the storage igloos formerly located at the north end of the site.

3.2.4 ESI Sampling

An ESI will be performed at this site consisting of a passive soil gas survey and installation of five additional soil borings of which four will be completed as permanent monitoring wells (see Figure 3-3). The results of the soil gas study will be used to identify if, and where, other elevated levels of chlorinated hydrocarbons exist in the vicinity of LS05. The soil borings/wells will be placed at locations, based upon the results of the soil gas study, to determine the extent of these solvents in the soil and groundwater at the site. Three soil samples will be collected from the soil boring and each well boring: one shallow soil sample at 0 to 0.25 feet, one soil sample at 0.25 to 2 feet, and a deeper soil sample directly above the groundwater interface. The well screens will be set approximately 3 feet below and 2 feet above the water table. Three surface water/sediment samples will also be collected on the north bank of Sixmile Creek to determine if groundwater adversely impacts the creek. If there is a seep present at the site that has not been sampled previously, a surface water/sediment sample will be collected there as well.

The soil, groundwater, and surface water/sediment samples to be collected will be analyzed for TCL VOCs, base neutral acid extractables (BNAs), pesticide/polychlorinated biphenyls (pest/PCBs), total recoverable petroleum hydrocarbons (TRPH), Target Analyte List (TAL) metals (filtered and unfiltered for groundwater), and % solids (soils only). A list of sample identifications to be collected and analyses to be performed is provided in Table 3-2. Sample locations are shown on Figure 3-3.

Table 3-2
AOI 9: WEAPONS STORAGE AREA (WSA)
LANDFILL—SAMPLE LISTING

8/7/97

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ANALYSES

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pests	PestPCB	Phosph	React-1	React-2	Sb6010	TALMet	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 7 AOI-9 (WSA)	Group I-ESI	FIELDQC RB9S	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1															X				X	X	X	X			X
	Group I-ESI	FIELDQC TB9GW	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group I-ESI	FIELDQC TB9SW	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group I-ESI	G009-MW01 Z1	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW01 Z2	9/15/97	ASC	Soil	0.25 - 2	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW01 Z3	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW01 Z1	9/15/97	ASC	Soil/QC Matrix	0 - 0.25	Y	O	MS1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW01 GW	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G009-MW01 GW-F	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1																			X	X					
	Group I-ESI	G009-MW02 Z1	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW02 Z1/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW02 Z1/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW02 Z2	9/15/97	ASC	Soil	0.25 - 2	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW02 Z3	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW02 GW	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G009-MW02 GW-F	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1																			X	X					
	Group I-ESI	G009-MW03 Z1	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW03 Z2	9/15/97	ASC	Soil	0.25 - 2	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW03 Z3	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW03 GW	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G009-MW03 GW-F	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1																			X	X					
	Group I-ESI	G009-MW04 Z1	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW04 Z2	9/15/97	ASC	Soil	0.25 - 2	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW04 Z3	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-MW04 GW	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1															X				X	X	X	X			X

Table 3-2 (Cont.)

Page 2 of 3

8/7/97

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EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 7 AOI-9 (WSA)	Group I-ESI	G009-MW04 GW-F	9/15/97	ASC	Groundwater	10 - 13	Y	O	N1																			X	X					
	Group I-ESI	G009-SD05	9/15/97	ASC	Sediment	0 - 0.5	Y	O	N1	X														X				X	X	X	X	X		X
	Group I-ESI	G009-SD06	9/15/97	ASC	Sediment	0 - 0.5	Y	O	N1	X														X				X	X	X	X	X		X
	Group I-ESI	G009-SD07	9/15/97	ASC	Sediment	0 - 0.5	Y	O	N1	X														X				X	X	X	X	X		X
	Group I-ESI	G009-SD08	9/15/97	ASC	Sediment	0 - 0.5	Y	O	N1	X														X				X	X	X	X	X		X
	Group I-ESI	G009-SS01 Z1	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-SS01 Z2	9/15/97	ASC	Soil	0.25 - 2	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-SS01 Z3	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G009-SW05	9/15/97	ASC	Surface Water	0 - 0	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G009-SW06	9/15/97	ASC	Surface Water	0 - 0	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G009-SW07	9/15/97	ASC	Surface Water	0 - 0	Y	O	N1															X				X	X	X	X			X

Table 3-2 (Cont.)

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	PestPCB	Phosph	React 1	React 2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 7 AOI-9 (WSA)	Group I-ESI	G009-SW08	9/15/97	ASC	Surface Water	0 - 0	Y	O	N1															X				X	X	X	X			X

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

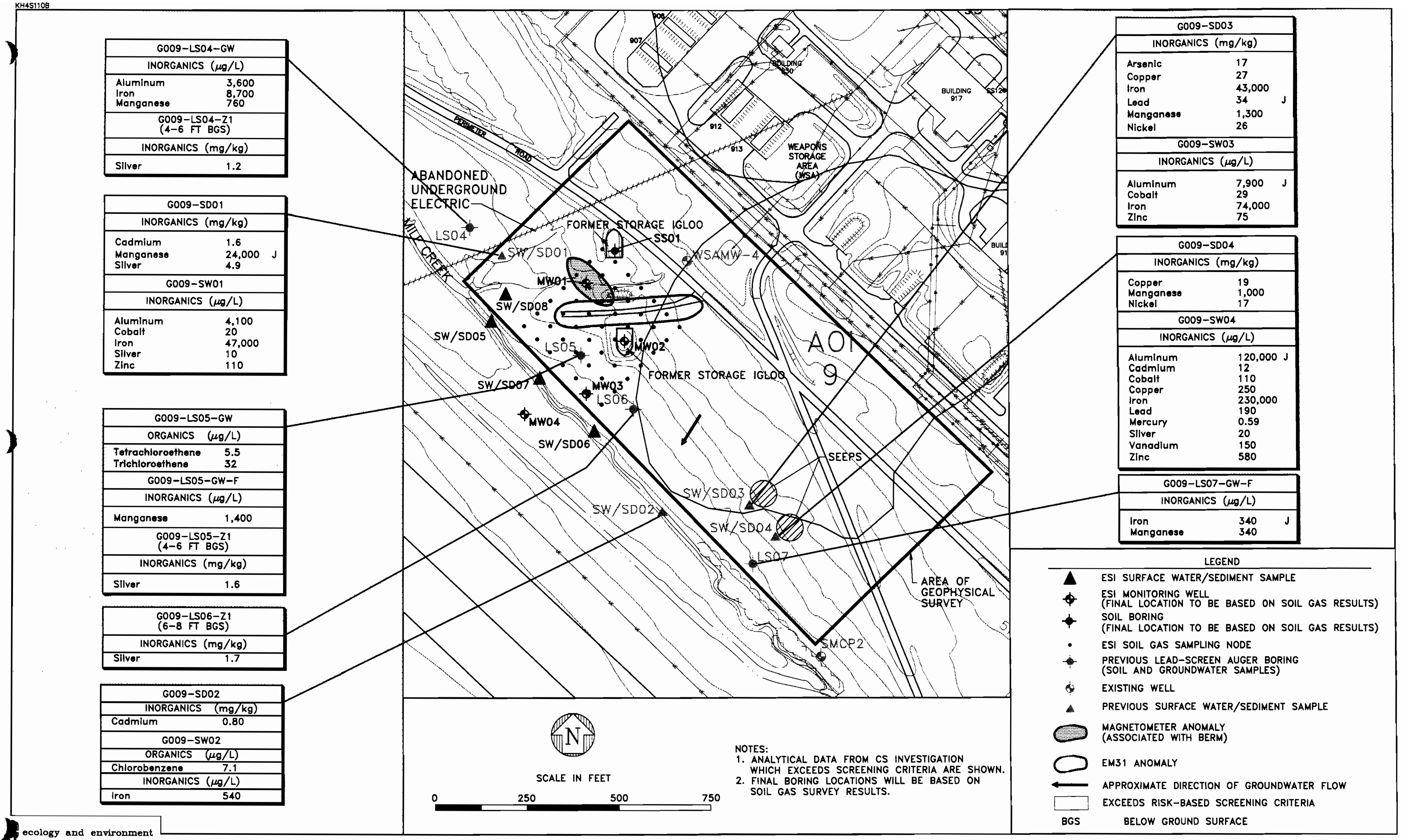
GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

KH4S110B



G009-LS04-GW	
INORGANICS (µg/L)	
Aluminum	3,600
Iron	8,700
Manganese	760
G009-LS04-Z1 (4-6 FT BGS)	
INORGANICS (mg/kg)	
Silver	1.2

G009-SD01		
INORGANICS (mg/kg)		
Cadmium	1.6	
Manganese	24,000	J
Silver	4.9	
G009-SW01		
INORGANICS (µg/L)		
Aluminum	4,100	
Cobalt	20	
Iron	47,000	
Silver	10	
Zinc	110	

G009-LS05-GW	
ORGANICS (µg/L)	
Tetrachloroethene	5.5
Trichloroethene	32
G009-LS05-GW-F	
INORGANICS (µg/L)	
Manganese	1,400
G009-LS05-Z1 (4-6 FT BGS)	
INORGANICS (mg/kg)	
Silver	1.6

G009-LS06-Z1 (6-8 FT BGS)	
INORGANICS (mg/kg)	
Silver	1.7

G009-SD02	
INORGANICS (mg/kg)	
Cadmium	0.80
G009-SW02	
ORGANICS (µg/L)	
Chlorobenzene	7.1
INORGANICS (µg/L)	
Iron	540

G009-SD03		
INORGANICS (mg/kg)		
Arsenic	17	
Copper	27	
Iron	43,000	
Lead	34	J
Manganese	1,300	
Nickel	26	
G009-SW03		
INORGANICS (µg/L)		
Aluminum	7,900	J
Cobalt	29	
Iron	74,000	
Zinc	75	

G009-SD04		
INORGANICS (mg/kg)		
Copper	19	
Manganese	1,000	
Nickel	17	
G009-SW04		
INORGANICS (µg/L)		
Aluminum	120,000	J
Cadmium	12	
Cobalt	110	
Copper	250	
Iron	230,000	
Lead	190	
Mercury	0.59	
Silver	20	
Vanadium	150	
Zinc	580	

G009-LS07-GW-F		
INORGANICS (µg/L)		
Iron	340	J
Manganese	340	

NOTES:
1. ANALYTICAL DATA FROM CS INVESTIGATION WHICH EXCEEDS SCREENING CRITERIA ARE SHOWN.
2. FINAL BORING LOCATIONS WILL BE BASED ON SOIL GAS SURVEY RESULTS.

LEGEND

▲	ESI SURFACE WATER/SEDIMENT SAMPLE
⊕	ESI MONITORING WELL (FINAL LOCATION TO BE BASED ON SOIL GAS RESULTS)
✦	SOIL BORING (FINAL LOCATION TO BE BASED ON SOIL GAS RESULTS)
•	ESI SOIL GAS SAMPLING NODE
✦	PREVIOUS LEAD-SCREEN AUGER BORING (SOIL AND GROUNDWATER SAMPLES)
⊕	EXISTING WELL
▲	PREVIOUS SURFACE WATER/SEDIMENT SAMPLE
▨	MAGNETOMETER ANOMALY (ASSOCIATED WITH BERM)
○	EM31 ANOMALY
←	APPROXIMATE DIRECTION OF GROUNDWATER FLOW
☐	EXCEEDS RISK-BASED SCREENING CRITERIA
BGS	BELOW GROUND SURFACE

ecology and environment

Figure 3-3 WEAPONS STORAGE AREA (WSA) LANDFILL (AOI 9)

3.3 AOI 16: Coal Storage and Debris Deposition Area West of Building 7 and AOI 193: Former Building P5 Tank Cleaning and Cutting Area

The purpose of the ESI investigation in this area is to determine the extent of the naphthalene in groundwater at AOI 16, a former coal storage and debris staging area, and to evaluate the extent of the TCE at AOI 193, a former tank cleaning and cutting area. The investigations of AOI 16 and AOI 193 were combined because of their proximity to each other.

3.3.1 Site Background

AOIs 16 and 193 (EBS study area 22) consist primarily of large concrete building foundations (see Figure 3-4). At AOI 16, coal was stored on the concrete foundation from 1969 to at least 1975. A pile of coal or debris was observed at the site in a 1975 aerial photograph. Subsequent aerial photographs show that this pile had been removed by September 1978, at which time the foundation was being used as a parking lot. Drums may also have been stored on the foundation. It was previously reported that the northern portion of the foundation (Lot 11) was used to store hazardous waste from 1983 until 1990. Closure of Lot 11 was completed under the Resource Conservation and Recovery Act (RCRA) in 1995. In 1995, potentially contaminated soil, which came primarily from electrical substation B-27, was stored on the AOI 16 portion of the foundation. Sampling of this soil revealed PCBs at one location. The soil was subsequently disposed of appropriately.

At AOI 193, the concrete building foundation was used for the storage of equipment and cutting apart of underground storage tanks (USTs) since 1973. These USTs were removed from other areas of the base prior to cutting (see Figure 3-4) (Tetra Tech 1995a). The foundation appears to have been used for this purpose until at least 1980 (Law Environmental 1994a). No tanks were stored at this AOI during an E & E site visit in April 1995.

3.3.2 Physical Characteristics

The site surface consists of a 6-inch-thick concrete pad. Based on the 10 borings drilled at the site, the overburden beneath the concrete pad is composed of fill materials consisting of sand, gravel, and silt to a depth of at 16 feet, which is the deepest boring drilled at this site. The depth to groundwater is approximately 16 feet BGS. Groundwater in the vicinity of the site flows toward the southwest.

3.3.3 Previous Confirmatory Sampling

CS was performed at AOI 16 and 193 to determine if environmental impacts were caused by past use of the sites. Ten subsurface-soil borings were drilled and sampled at each site. One groundwater screening sample was collected from each of two LSA borings at each site.

Results of the CS program for AOI 16 indicate that the PAHs benzo(a)pyrene and dibenzo(a,h)anthracene were present above RBCs in two subsurface soil samples collected at depths of 4 to 8 feet below the concrete surface. One PAH, naphthalene, was detected in one groundwater sample at a concentration above NYSDEC Class GA groundwater standards.

Results of the CS investigation at AOI 193 indicated the presence of the PAH benzo(a)pyrene at concentrations above EPA Region III RBCs in three subsurface soil samples at depth ranging from 2 to 5 feet below the concrete. PAHs were not present in groundwater; however, TCE was found at LS16 (See Figure 3-4) at concentrations below NYSDEC class GA standards.

At both AOI sites, the PAHs appear to be limited to the shallow subsurface depth and the concrete foundation significantly limits any exposure to the soils. Redevelopment of the area will include demolition of the concrete pads. As much as eighteen inches (BGS) of soil may be removed during demolition. However, the existing soils are expected to be covered again by new buildings, paved areas, and/or clean fill and top soil. A soil screening-level risk assessment performed for the site concluded it does not pose a significant human health risk to construction workers engaged in the planned site improvement or redevelopment activities.

3.3.4 ESI Sampling

The ESI sampling at AOIs 16 and 193 is expected to be performed after the concrete foundations are demolished. At AOI 16, two additional soil borings will be installed and completed as permanent monitoring wells to determine the extent of the naphthalene in groundwater at this AOI (see Figure 3-4). Each well screen will be set 2 feet above and 8 feet below the water table. Two soil samples will be collected during the drilling of each monitoring well boring. A shallow soil sample will be collected from below the bottom of the concrete rubble, which is estimated to be 2 to 4 feet BGS. A deeper soil sample will be collected directly above the groundwater interface. Both the soil and groundwater samples will be analyzed for TCL VOCs and PAHs (% solids for soil).

For AOI 193, the extent of the TCE will be further evaluated as part of the ESI program. Three additional borings will be installed and completed as permanent monitoring wells (see Figure 3-4). Each well will be set 8 feet below and 2 feet above the water table. Two soil samples will be collected from each monitoring well boring during drilling. A shallow soil sample will be collected below the bottom of the concrete rubble, which is estimated to be 2 to 4 feet below ground surface. A deeper soil sample will be collected directly above the groundwater interface. Soil and groundwater samples will be analyzed for TCL VOCs and PAHs (% solids for soil). A list of sample identifications and analyses is presented in Table 3-3. Sample locations are shown on Figure 3-4.

Groundwater flow is generally towards the southwest at both AOIs but may be affected locally by a 66-inch storm drain that crosses both AOIs. Water level measurements will be obtained from the storm drain at accessible manholes in proximity to the site to determine if the 66-inch storm drain that transects the site influences groundwater flow. These water levels will be compared with those in the wells to better define the direction of groundwater flow at this site.

Table 3-3
AOI 16: COAL STORAGE AND DEBRIS DEPOSITION AREA WEST OF BUILDING 7 AND AOI 193: FORMER BUILDING P5 TANK CLEANING AND CUTTING AREA—SAMPLE LISTING

Griffiss AFB

ANALYSES

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TALMet	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 22 AOI-16 (CSA)	Group I-ESI	FIELDQC TB16	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group I-ESI	G016-MW01 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X								X													X			
	Group I-ESI	G016-MW01 Z2	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X								X													X			
	Group I-ESI	G016-MW01 GW	9/15/97	ASC	Groundwater	12 - 20	Y	O	N1									X													X			
	Group I-ESI	G016-MW02 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X								X													X			
	Group I-ESI	G016-MW02 Z2	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X								X													X			
	Group I-ESI	G016-MW02 GW	9/15/97	ASC	Groundwater	12 - 20	Y	O	N1									X													X			
Study Area 22 AOI-193 (TC&C)	Group I-ESI	FIELDQC RB193S	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1									X													X			
	Group I-ESI	FIELDQC TB193	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group I-ESI	G193-MW01 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X								X													X			
	Group I-ESI	G193-MW01 Z2	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X								X													X			
	Group I-ESI	G193-MW01 GW	9/15/97	ASC	Groundwater	12 - 20	Y	O	N1									X													X			
	Group I-ESI	G193-MW02 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X								X													X			
	Group I-ESI	G193-MW02 Z1/D	9/15/97	ASC	Soil	2 - 4	Y	O	FD1	X								X													X			
	Group I-ESI	G193-MW02 Z1/S	9/15/97	MRD	Soil	2 - 4	Y	O	FR1	X								X													X			
	Group I-ESI	G193-MW02 Z2	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X								X													X			
	Group I-ESI	G193-MW02 GW	9/15/97	ASC	Groundwater	12 - 20	Y	O	N1									X													X			
	Group I-ESI	G193-MW03 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X								X													X			
	Group I-ESI	G193-MW03 Z2	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X								X													X			
	Group I-ESI	G193-MW03 GW	9/15/97	ASC	Groundwater	12 - 20	Y	O	N1									X													X			
	Group I-ESI	G193-MW03 GW	9/15/97	ASC	Water/QC Matrix	12 - 20	Y	O	MS1									X													X			

Table 3-3 (Cont.)

Griffiss AFB

										ANALYSES																								
EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	Pest PCB	Phosph	React - 1	React - 2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 22 AOI-193 (TC&C)	Group I-ESI	ZZZZ	9/15/97	ASC	Water/QC Matrix	0 - 0	Y	O	MS1																									

Note: Depth is measured in feet.

Key:

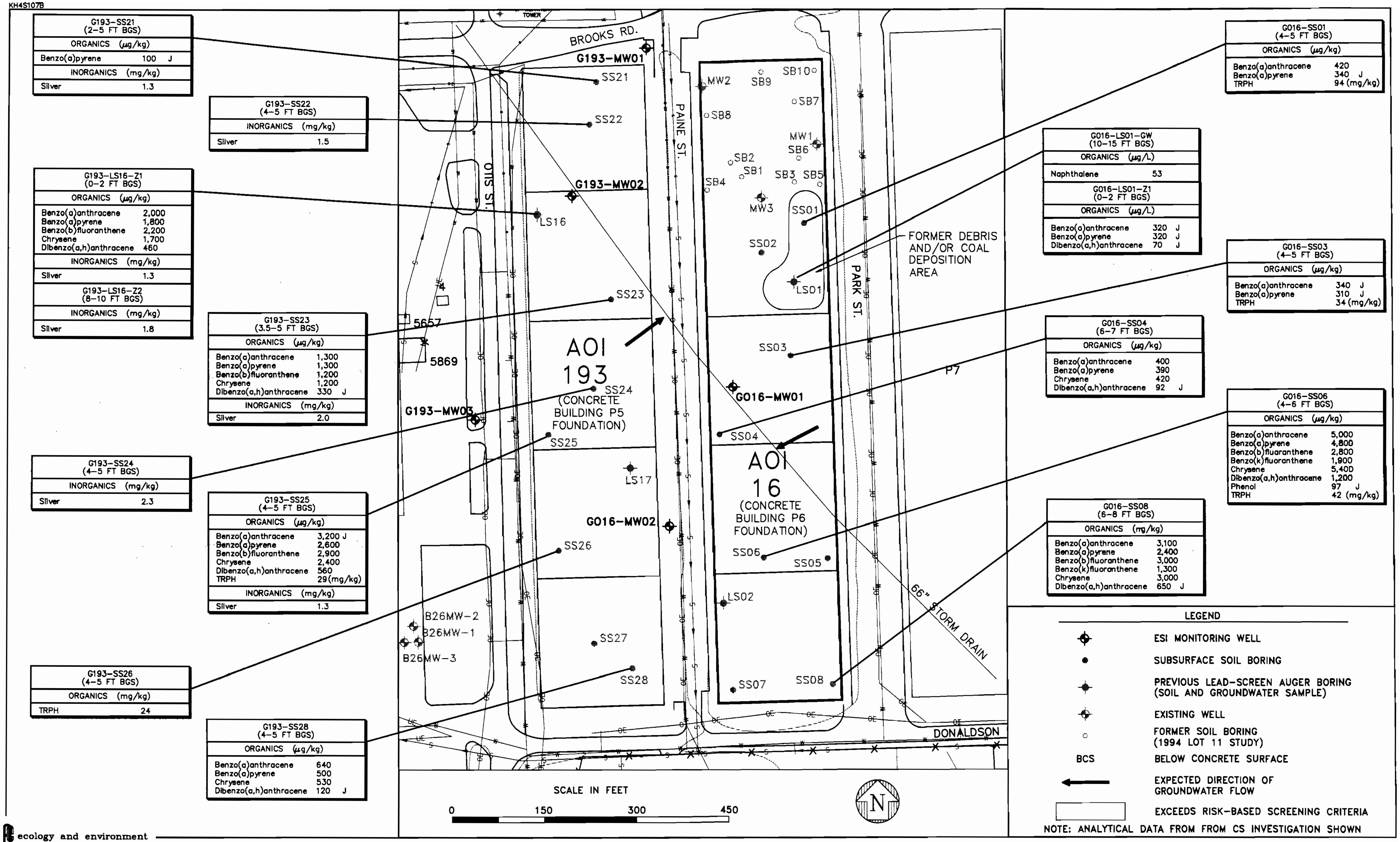
AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons



G193-SS21 (2-5 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)pyrene	100 J
INORGANICS (mg/kg)	
Silver	1.3

G193-SS22 (4-5 FT BGS)	
INORGANICS (mg/kg)	
Silver	1.5

G193-LS16-Z1 (0-2 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	2,000
Benzo(a)pyrene	1,800
Benzo(b)fluoranthene	2,200
Chrysene	1,700
Dibenzo(a,h)anthracene	460
INORGANICS (mg/kg)	
Silver	1.3
G193-LS16-Z2 (8-10 FT BGS)	
INORGANICS (mg/kg)	
Silver	1.8

G193-SS23 (3.5-5 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	1,300
Benzo(a)pyrene	1,300
Benzo(b)fluoranthene	1,200
Chrysene	1,200
Dibenzo(a,h)anthracene	330 J
INORGANICS (mg/kg)	
Silver	2.0

G193-SS24 (4-5 FT BGS)	
INORGANICS (mg/kg)	
Silver	2.3

G193-SS25 (4-5 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	3,200 J
Benzo(a)pyrene	2,600
Benzo(b)fluoranthene	2,900
Chrysene	2,400
Dibenzo(a,h)anthracene	560
TRPH	29(mg/kg)
INORGANICS (mg/kg)	
Silver	1.3

G193-SS26 (4-5 FT BGS)	
ORGANICS (mg/kg)	
TRPH	24

G193-SS28 (4-5 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	640
Benzo(a)pyrene	500
Chrysene	530
Dibenzo(a,h)anthracene	120 J

G016-SS01 (4-5 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	420
Benzo(a)pyrene	340 J
TRPH	94 (mg/kg)

G016-LS01-GW (10-15 FT BGS)	
ORGANICS (µg/L)	
Naphthalene	53
G016-LS01-Z1 (0-2 FT BGS)	
ORGANICS (µg/L)	
Benzo(a)anthracene	320 J
Benzo(a)pyrene	320 J
Dibenzo(a,h)anthracene	70 J

G016-SS03 (4-5 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	340 J
Benzo(a)pyrene	310 J
TRPH	34 (mg/kg)

G016-SS04 (6-7 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	400
Benzo(a)pyrene	390
Chrysene	420
Dibenzo(a,h)anthracene	92 J

G016-SS06 (4-6 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	5,000
Benzo(a)pyrene	4,800
Benzo(b)fluoranthene	2,800
Benzo(k)fluoranthene	1,900
Chrysene	5,400
Dibenzo(a,h)anthracene	1,200
Phenol	97 J
TRPH	42 (mg/kg)

G016-SS08 (6-8 FT BGS)	
ORGANICS (mg/kg)	
Benzo(a)anthracene	3,100
Benzo(a)pyrene	2,400
Benzo(b)fluoranthene	3,000
Benzo(k)fluoranthene	1,300
Chrysene	3,000
Dibenzo(a,h)anthracene	650 J

LEGEND

⊕	ESI MONITORING WELL
●	SUBSURFACE SOIL BORING
⊕	PREVIOUS LEAD-SCREEN AUGER BORING (SOIL AND GROUNDWATER SAMPLE)
⊕	EXISTING WELL
○	FORMER SOIL BORING (1994 LOT 11 STUDY)
BCS	BELOW CONCRETE SURFACE
←	EXPECTED DIRECTION OF GROUNDWATER FLOW
☐	EXCEEDS RISK-BASED SCREENING CRITERIA

NOTE: ANALYTICAL DATA FROM FROM CS INVESTIGATION SHOWN

Figure 3-4 COAL STORAGE AND DEBRIS DEPOSITION AREA WEST OF BUILDING 7 (P7) (AOI 16)/ FORMER BUILDING P5 TANK CLEANING AND CUTTING AREA (AOI 193)

3.4 AOI 17: Disposal Area Northeast of Hardfill 49c

The purpose of the ESI investigation at AOI 17 is to define the boundaries of the former landfill located directly northwest of Landfill 6.

3.4.1 Site Background

AOI 17 (EBS study area 28/35) was described in the AOI report as a disposal area north of Landfill 6 containing debris and refuse. The EBS/AOI Summary Table states this AOI is apparently an extension of Landfill 6 and Hardfill 49c is also listed under this AOI. Review of aerial photograph No. 266, dated 1975, clearly shows that landfilling occurred northwest of Landfill 6. However, since Landfill 6 operated between 1955 and 1959, the landfilling at AOI 17, was not part of the former operation (see Figure 3-5). Because Hardfill 49c is located south of AOI 17, it is not part of this site. Because of the relative locations of the three sites with respect to the southwest flow of groundwater beneath this area, neither of the investigations at Landfill 6 or Hardfill 49c characterized the potential landfill operations noted at AOI 17.

3.4.2 Confirmatory Sampling

CS of AOI 17 will be performed because earlier investigations of Landfill 6 and Hardfill 49c did not include the investigation of this AOI. A geophysical survey using a magnetometer and EM31 will be performed to delineate the boundaries of the landfill at AOI 17 (see Figure 3-6). Once the landfill is delineated, three subsurface soil borings will be drilled on the north, southwest, and south sides of the fill area. These locations will be based on the results of the geophysical survey such that no drilling through fill material is performed. Two soil samples will be collected in each boring, one at an intermediate depth and one directly above the soil/groundwater interface. The borings will be drilled to a depth of 8 feet below the water table, and a temporary well will be installed in each boring. The well screens will be set approximately 8 feet below and 2 feet above the water table. A groundwater sample will be collected from each temporary well for screening purposes. The soil and groundwater screening samples will be analyzed for TCL VOCs and BNAs, pest./PCBs, TRPH, and TAL metals (filtered and unfiltered for groundwater) and % solids (for soil only). A list of sample identifications and analyses is presented in Table 3-4.

Six near-surface (0 to 0.25 feet BGS) soil samples will be collected from the landfill cover and analyzed for the same parameters listed above. A preliminary study of the existing cover material will also be performed. A document search for as-built drawings of the cover and a visual inspection of the cover will be conducted. A description of the cover will also be provided based on the inspection of the six near-surface soil samples collected. After review of the results of the CS investigation at AOI 17, it will be determined if test pits will be performed at this site in a subsequent investigation.

Table 3-4
AOI 17: DISPOSAL AREA NORTHEAST OF HARDFILL 49C—SAMPLE LISTING

Page 1 of 2

8/5/97

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ANALYSES

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 28 AOI-17 (DAH49C)	Group I-ESI	FIELDQC RB17NS	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1															X				X	X	X	X			X
	Group I-ESI	FIELDQC RB17SS	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1															X				X	X	X	X			X
	Group I-ESI	FIELDQC TB17	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group I-ESI	G017-NS01	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS01	9/15/97	ASC	Soil/QC Matrix	0 - 0.25	Y	O	MS1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS02	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS03	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS04	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS04/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS04/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS05	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-NS06	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS01 Z2	9/15/97	ASC	Soil	16 - 18	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS01 Z3	9/15/97	ASC	Soil	34 - 36	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS01 Z2	9/15/97	ASC	Soil/QC Matrix	16 - 18	Y	O	MS1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS01 GW	9/15/97	ASC	Groundwater	36 - 44	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G017-SS01 GW-F	9/15/97	ASC	Groundwater	36 - 44	Y	O	N1																			X	X					
	Group I-ESI	G017-SS02 Z2	9/15/97	ASC	Soil	16 - 18	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS02 Z2/D	9/15/97	ASC	Soil	16 - 18	Y	O	FD1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS02 Z2/S	9/15/97	MRD	Soil	16 - 18	Y	O	FR1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS02 Z3	9/15/97	ASC	Soil	34 - 36	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS02 GW	9/15/97	ASC	Groundwater	36 - 44	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G017-SS02 GW-F	9/15/97	ASC	Groundwater	36 - 44	Y	O	N1																			X	X					
	Group I-ESI	G017-SS02 GW	9/15/97	ASC	Water/QC Matrix	36 - 44	Y	O	MS1															X				X	X	X	X			X
	Group I-ESI	G017-SS02 GW-F	9/15/97	ASC	Water/QC Matrix	36 - 44	Y	O	MS1																			X	X					

Table 3-4 (Cont.)

Page 2 of 2

8/5/97

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ANALYSES

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	Pest PCB	Phosph	React 1	React 2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 28 AOI-17 (DAH49C)	Group I-ESI	G017-SS03 Z2	9/15/97	ASC	Soil	16 - 18	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS03 Z3	9/15/97	ASC	Soil	34 - 36	Y	O	N1	X														X				X	X	X	X			X
	Group I-ESI	G017-SS03 GW	9/15/97	ASC	Groundwater	36 - 44	Y	O	N1															X				X	X	X	X			X
	Group I-ESI	G017-SS03 GW-F	9/15/97	ASC	Groundwater	36 - 44	Y	O	N1																			X	X					

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

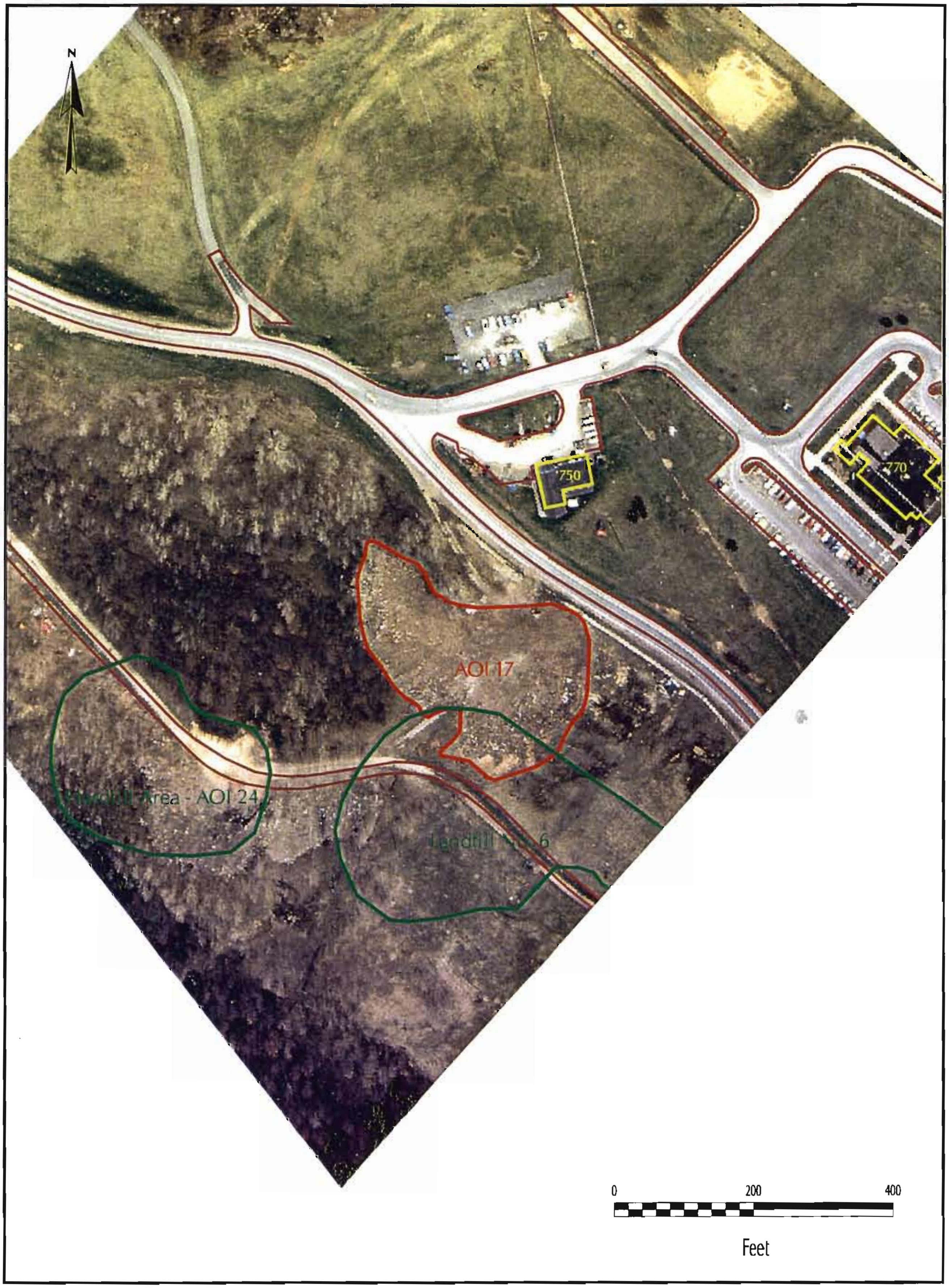
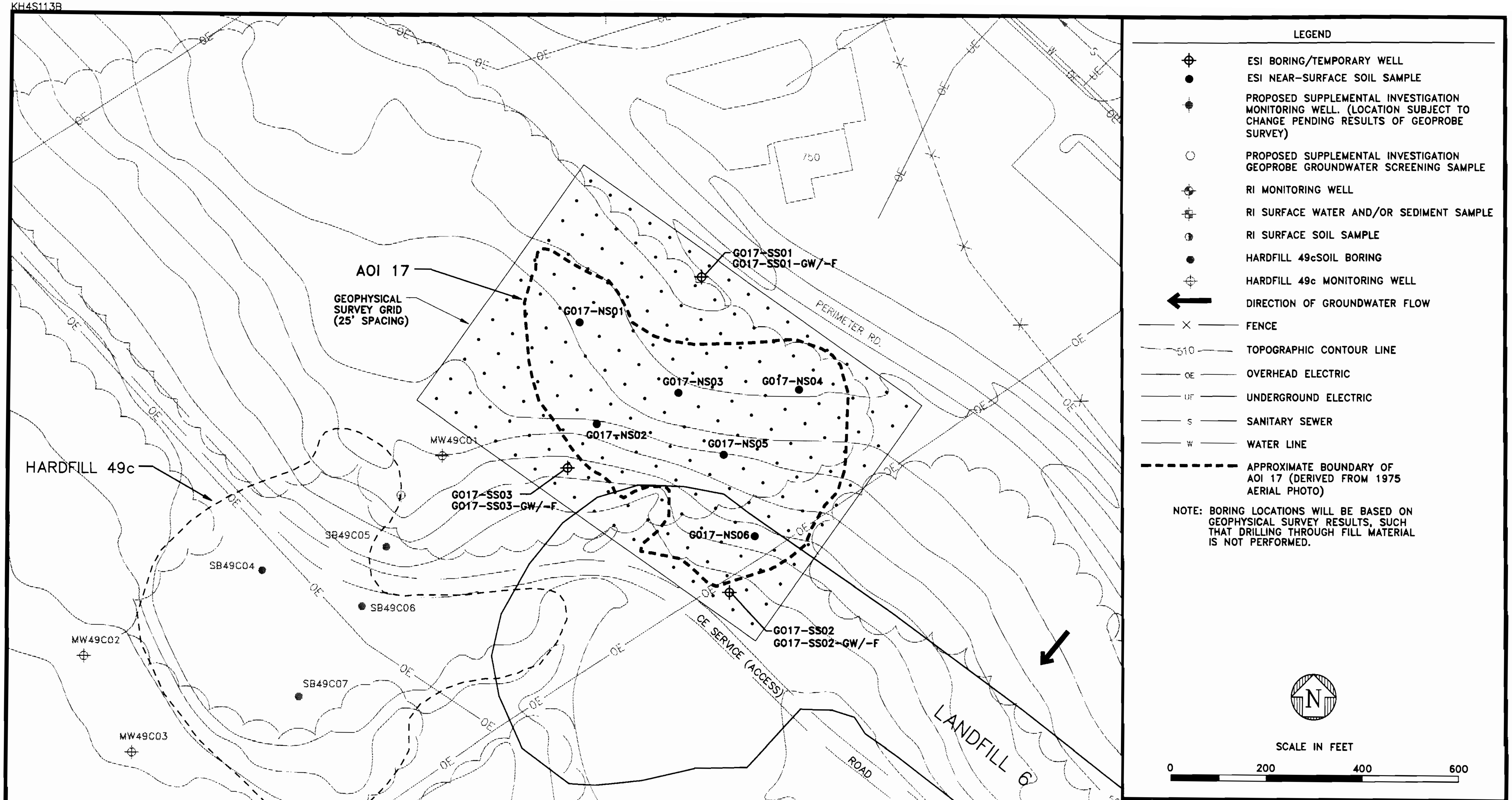


Figure 3-5
GAFB - Existing Site Plan Projected Over 1975 Aerial Photo (No. 266) Showing Former Disposal Area (AOI 17)



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GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 3-6
FORMER DISPOSAL AREA
(AOI 17)

3.5 AOI 24: CE Road Paint Dump Areas

The purpose of the ESI investigation at AOI 24 is to determine the extent of lead in soils in the northwest area and PAHs and lead in the southeast area.

3.5.1 Site Background

During an anonymous interview, a former base employee stated that a mixture of diesel fuel and paint had been discharged to the ground in two areas along the CE Service Road near Landfill No. 5 (Law Environmental 1993b). The diesel fuel was used to clean out truck-mounted paint tanks, which were used to paint buildings. Based on the interview, the cumulative volume of the paint/diesel fuel mixture that was disposed of at these areas was 3,200 gallons assuming a 40-year period of disposal (Law Environmental 1994a). The frequency of the disposal is not known. The estimate is probably not very accurate. The interviewee identified two disposal locations on a base map from memory. These two areas lie 300 to 500 feet northeast of Threemile Creek (see Figures 3-7a and 3-7b). AOI 24 lies in EBS Study Area 35.

3.5.2 Physical Characteristics

Based on the samples collected from on-site borings, surface soils consist of approximately 6 inches of dark, silty topsoil. The topsoil is underlain by sand in the southeast area of the site to a depth of at least 6 feet BGS, which was the greatest depth sampled. In the northwest area, an approximately 1.5-foot layer of clay-rich soil is present between the topsoil and the sand. Groundwater in the vicinity of the site flows to the southwest and was encountered at a depth of about 5 feet BGS.

3.5.3 Previous Confirmatory Sampling

A CS investigation was performed at AOI 24. Five near surface soil samples (0 to 2 feet BGS) were collected in each of the two disposal areas. In the northwest area, two of these borings were continued down to the water table. In the southeast area, one boring was continued to the water table. In each of the deeper borings a saturated soil sample and groundwater sample were collected.

Results of the CS program showed the presence of lead in soil samples in the northwest area and lead and PAHs in soil samples in the southeast area. In the northwest area, lead was present above EPA RBCs in two soil samples collected at depths of 0 to 2 feet BGS. In the southeast area, three soil samples (0 to 2 feet BGS) contained benzo(a)pyrene at concentrations exceeding the EPA RBC. The concentrations of PAHs found are similar to those for soil in urban areas near traffic or other fossil fuel combustion sources. Groundwater does not appear to be adversely impacted at the sites.

3.5.4 ESI Sampling

Since this area has been designated for future public/recreational development, an ESI will be conducted to determine if lead and/or PAHs pose any threat to human health. Additional sampling to determine the extent of the lead and PAHs in near-surface soils at the northwest and the southeast areas will be performed. Twenty-four near-surface soil samplings (0 to 0.25 feet BGS) are proposed for the northwest area as shown on Figure 3-7a. All 24 soil samples will be analyzed for lead using the inductively coupled argon plasma (ICP) method. Twelve of the near-surface soil samples for the northwest area will also be analyzed for PAHs. At the southeast area, 20 near-surface borings will be performed. These 20 soil samples will also be analyzed for ICP lead. Ten of the near-surface soils from the southeast area will also be analyzed for PAHs. The near-surface soil sampling locations for the southeast area are shown on Figure 3-7b. A list of sample identifications and analyses to be performed is presented on Table 3-5.

Table 3-5
AOI 24: CE ROAD PAINT DUMP AREAS—SAMPLE LISTING

Page 1 of 3

8/7/97

Griffiss AFB

										ANALYSES																								
EB Study Area-AOI #	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TAL Metl	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 35 AOI-24 (PDA)	Group I-ESI	FIELDQC31 RB24NS1	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group I-ESI	FIELDQC31 RB24NS2	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group I-ESI	FIELDQC31 RB24NS3	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group I-ESI	FIELDQC31 RB24NS4	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X														
	Group I-ESI	G024-NS31	9/15/97	ASC	Soil/QC Matrix	0 - 0.25	Y	O	MS1	X										X														
	Group I-ESI	G024-NS31	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS32	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS33	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS34	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS35	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS36	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS37	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS38	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS39	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS40	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS40/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X								X		X														
	Group I-ESI	G024-NS40/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X								X		X														
	Group I-ESI	G024-NS41	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS42	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS43	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS44	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS45	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS46	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS47	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS48	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														

Table 3-5 (Cont.)

Page 2 of 3

8/7/97

Griffiss AFB

EB Study Area-AOI #	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TALMet	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 35 AOI-24 (PDA)	Group I-ESI	G024-NS49	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS50	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS50/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X								X		X														
	Group I-ESI	G024-NS50/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X								X		X														
	Group I-ESI	G024-NS51	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS52	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS53	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS54	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS55	9/15/97	ASC	Soil/QC Matrix	0 - 0.25	Y	O	MS1	X										X														
	Group I-ESI	G024-NS55	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS56	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS57	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS58	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS59	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS60	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS60/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X								X		X														
	Group I-ESI	G024-NS60/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X								X		X														
	Group I-ESI	G024-NS61	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS62	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS63	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS64	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS65	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS66	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS67	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS68	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														

Table 3-5 (Cont.)

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb 6010	Pb 7421	PCBs	Pest	Pest PCB	Phosph	React-1	React-2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 35 AOI-24 (PDA)	Group I-ESI	G024-NS69	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS70	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS70/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X								X		X														
	Group I-ESI	G024-NS70/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X								X		X														
	Group I-ESI	G024-NS71	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS72	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS73	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS74	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														
	Group I-ESI	G024-NS75	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X														
	Group I-ESI	G024-NS76	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X								X		X														

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

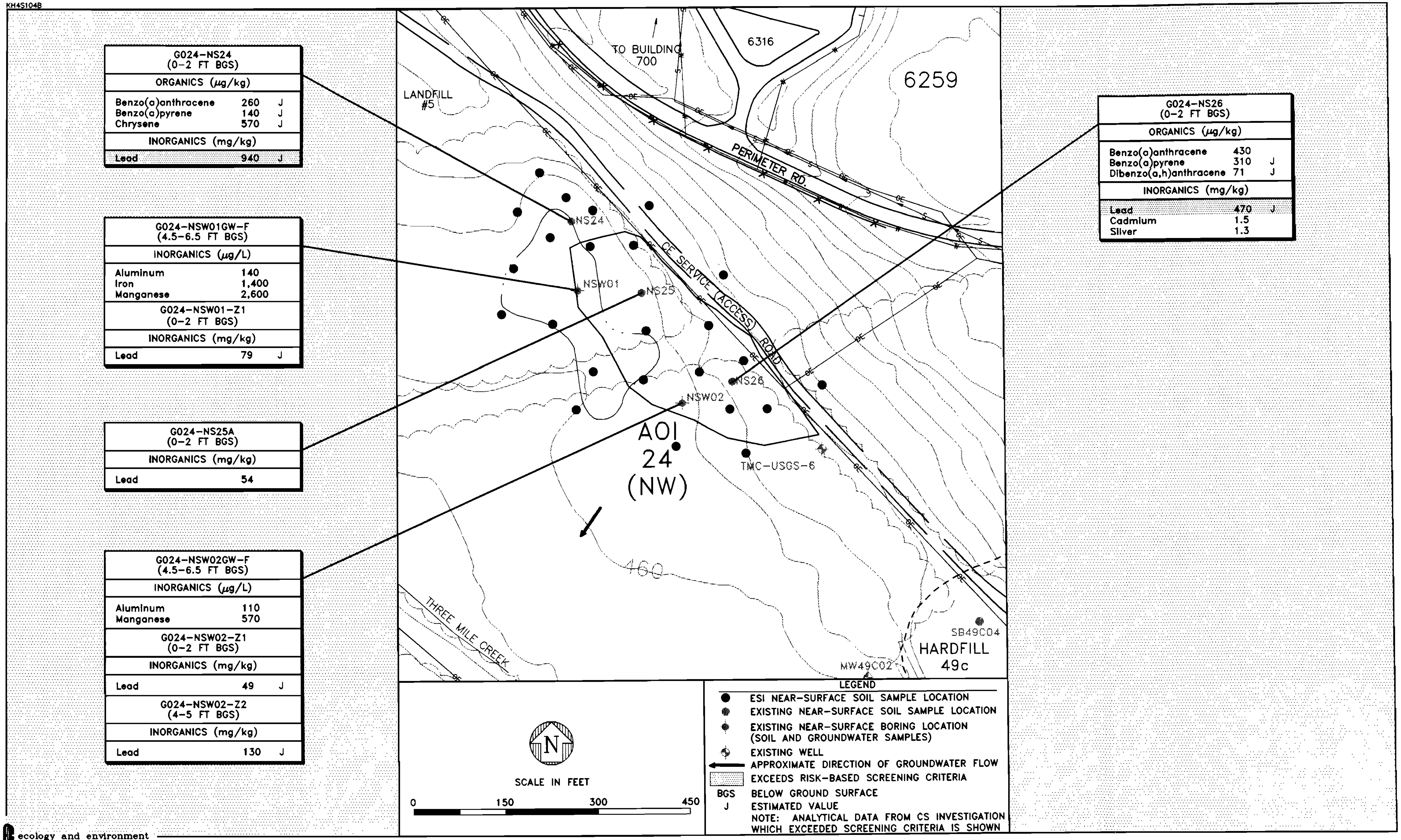
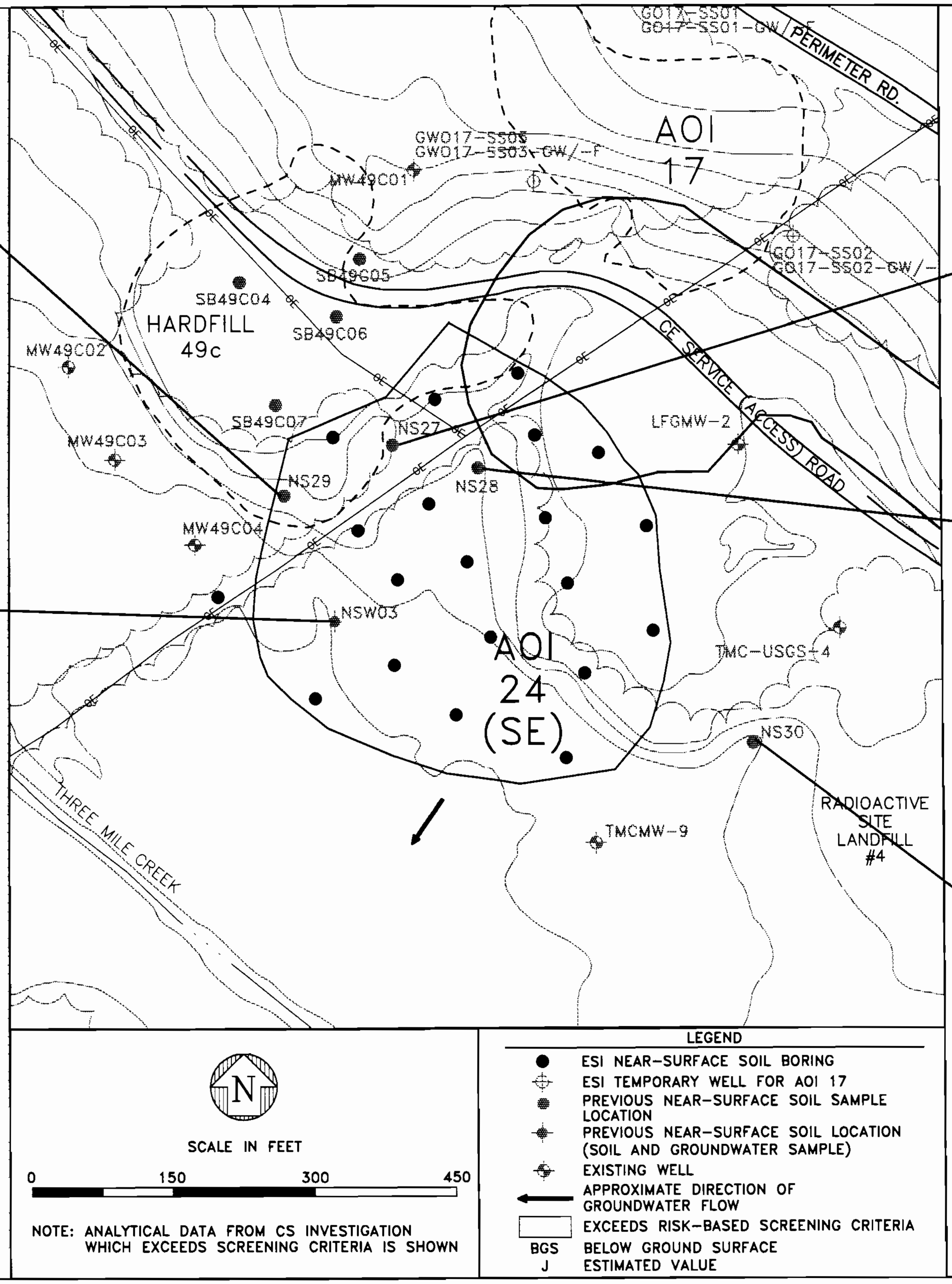


Figure 3-7a CE ROAD PAINT DUMP AREAS (AOI 24 – NORTHWEST)

KH4S103B

G024-NS29 (0-2 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	2,100
Benzo(a)pyrene	1,600
Benzo(b)fluoranthene	3,000
Benzo(k)fluoranthene	1,400
Chrysene	1,400
Dibenzo(a,h)anthracene	510
INORGANICS (mg/kg)	
Lead	360 J
Silver	1.3

G024-NSW03-GW-F (2-6 FT BGS)	
ORGANICS (µg/L)	
Aluminum	200
Manganese	590
G024-NSW03-Z1 (0-2 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)pyrene	280 J
INORGANICS (mg/kg)	
Cadmium	1.7



NOTE: ANALYTICAL DATA FROM CS INVESTIGATION WHICH EXCEEDS SCREENING CRITERIA IS SHOWN

G024-NS27 (0-2 FT BGS)	
Benzo(a)anthracene	760
Benzo(a)pyrene	830
Benzo(b)fluoranthene	1,600
Chrysene	640
Dibenzo(a,h)anthracene	150 J
INORGANICS (mg/kg)	
Lead	150 J

G024-NS28 (0-2 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)anthracene	4,700
Benzo(a)pyrene	3,400
Benzo(b)fluoranthene	4,400
Benzo(k)fluoranthene	2,700
Chrysene	3,700
Dibenzo(a,h)anthracene	720 J
INORGANICS (mg/kg)	
Cadmium	1.2
Copper	63
Lead	690 J
Silver	1.5

G024-NS30 (0-2 FT BGS)	
ORGANICS (µg/kg)	
Benzo(a)pyrene	140 J
INORGANICS (mg/kg)	
Silver	1.3

Figure 3-7b CE ROAD PAINT DUMP AREAS (AOI 24 - SOUTHEAST)

3.6 AOI 58: P3/Building 14 Railroad Loading/Unloading and Storage Area and AOI 101: Building 3 Fuel Dumping Area

The purpose of the ESI investigation at AOI 58/101 is to verify that the low levels of organic contamination identified during the CS investigation are not more extensive than current results indicate. The further investigations of AOI 58 and AOI 101 were combined because of their proximity to each other (see Figure 3-8).

3.6.1 Site Background

AOI 58 was identified as an AOI in the 1994 AOI report (Law Environmental 1994) based on Aerial Photograph No. 51-824-433 and Drawing No. 7-C-11, both dated 1943. The AOI report states that chemicals were stored on the south end of the current Building 3 site and that aircraft oil was stored to the southeast of Building 3 through 1984. Prior to construction of Building 3 in 1954, the area was used as a railroad load/unload area. E & E's review of the 1943 aerial photograph for AOI 58 revealed that prior to the construction of Building 3, the area was unpaved and contained a variety of material and debris (possibly drums and coal). By 1945, the area consisted of a well-organized storage area. Storage ceased prior to the construction of Building 3 in 1954.

AOI 101 is located at the north end of Building 3 and includes the front parking lot. This site was identified as an AOI in the 1994 AOI report (Law Environmental 1994) based on interviews with Griffiss AFB personnel conducted in 1994. The AOI report states that fuels and waste oils from vehicles were dumped onto the ground at this site in the 1960s.

Five AOIs and two AOCs have been identified beneath or adjacent to current Building 3. Two of these AOIs (AOIs 83 and 185) have been recommended for NFS. In addition, one AOI (AOI 400) and the two AOCs (DP-11-Building 3 Drywell and ST-35-Building 26 Former Pumping Station) are currently being investigated under another program. The 1994 AOI Report (Law Environmental 1994) also describes AOI 25 as being a potential metals burial site at Building 14. However, the AOI report indicates an incorrect location for Building 14. AOI 25 was recommended for NFS under the Group II AOIs program because the location identified (Map No. 261) was not an area with any known environmental concerns. Because Building 14 is actually located adjacent to the southwest corner of Building 3 and within the area designated as AOI 58, the potential for metals burial there was evaluated as part of the investigation of Group III AOIs.

3.6.2 Physical Characteristics of the Site

AOI 58

The vast majority AOI 58 is occupied by Building 3, which is operated by Rome Laboratories. Those portions of the former railroad loading/unloading and storage area that are not covered by Building 3 are covered with asphalt-paved parking lots directly north and east of this building (see Figure 3-8). The topography is flat, with surface drainage to the nearby storm sewers.

Review of drilling logs indicates that subsurface soils at AOI 58 consist mainly of very fine to coarse grained sand and silt, with some rounded gravel. Saturation of the soil was noted at 9 to 10 feet BGS in boring G058-SS01 at the southwest of Building 14 and at 7 to 8 feet BGS in borings G058-SS02 and -SS03 at the southwest corner and west side of Building 3, respectively. Water levels measured in temporary wells set in these borings ranged from 13.7 to 17.6 feet at the time of groundwater sampling. It should be noted that multiple boring refusals were encountered at the southwest corner of Building 3 where G058-SS02 was drilled. These refusals were attributed to the probable presence of demolition debris predating the construction of Building 3.

AOI 101

AOI 101 is now completely covered by the parking lot directly north of Building 3 and the north end of that building (see Figure 3-8).

Review of drilling logs indicates that subsurface soils at AOI 101 consist mainly of very fine to medium sand with traces of silt and rounded gravel. Saturated soils were noted at 7 to 8 feet in boring G101-SS01 on the east side of the site and 8 to 9 feet in boring G101-SS02 on the southwest corner of the site. The water level measured in the temporary well set in boring G101-SS02 was 16.2 feet BGS at the time of groundwater sampling.

3.6.3 Previous Confirmatory Sampling

The CS investigation was combined at AOIs 58 and 101 because of their proximity to each other. During the CS investigation at AOI 58, three borings were drilled and temporary wells were installed in each boring. At AOI 101, two borings were drilled and a temporary well was installed in one of the borings. Soil and groundwater samples were collected from both sites. Low levels of volatile organic compound (VOC) contamination were detected in soil and TCE was found in groundwater at low concentrations at both AOIs. At AOI 58, TRPH was found in the deeper soil sample and in the groundwater sample boring/temporary well SS02 at 5,600 mg/kg and 31 mg/L, respectively. PCB-1260 was found in the groundwater at AOI 101 (SS02) at an estimated concentration of 0.25 μg/L.

3.6.4 ESI Sampling

The ESI will consist of installing seven subsurface soil borings, of which three soil borings will be completed as permanent monitoring wells (see Figure 3-8). Four of these subsurface borings will be drilled below the base of the asphalt that covers these AOIs. A soil sample will be collected from approximately 2 to 4 feet BGS in each of these subsurface borings. The three borings that will be completed as monitoring wells will be drilled to approximately 8 feet below the water table. Soil samples will be collected directly below the asphalt and directly above the groundwater interfaces at G058-MW01 located within AOI 58. Soil samples will be collected at the groundwater interface in G058-MW02 and G101-MW01, which are located outside of AOIs 58 and 101, respectively. The well screens will be set approximately 8 feet below and 2 feet above the water table. The soil and groundwater samples will be analyzed for TCL VOCs, TCL BNAs, PCBs, TRPH, and % solids (soil only). A list of sample identifications and analyses to be performed is presented on Table 3-6.

According to the E & E Groundwater Interpretation Map (1996), the existence of a groundwater divide is suspected in this area. Therefore, the direction of groundwater flow may be northeast or southwest. The locations of the ESI monitoring wells in conjunction with existing monitoring points will be used to determine the extent of contamination and better define groundwater flow direction in this area.

In addition, a groundwater sample will be collected from existing well 26MB-3 and analyzed for TRPH to determine if the contamination previously identified on the west side of Building 14 is associated with the former Building 26 UST site.

Table 3-6
AOI 58: P3/BUILDING 14 RAILROAD LOADING/UNLOADING AND STORAGE AREA AND AOI 101: BUILDING 3 FUEL DUMPING AREA—SAMPLE LISTING

Page 1 of 2

8/5/97

Griffiss AFB

ANALYSES

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb 6010	TAL Mel	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 21 AOI-58 (B14)	Group 3-ESI	FILEDQC RB58S	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1													X								X	X			X
	Group 3-ESI	FILEDQC TB58	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group 3-ESI	G058-MW01 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X												X								X	X			X
	Group 3-ESI	G058-MW01 Z2	9/15/97	ASC	Soil	6 - 8	Y	O	N1	X												X								X	X			X
	Group 3-ESI	G058-MW01 GW	9/15/97	ASC	Groundwater	8 - 16	Y	O	N1													X								X	X			X
	Group 3-ESI	G058-MW02 Z2	9/15/97	ASC	Soil	6 - 8	Y	O	N1	X												X								X	X			X
	Group 3-ESI	G058-MW02 GW	9/15/97	ASC	Groundwater	8 - 16	Y	O	N1													X								X	X			X
	Group 3-ESI	G058-SS04 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X												X								X	X			X
	Group 3-ESI	G058-SS04 Z1/D	9/15/97	ASC	Soil	2 - 4	Y	O	FD1	X												X								X	X			X
	Group 3-ESI	G058-SS04 Z1/S	9/15/97	MRD	Soil	2 - 4	Y	O	FR1	X												X								X	X			X
Study Area 21 AOI-101 (B3)	Group 3-ESI	FIELDQC RB101S	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1													X								X	X			X
	Group 3-ESI	FIELDQC TB101	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group 3-ESI	G101-MW01 Z2	9/15/97	ASC	Soil	6 - 8	Y	O	N1	X												X								X	X			X
	Group 3-ESI	G101-MW01 Z2/D	9/15/97	ASC	Soil	6 - 8	Y	O	FD1	X												X								X	X			X
	Group 3-ESI	G101-MW01 Z2/S	9/15/97	MRD	Soil	6 - 8	Y	O	FR1	X												X								X	X			X
	Group 3-ESI	G101-MW01 GW	9/15/97	ASC	Groundwater	8 - 16	Y	O	N1													X								X	X			X
	Group 3-ESI	G101-SS03 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X												X								X	X			X
	Group 3-ESI	G101-SS04 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X												X								X	X			X
	Group 3-ESI	G101-SS05 Z1	9/15/97	ASC	Soil	2 - 4	Y	O	N1	X												X								X	X			X

Table 3-6 (Cont.)

Griffiss AFB

										ANALYSES																								
EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	Pest-PCB	Phosph	React-1	React-2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 21 AOI-101 (B3)	Group 3-ESI	ZZZZ	9/15/97	ASC	Soil	0 - 0	Y	O	N1																									

Note: Depth is measured in feet.

Key:

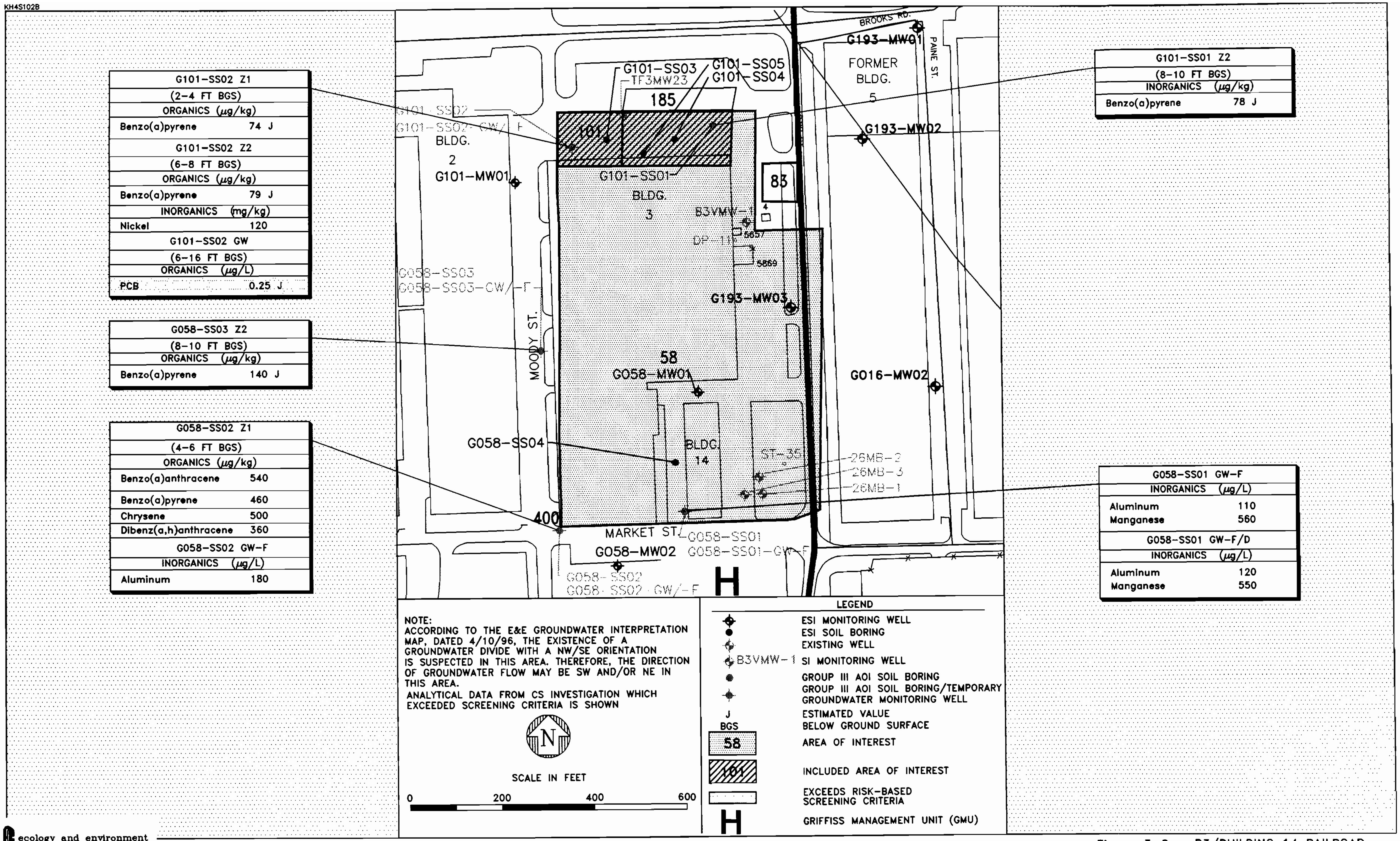
AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons



ecology and environment

Figure 3-8 P3/BUILDING 14 RAILROAD LOADING/UNLOADING AND STORAGE AREA (AOI 58) AND BUILDING 3 FUEL DUMPING AREA (AOI 101)

3.7 AOI 67: Former Storage Area Beneath Building 700

The purpose of the ESI investigation at AOI 67 is to determine the extent of PCBs in near-surface soils at the site.

3.7.1 Site Background

AOI 67 was identified as an AOI in the 1994 AOI report (Law Environmental 1994) based on aerial photos from 1960 and 1967 and Drawing No. G-3, dated 1967. The AOI report states that the site was used to store undefined materials. A stain is shown in the 1960 photo. E & E has reviewed the photos and agrees that the area was used for storage. Vehicles and debris were observed in the 1955 and 1960 aerial photographs; however, by 1967 the area was graded. Building 700, which houses the Northeast Air Defense Sector (NEADS), was built over the former storage area sometime around 1982 (see Figure 3-9).

3.7.2 Physical Characteristics

AOI 67 primarily consists of landscaped and well-maintained areas with grass and trees surrounding Building 700. In addition, portions of the site are paved parking areas and sidewalks.

Subsurface drilling logs indicate that subsurface soils beneath the site consist primarily of very fine sand with traces of silt and rounded gravel. Soil saturation was observed in the borings at depths ranging from 9 to 34 feet BGS. The depth of the water table measured at the time of groundwater sampling ranged from 34.9 to 39.34 feet BGS.

3.7.3 Previous Confirmatory Sampling

CS was performed to determine if the former storage area had impacted soils and groundwater at the site. A high sensitivity metal detector (EM61) survey was performed and it was determined that buried metal objects were not prevalent beneath the site. An explosive ordnance detection (EOD) survey was also performed prior to drilling, and no such materials were found at the drilling locations. Groundwater samples showed no significant contamination, however, shallow soil samples collected from the 0 to 2 foot depth in each of the three soil borings contained levels of polychlorinated biphenyls (PCBs). No PCBs were detected in the deeper soil samples collected between 16 and 22 feet BGS.

3.7.4 ESI Sampling

Thirty-five near-surface soil samples will be collected at 0 to 0.5 feet BGS as part of the ESI program to determine the extent of PCBs in the near-surface soils at the site. A soil sampling grid with varied spacing will be established at AOI 67 to identify these sampling locations (see Figure 3-9). The near-surface soil samples will be located at accessible areas surrounding Building 700 where the former storage area was located. Further, some of the soil sample locations will extend beyond the boundary of the former storage area to determine if any contaminated soil from AOI 67 was moved during the landscaping of the grounds for Building 700. The soil samples will be analyzed for PCBs and % solids. A list of sample identifications and analyses is presented on Table 3-7.

Table 3-7
AOI 67: FORMER STORAGE AREA BENEATH BUILDING 700—SAMPLE LISTING

8/5/97

Griffiss AFB

ANALYSES

EB Study Area-AOI #-		Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TALMetl	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 27	AOI-67 (B700)	Group 3-ESI	FIELDQC RB67NS1	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1													X												
		Group 3-ESI	FIELDQC RB67NS2	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1													X												
		Group 3-ESI	FIELDQC RB67NS3	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1													X												
		Group 3-ESI	FIELDQC RB67NS4	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1													X												
		Group 3-ESI	G067-NS01	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS01	9/15/97	ASC	Soil/QC Matrix	0 - 0.5	Y	O	MS1	X												X												
		Group 3-ESI	G067-NS02	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS03	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS04	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS05	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS06	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS07	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS08	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS09	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS10	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS10/D	9/15/97	ASC	Soil	0 - 0.5	Y	O	FD1	X												X												
		Group 3-ESI	G067-NS10/S	9/15/97	MRD	Soil	0 - 0.5	Y	O	FR1	X												X												
		Group 3-ESI	G067-NS11	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS12	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS13	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS14	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS15	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS15	9/15/97	ASC	Soil/QC Matrix	0 - 0.5	Y	O	MS1	X												X												
		Group 3-ESI	G067-NS16	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
		Group 3-ESI	G067-NS17	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												

Table 3-7 (Cont.)

Griffiss AFB

EB Study Area-AOI #	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	ANALYSES																								
										%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 27 AOI-67 (B700)	Group 3-ESI	G067-NS18	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS19	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS20	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS20/D	9/15/97	ASC	Soil	0 - 0.5	Y	O	FD1	X												X												
	Group 3-ESI	G067-NS20/S	9/15/97	MRD	Soil	0 - 0.5	Y	O	FR1	X												X												
	Group 3-ESI	G067-NS21	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS22	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS23	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS24	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS25	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS26	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS27	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS28	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS29	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS30	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS30/D	9/15/97	ASC	Soil	0 - 0.5	Y	O	FD1	X												X												
	Group 3-ESI	G067-NS30/S	9/15/97	MRD	Soil	0 - 0.5	Y	O	FR1	X												X												
	Group 3-ESI	G067-NS31	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS32	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS33	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS34	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												
	Group 3-ESI	G067-NS35	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1	X												X												

Table 3-7 (Cont.)

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TALMet	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 27 AOI-67 (B700)	Group 3-ESI	ZZZZ	9/15/97	ASC	Soil	0 - 0.5	Y	O	N1																									

Note: Depth is measured in feet.

Key:

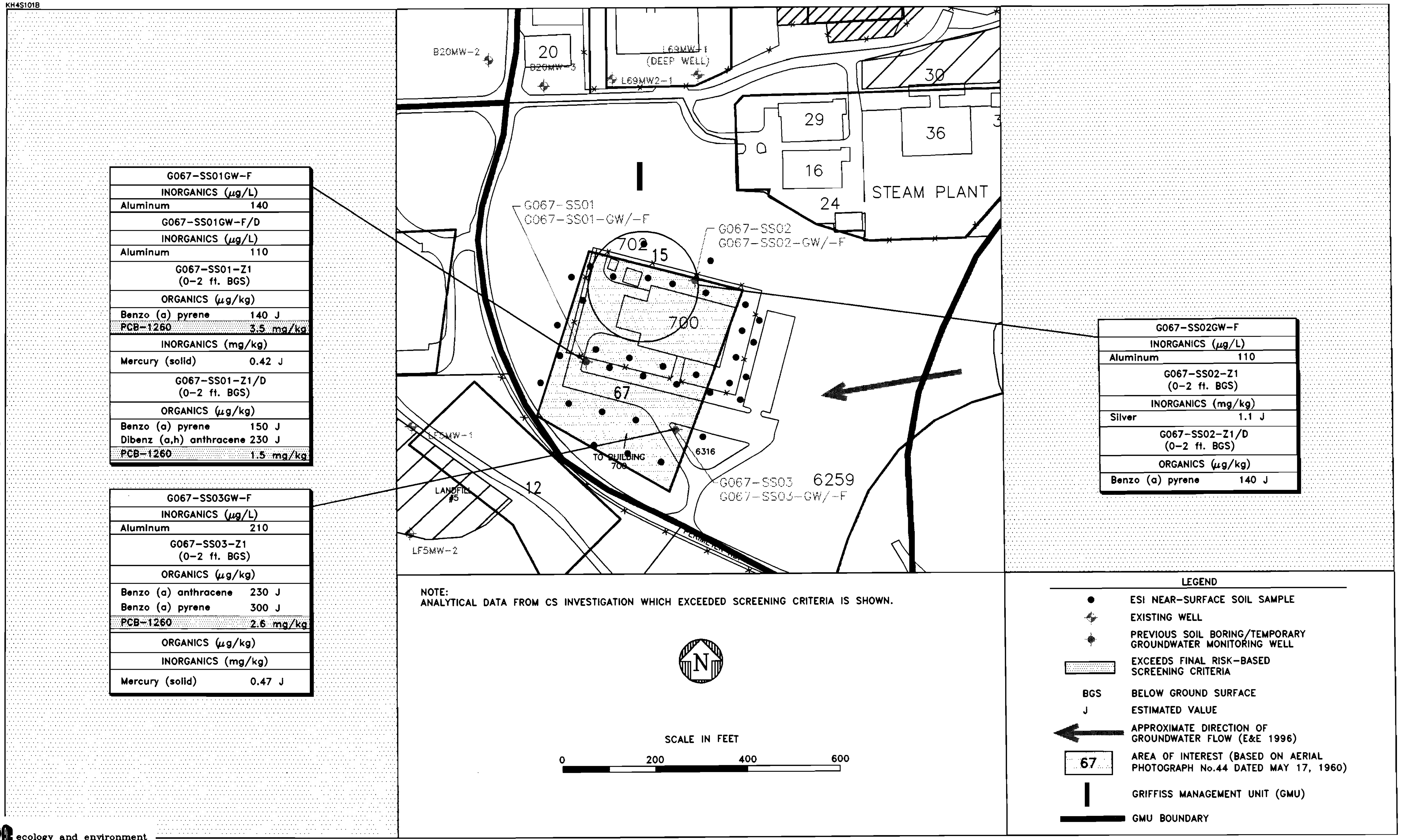
AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons



G067-SS01GW-F	
INORGANICS (µg/L)	
Aluminum	140
G067-SS01GW-F/D	
INORGANICS (µg/L)	
Aluminum	110
G067-SS01-Z1 (0-2 ft. BGS)	
ORGANICS (µg/kg)	
Benzo (a) pyrene	140 J
PCB-1260	3.5 mg/kg
INORGANICS (mg/kg)	
Mercury (solid)	0.42 J
G067-SS01-Z1/D (0-2 ft. BGS)	
ORGANICS (µg/kg)	
Benzo (a) pyrene	150 J
Dibenz (a,h) anthracene	230 J
PCB-1260	1.5 mg/kg

G067-SS03GW-F	
INORGANICS (µg/L)	
Aluminum	210
G067-SS03-Z1 (0-2 ft. BGS)	
ORGANICS (µg/kg)	
Benzo (a) anthracene	230 J
Benzo (a) pyrene	300 J
PCB-1260	2.6 mg/kg
ORGANICS (µg/kg)	
INORGANICS (mg/kg)	
Mercury (solid)	0.47 J

G067-SS02GW-F	
INORGANICS (µg/L)	
Aluminum	110
G067-SS02-Z1 (0-2 ft. BGS)	
INORGANICS (mg/kg)	
Silver	1.1 J
G067-SS02-Z1/D (0-2 ft. BGS)	
ORGANICS (µg/kg)	
Benzo (a) pyrene	140 J

NOTE:
ANALYTICAL DATA FROM CS INVESTIGATION WHICH EXCEEDED SCREENING CRITERIA IS SHOWN.

LEGEND

●	ESI NEAR-SURFACE SOIL SAMPLE
✦	EXISTING WELL
✦	PREVIOUS SOIL BORING/TEMPORARY GROUNDWATER MONITORING WELL
▨	EXCEEDS FINAL RISK-BASED SCREENING CRITERIA
BGS	BELOW GROUND SURFACE
J	ESTIMATED VALUE
←	APPROXIMATE DIRECTION OF GROUNDWATER FLOW (E&E 1996)
67	AREA OF INTEREST (BASED ON AERIAL PHOTOGRAPH No.44 DATED MAY 17, 1960)
I	GRIFFISS MANAGEMENT UNIT (GMU)
▬	GMU BOUNDARY

Figure 3-9 FORMER STORAGE AREA BENEATH BUILDING 700 (AOI 67)

3.8 AOI 90: Industrial Soils Pad Area

The purpose of the ESI investigation at AOI 90 is to assess the extent of lead and petroleum hydrocarbon contamination southeast of the industrial soils pad (ISP).

3.8.1 Site Background

The ISP site (EBS Study Area 4) was identified during the IRP and designated IRP Site SS-45. The ISP site is part of the former Rome Laboratory electronic test site No. 11 (Tetra Tech 1995a).

The ISP site was used as a vehicle and equipment storage area when Landfill No. 1 was in operation. Because tanks were noted in aerial photographs dated 1966, 1971, and 1983, EPA speculated that the pad was converted to a fueling facility in 1960 (Law Environmental 1994c). Since 1987 contaminated soils from base activities have been stored on the ISP while awaiting disposal (see Figure 3-10). Since 1993, these soils have been stored at this location in a new covered storage building. Wood, railroad ties, and tires are stored east of the ISP (Law Environmental 1994c).

One 6-foot-deep by 9-foot-square vault is located directly northwest of the ISP, and another is located southeast of the ISP. The vaults were reportedly used to house transformers when the area was used as a Rome Laboratory test site (Tetra Tech 1995a).

During a 1993 investigation performed at the ISP, high levels of lead contamination were detected in shallow soil sample ISPSS-12 (1700 mg/kg) on the west side of the site (see Figure 3-10). However, other soil samples near the ISPSS-12 samples did not contain elevated levels of lead. Elevated levels of lead were also found on the east side of the site at ISPSS-5 (120 mg/kg), but elsewhere at this site, lead concentrations in soil are close to background. Lead was found at a concentration of 2 μg/L in well LF1-P3 downgradient of the site. Elevated levels of TRPH (>200 mg/kg) were found in 2 of the 12 shallow (0-6 inch) soil samples collected during the previous investigation. TRPH was found at the southeast corner of the site at ISPSS-5 (1,000 mg/kg) and ISPSS-4 (210 mg/kg). Runoff from soils formerly stored at the site or localized spills are the likely cause of the elevated TRPH at ISPSS-5 and ISPSS-4.

3.8.2 Physical Characteristics

The ISP site consists of a 240- by 105-foot asphalt area and the adjacent perimeter area (Law Environmental 1994c). The ISP is a 20- by 30-foot concrete pad in the center of this paved area. The pad is enclosed on three sides and covered with a roof.

The site located approximately 600 feet northeast (upgradient) of Sixmile Creek, 400 feet east of Landfill No. 1, and due west of the small arms range. The groundwater in this area is approximately 40 feet below the surface and flows southwest toward Sixmile Creek. The paved area is located on an isolated knoll, and surface runoff moves radially from the pavement.

3.8.3 Previous Confirmatory Sampling

During the CS performed at the ISP site in 1995, high levels of lead, several PAHs, and TRPH were found in the southeast vault. The scope of the 1995 CS investigation consisted of the vault sampling only. A soil sample, G090-SV-01, collected from the vault contained lead at a concentration of 2,500 mg/kg (see Figure 3-10).

3.8.4 ESI Sampling

To assess the extent of shallow soil contamination north and south of the site, three near-surface soil samples will be collected from each of these areas (see Figure 3-10). Six near-surface (0 to 0.25 feet BGS) soil samples will be collected. These soil samples will be analyzed for TCL BNAs, TRPH, and lead. The ESI will also include three 26-foot-deep soil borings. Soil samples will also be collected from these borings at shallow (0- to 2-foot), intermediate (12- to 14-foot), and deep (24- to 26-foot) depth intervals to profile potential contamination. Two additional soil borings will be installed 8 feet below the water table and will be completed as permanent monitoring wells to determine if elevated lead and petroleum hydrocarbon contamination exists in the groundwater south and southeast of the ISP. Two soil samples will be collected from the well boring on the south side of the site: a shallow soil sample (0 to 2 feet BGS) and a deeper soil sample (approximately 24 to 26 feet BGS) directly above the water table interface. A soil sample will be collected at the groundwater interface in the well southeast of the site. Groundwater samples will be collected from each of the permanent wells. A list of sample identifications and analyses is presented in Table 3-8.

Because the level of lead in the southeast vault (2500 mg/kg) could be characteristically hazardous, a grab sample will also be taken from the bottom of this vault and analyzed for

RCRA characteristics. This data will be used to determine the most appropriate means of disposing of the material in the vault.

Table 3-8
AOI 90: INDUSTRIAL SOILS PAD AREA—SAMPLE LISTING

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	ANALYSES																								
										%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TALMetl	TCLBNA	TCLVOC	TOC	TOX	TRPH
Study Area 4 AOI-90 (ISP)	Group I-ESI	FIELDQC RB90NS	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X										X				X
	Group I-ESI	FIELDQC RB90SS	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1											X										X				X
	Group I-ESI	G090 SV02	9/15/97	ASC	Soil	0 - 1	Y	O	N1	X										X														
	Group I-ESI	G090-MW01 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X										X										X				X
	Group I-ESI	G090-MW01 Z2	9/15/97	ASC	Soil	24 - 26	Y	O	N1	X										X										X				X
	Group I-ESI	G090-MW01 GW	9/15/97	ASC	Groundwater	26 - 34	Y	O	N1											X										X				X
	Group I-ESI	G090-MW01 GW-F	9/15/97	ASC	Groundwater	26 - 34	Y	O	N1											X														
	Group I-ESI	G090-MW02 Z2	9/15/97	ASC	Soil	24 - 26	Y	O	N1	X										X										X				X
	Group I-ESI	G090-MW02 GW	9/15/97	ASC	Groundwater	26 - 34	Y	O	N1											X										X				X
	Group I-ESI	G090-MW02 GW-F	9/15/97	ASC	Groundwater	26 - 34	Y	O	N1											X														
	Group I-ESI	G090-MW02 GW/D	9/15/97	ASC	Groundwater	26 - 34	Y	O	FD1											X										X				X
	Group I-ESI	G090-MW02 GW/S	9/15/97	MRD	Groundwater	26 - 34	Y	O	FR1											X										X				X
	Group I-ESI	G090-NS01	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X										X				X
	Group I-ESI	G090-NS01	9/15/97	ASC	Soil/QC Matrix	0 - 0.25	Y	O	MS1	X										X										X				X
	Group I-ESI	G090-NS02	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X										X				X
	Group I-ESI	G090-NS03	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X										X				X
	Group I-ESI	G090-NS04	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X										X				X
	Group I-ESI	G090-NS04/D	9/15/97	ASC	Soil	0 - 0.25	Y	O	FD1	X										X										X				X
	Group I-ESI	G090-NS04/S	9/15/97	MRD	Soil	0 - 0.25	Y	O	FR1	X										X										X				X
	Group I-ESI	G090-NS05	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X										X				X
	Group I-ESI	G090-NS06	9/15/97	ASC	Soil	0 - 0.25	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS01 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS01 Z2	9/15/97	ASC	Soil	12 - 14	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS01 Z3	9/15/97	ASC	Soil	24 - 26	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS01 Z1	9/15/97	ASC	Soil/QC Matrix	0 - 2	Y	O	MS1	X										X										X				X

Table 3-8 (Cont.)

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	% Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	Pest PCB	Phosph	React-1	React-2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 4 AOI-90 (ISP)	Group I-ESI	G090-SS02 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS02 Z1/D	9/15/97	ASC	Soil	0 - 2	Y	O	FD1	X										X										X				X
	Group I-ESI	G090-SS02 Z1/S	9/15/97	MRD	Soil	0 - 2	Y	O	FR1	X										X										X				X
	Group I-ESI	G090-SS02 Z2	9/15/97	ASC	Soil	12 - 14	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS02 Z3	9/15/97	ASC	Soil	24 - 26	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS03 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS03 Z2	9/15/97	ASC	Soil	12 - 14	Y	O	N1	X										X										X				X
	Group I-ESI	G090-SS03 Z3	9/15/97	ASC	Soil	24 - 26	Y	O	N1	X										X										X				X

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

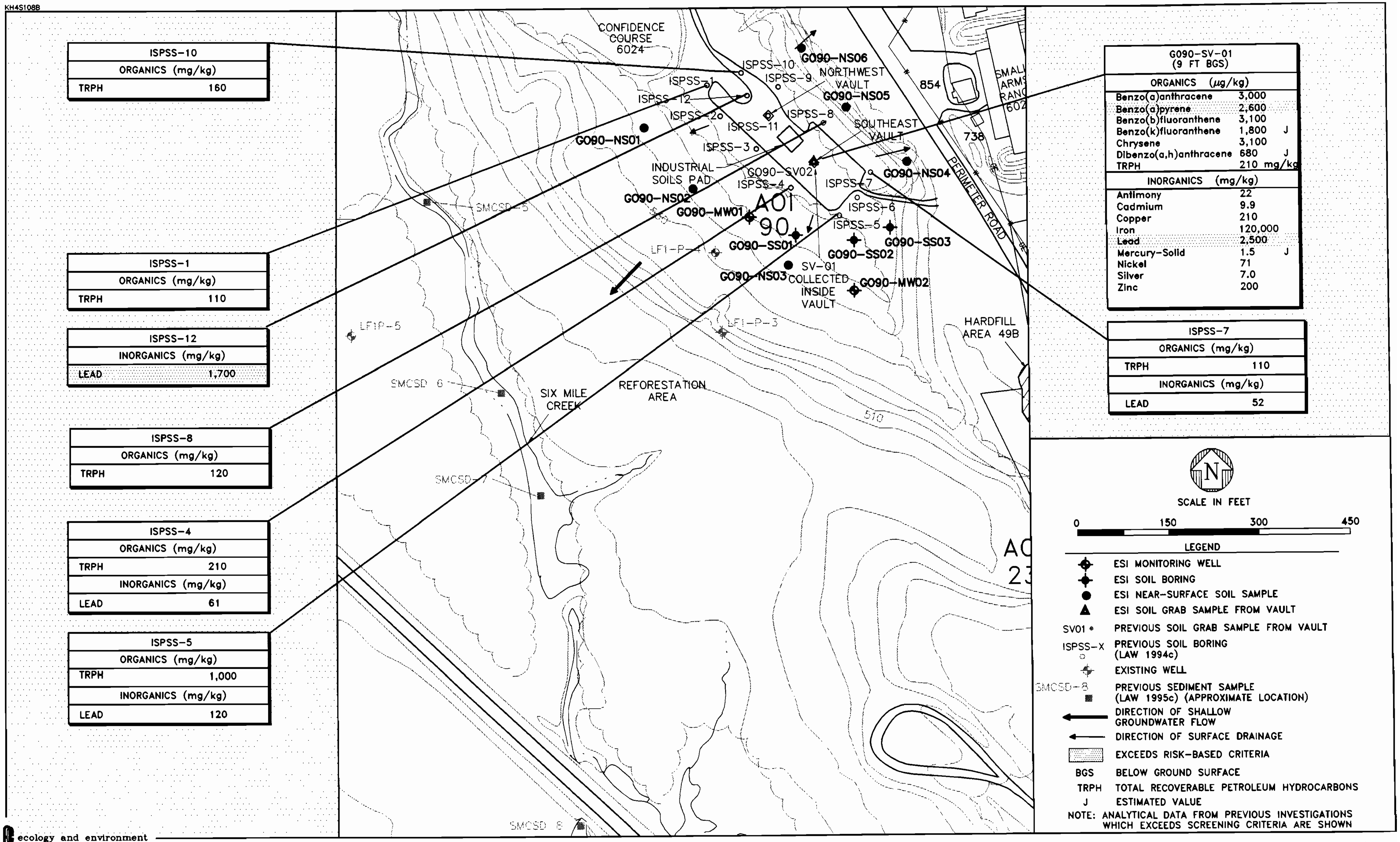


Figure 3-10 INDUSTRIAL SOIL PAD (AOI 90)

3.9 AOI 100: Paint Staging Area Northeast of Former Engine Testing Facility

The purpose of the ESI investigation at AOI 100 is to better define the area of inorganic and organic contamination identified at this site during the CS investigation.

3.9.1 Site Background

The area surrounding the circular concrete pad identified as the Paint Staging Area (EBS Study Area 6) was reportedly used for waste paint disposal during the loading and unloading of mobile paint trucks from 1975 to 1984 (Law Environmental 1993b). Discharge to the surface may have occurred in the process of cleaning out the paint tanks and paint lines. These spills were reported to have occurred on the east side of the pad currently used as a staging area for snow plow attachments (Law Environmental 1993b) (see Figure 3-11).

Two hand-dug wells from a former homestead also exist at the site. It is possible that some waste materials were also placed into these hand-dug wells.

Base personnel have reported that landfill material has occasionally been dumped in the area directly east and northeast of the AOI 100 site.

3.9.2 Physical Characteristics

AOI 100 consists of a 100-foot-diameter circular concrete pad that is surrounded by a grassy field. It lies north of Taxiway 17, the Former Engine Testing Facility, and the current engine testing "Hush House," and southwest of the main base runways. Paint stains are prevalent on the surface of the concrete pad and an extended apron on the east side of the pad. Further, there are small, isolated areas where dried paint was observed on the ground surface directly east of the extended apron. The topography of the grass field is relatively flat; however, in some areas large slabs of concrete protrude from the ground surface. The vegetation is open with small conifers present directly east of the site.

Two hand-dug wells from a pre-existing homestead are located northeast of the circular concrete pad. One of these wells appears to have collapsed and is now only a surface depression. The soil at the bottom of the collapsed dry well is composed of fine sand and gravel. The soil at the bottom of the open dry well contains 4 inches of cement.

The seven borings drilled to the water table indicate the overburden is glacially derived sand, silt, and gravel grading to sand and silt between 16 and 22 feet BGS.

The groundwater is approximately 25 feet BGS and apparently flows generally toward the south. AOI 100 lies near a groundwater drainage divide. Depending on the exact location of this divide, groundwater from this area is intercepted by Threemile Creek or the Mohawk River.

3.9.3 Previous Confirmatory Sampling

A geophysical survey, performed as part of the CS investigation, indicated the presence of an anomaly caused by steel-reinforced concrete. The reinforced concrete was present at the surface in some areas, coincident with the observed anomaly (see Figure 3-11). No buried drums were present.

Seven borings were drilled at the site. Temporary wells were installed in three of the borings. Analytical results from the CS investigation indicate that lead and TRPH contamination is present in near-surface and subsurface borings east of the concrete pad. TRPH and lead contamination was also found in the soil sample HB02 taken from the bottom of the deeper pre-existing hand-dug well which is approximately 10 feet deep. It is possible that waste materials were placed into this hand-dug well. Lead was found at the highest levels in soil at the 0- to 2-foot interval and at the bottom of the hand-dug wells. Lead was not elevated in the deeper soil samples taken at 18 to 20 feet. Total chromium was also found above NYS standards in the two hand dug wells. LS13 and HB02 also have the highest total concentrations of organics as tentatively identified compounds (TICs). The majority of the TICs at AOI 100 are unknown hydrocarbons, but some of the TICs are PAHs. PAHs were found in nearly all the shallow samples at this site, with the highest elevations at LS13 and SS18. The presence of PAHs is not a major concern at this site since they are found across the base, near other airstrips, and along many highways at similar levels.

3.9.4 ESI Sampling

The ESI will consist of the installation of three subsurface borings which will be completed as permanent monitoring wells (see Figure 3-11). One well will be located upgradient (northeast) of the site, one well will be located approximately 100 feet downgradient of the suspected paint spill area, and one well will be approximately 100 feet downgradient of the hand-dug wells. Soil samples will be collected from the well borings. One shallow soil sample will be collected from 0 to 2 feet BGS and a deeper soil sample will be collected from directly above the groundwater interface. Groundwater samples will be analyzed for TCL VOCs, TCL BNAs, TRPH, and TAL metals (filtered and unfiltered).

A near-surface soil sampling grid with 75-foot station spacing will also be established northeast of the pad. Sixteen 0- to 2-foot soil samples will be collected to determine the extent of organic and inorganic contamination in the shallow soils in this area where the results for previous borings and aerial photography indicate disposal may have occurred. At three grid points surrounding the hand dug wells, an intermediate, and a deeper (at groundwater interface) soil sample will also be collected to determine if subsurface contamination that may have been associated with these wells has migrated. The near surface and subsurface soil samples will be analyzed for TCL VOCs, TCL BNAs, TRPH, TAL metals, and % solids. A list of sample identifications and analyses is presented in Table 3-9.

Table 3-9
AOI 100: PAINT STAGING AREA NORTHEAST OF FORMER ENGINE TESTING FACILITY—SAMPLE LISTING

Griffiss AFB

										ANALYSES																								
EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 6 AOI-100 (PSA)	Group I-ESI	FIELDQC RB100NS1	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1																			X	X	X	X			X
	Group I-ESI	FIELDQC RB100NS2	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1																			X	X	X	X			X
	Group I-ESI	FIELDQC RB100S	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1																			X	X	X	X			X
	Group I-ESI	FIELDQC RB100W1	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1																			X	X	X	X			X
	Group I-ESI	FIELDQC RB100W2	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1																			X	X	X	X			X
	Group I-ESI	FIELDQC TB100	9/15/97	ASC	Drinking Water	0 - 0	Y	O	TB1																						X			
	Group I-ESI	G100-MW01 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-MW01 Z2	9/15/97	ASC	Soil	20 - 22	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-MW01 GW	9/15/97	ASC	Groundwater	22 - 30	Y	O	N1																			X	X	X	X			X
	Group I-ESI	G100-MW01 GW-F	9/15/97	ASC	Groundwater	22 - 30	Y	O	N1																			X	X					
	Group I-ESI	G100-MW01 GW-F/D	9/15/97	ASC	Groundwater	22 - 30	Y	O	FD1																			X	X					
	Group I-ESI	G100-MW01 GW-F/S	9/15/97	MRD	Groundwater	22 - 30	Y	O	FR1																			X	X					
	Group I-ESI	G100-MW01 GW/D	9/15/97	ASC	Groundwater	22 - 30	Y	O	FD1																			X	X	X	X			X
	Group I-ESI	G100-MW01 GW/S	9/15/97	MRD	Groundwater	22 - 30	Y	O	FR1																			X	X	X	X			X
	Group I-ESI	G100-MW02 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-MW02 Z2	9/15/97	ASC	Soil	20 - 22	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-MW02 GW	9/15/97	ASC	Groundwater	22 - 30	Y	O	N1																			X	X	X	X			X
	Group I-ESI	G100-MW02 GW-F	9/15/97	ASC	Groundwater	22 - 30	Y	O	N1																			X	X					
	Group I-ESI	G100-MW03 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-MW03 Z1/D	9/15/97	ASC	Soil	0 - 2	Y	O	FD1	X																		X	X	X	X			X
	Group I-ESI	G100-MW03 Z1/S	9/15/97	MRD	Soil	0 - 2	Y	O	FR1	X																		X	X	X	X			X
	Group I-ESI	G100-MW03 Z2	9/15/97	ASC	Soil	20 - 22	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-MW03 GW	9/15/97	ASC	Groundwater	22 - 30	Y	O	N1																			X	X	X	X			X
	Group I-ESI	G100-MW03 GW-F	9/15/97	ASC	Groundwater	22 - 30	Y	O	N1																			X	X					
	Group I-ESI	G100-NS01	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X

Table 3-9 (Cont.)

Page 2 of 3
8/5/97

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	ANALYSES %Solids	Ag6010	Corrosi	Explosl	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 6 AOI-100 (PSA)	Group I-ESI	G100-NS01	9/15/97	ASC	Soil/QC Matrix	0 - 2	Y	O	MS1	X																		X	X	X	X			X
	Group I-ESI	G100-NS02	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS03	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS04	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS05	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS06	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS07	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS08	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS09	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS10	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS10/D	9/15/97	ASC	Soil	0 - 2	Y	O	FD1	X																		X	X	X	X			X
	Group I-ESI	G100-NS10/S	9/15/97	MRD	Soil	0 - 2	Y	O	FR1	X																		X	X	X	X			X
	Group I-ESI	G100-NS11	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS12	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS13	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS14	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS15	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS16	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-NS16/D	9/15/97	ASC	Soil	0 - 2	Y	O	FD1	X																		X	X	X	X			X
	Group I-ESI	G100-NS16/S	9/15/97	MRD	Soil	0 - 2	Y	O	FR1	X																		X	X	X	X			X
	Group I-ESI	G100-SS20 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-SS20 Z2	9/15/97	ASC	Soil	4 - 6	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-SS20 Z3	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-SS21 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
	Group I-ESI	G100-SS21 Z2	9/15/97	ASC	Soil	4 - 6	Y	O	N1	X																		X	X	X	X			X

Table 3-9 (Cont.)

Griffiss AFB

EB Study Area-AOI #-		Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	% Solids	Ag 6010	Corrosi	Explosi	Hg 7471	Ignitab	Metals	OrgCarb	PAHs	Pb + Cu	Pb 6010	Pb 7421	PCBs	Pest	Pest PCB	Phosph	React-1	React-2	Sb 6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 6	AOI-100 (PSA)	Group I-ESI	G100-SS21 Z3	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X																		X	X	X	X			X
		Group I-ESI	G100-SS22 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X																		X	X	X	X			X
		Group I-ESI	G100-SS22 Z2	9/15/97	ASC	Soil	4 - 6	Y	O	N1	X																		X	X	X	X			X
		Group I-ESI	G100-SS22 Z3	9/15/97	ASC	Soil	10 - 12	Y	O	N1	X																		X	X	X	X			X

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

3.10 AOI 102: Lindane Spill Site

The purpose of the ESI investigation at AOI 102 is to determine the extent of the pesticide contamination at this site.

3.10.1 Site Background

AOI 102 was formerly the location of Building 331, an Entomology Shop pesticide storage shed. This building has since been removed. An outline of the former building site is presented in Figure 3-12. The site was initially identified by Engineering-Science in a Phase I IRP study conducted for the U.S. Air Force in 1981 (Engineering-Science 1981). A subsequent investigation by Law Environmental in 1994 reported that a lindane spill occurred in this area during the summer of either 1957 or 1958 (Law Environmental 1994b). The volume of the spill is reported to have been approximately 55 gallons of a 46% solution of lindane. The spill occurred inside the storage shed over a three-day period due to a pin-hole leak in a 55-gallon drum (Law Environmental 1994b). The drum's entire contents spilled through the building's wooden floor into the soils over a three-day period. The area of the spill was reported to be localized beneath the building (Law Environmental 1994b).

As part of the site investigation for Interagency Agreement (IAG) Regulator chosen sites, four shallow soil borings were augured to a depth of 2 feet in proximity to the spill site by Law Environmental personnel. Soil samples were collected from 0 to 1 feet and 1 to 2 feet BGS in each of the borings. Analytical testing of the soil samples revealed no evidence of lindane contamination; however, concentrations of the pesticides chlordane, 4,4-DDE, and 4,4-DDT exceeded NYSDEC guidance values for soil (Law Environmental 1994a).

3.10.2 Physical Characteristics

The site is currently a grass-covered lot at the northeast corner of the intersection of Chanute Street and the driveway for Building 301. A row of mature trees lines both sides of the Building 301 driveway, terminating within 30 feet of Chanute Street. The remainder of the site consists of an open, flat, grassy area. No visible evidence of chemical stains or stressed vegetation was observed during the site reconnaissance. The soils at AOI 102 consist of varying percentages of gravel/sand with minor amounts of silt. The dominant component is well-rounded, coarse- to cobble-size gravel. The sand is well rounded and fine to medium grained. The soils are generally poorly graded and moderately sorted glacial outwash. The depth at which groundwater was encountered during the subsurface investigation at the site was approximately 17.5 feet BGS.

Groundwater flow is toward the southwest. Based on the review of the E & E Groundwater Interpretation Map dated April 10, 1996, the existence of a groundwater divide with a north-south orientation is suspected in proximity to this site. Because of the presence of this divide and the prominent hill just to the south of this site, the direction of groundwater flow at this location is not known.

3.10.3 Previous Confirmatory Sampling

A CS investigation consisting of the drilling of one soil boring and one LSA boring was performed at this site. Two subsurface soil samples were collected from each boring and one groundwater screening sample was collected from the LSA boring for pesticide analysis. Although no lindane was found, chlordane, 4,4-DDE, and 4,4-DDT were detected above NYSDEC guidance values in the soil and above RBCs in the groundwater.

3.10.4 ESI Sampling

The ESI will consist of the collection and analysis of four near-surface (0 to 2 feet BGS) soil samples and the installation of three monitoring wells (see Figure 3-12). All samples collected during the ESI will be analyzed for pesticides. Three soil samples will be collected in each well boring, one near the surface, one at an intermediate depth, and one directly above the groundwater interface to investigate the potential source of groundwater contamination, if present. Permanent wells will be installed to a depth of 8-feet below the water table in the borings. In addition, existing well LAWMW-14 will also be sampled and analyzed for pesticides including lindane, chlordane, 4,4-DDE, and 4,4-DDT. Results from these four groundwater samples and water level measurements from the new wells will be used to determine the extent of groundwater contamination and better define the direction of groundwater flow at this site. A list of sample identifications and analyses is provided on Table 3-10.

Table 3-10
AOI 102: LINDANE SPILL SITE—SAMPLE LISTING

Page 1 of 2

8/5/97

Griffiss AFB

EB Study Area-AOI #	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosl	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
										ANALYSES																								
Study Area 20 AOI-102 (LS)	Group I-ESI	FIELDQC RB102S	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1														X											
	Group I-ESI	FIELDQC RB102W	9/15/97	ASC	Eqpt. Washwater	0 - 0	Y	O	EB1														X											
	Group I-ESI	G102-MW01 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X													X											
	Group I-ESI	G102-MW01 Z2	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X													X											
	Group I-ESI	G102-MW01 Z3	9/15/97	ASC	Soil	12 - 14	Y	O	N1	X													X											
	Group I-ESI	G102-MW01 GW	9/15/97	ASC	Groundwater	14 - 22	Y	O	N1														X											
	Group I-ESI	G102-MW01 Z1	9/15/97	ASC	Water/QC Matrix	0 - 2	Y	O	MS1	X													X											
	Group I-ESI	G102-MW02 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X													X											
	Group I-ESI	G102-MW02 Z1/D	9/15/97	ASC	Soil	0 - 2	Y	O	FD1	X													X											
	Group I-ESI	G102-MW02 Z1/S	9/15/97	MRD	Soil	0 - 2	Y	O	FR1	X													X											
	Group I-ESI	G102-MW02 Z2	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X													X											
	Group I-ESI	G102-MW02 Z3	9/15/97	ASC	Soil	12 - 14	Y	O	N1	X													X											
	Group I-ESI	G102-MW02 GW	9/15/97	ASC	Groundwater	14 - 22	Y	O	N1														X											
	Group I-ESI	G102-MW03 Z1	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X													X											
	Group I-ESI	G102-MW03 Z2	9/15/97	ASC	Soil	8 - 10	Y	O	N1	X													X											
	Group I-ESI	G102-MW03 Z3	9/15/97	ASC	Soil	12 - 14	Y	O	N1	X													X											
	Group I-ESI	G102-MW03 GW	9/15/97	ASC	Groundwater	14 - 22	Y	O	N1														X											
	Group I-ESI	G102-MW03 GW/D	9/15/97	ASC	Groundwater	14 - 22	Y	O	FD1														X											
	Group I-ESI	G102-MW03 GW/S	9/15/97	MRD	Groundwater	14 - 22	Y	O	FR1														X											
	Group I-ESI	G102-NS01	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X													X											
	Group I-ESI	G102-NS02	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X													X											
	Group I-ESI	G102-NS03	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X													X											
	Group I-ESI	G102-NS04	9/15/97	ASC	Soil	0 - 2	Y	O	N1	X													X											
	Group I-ESI	LAWMW-14	9/15/97	ASC	Groundwater	15 - 25	Y	O	N1														X											

Table 3-10 (Cont.)

Page 2 of 2

8/5/97

Griffiss AFB

EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	Phosph	React1	React2	Sb6010	TAL Met	TCL BNA	TCL VOC	TOC	TOX	TRPH
Study Area 20 AOI-102 (LS)	Group I-ESI	ZZZZ	9/15/97	ASC	Groundwater	15 - 25	Y	O	N1																								

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

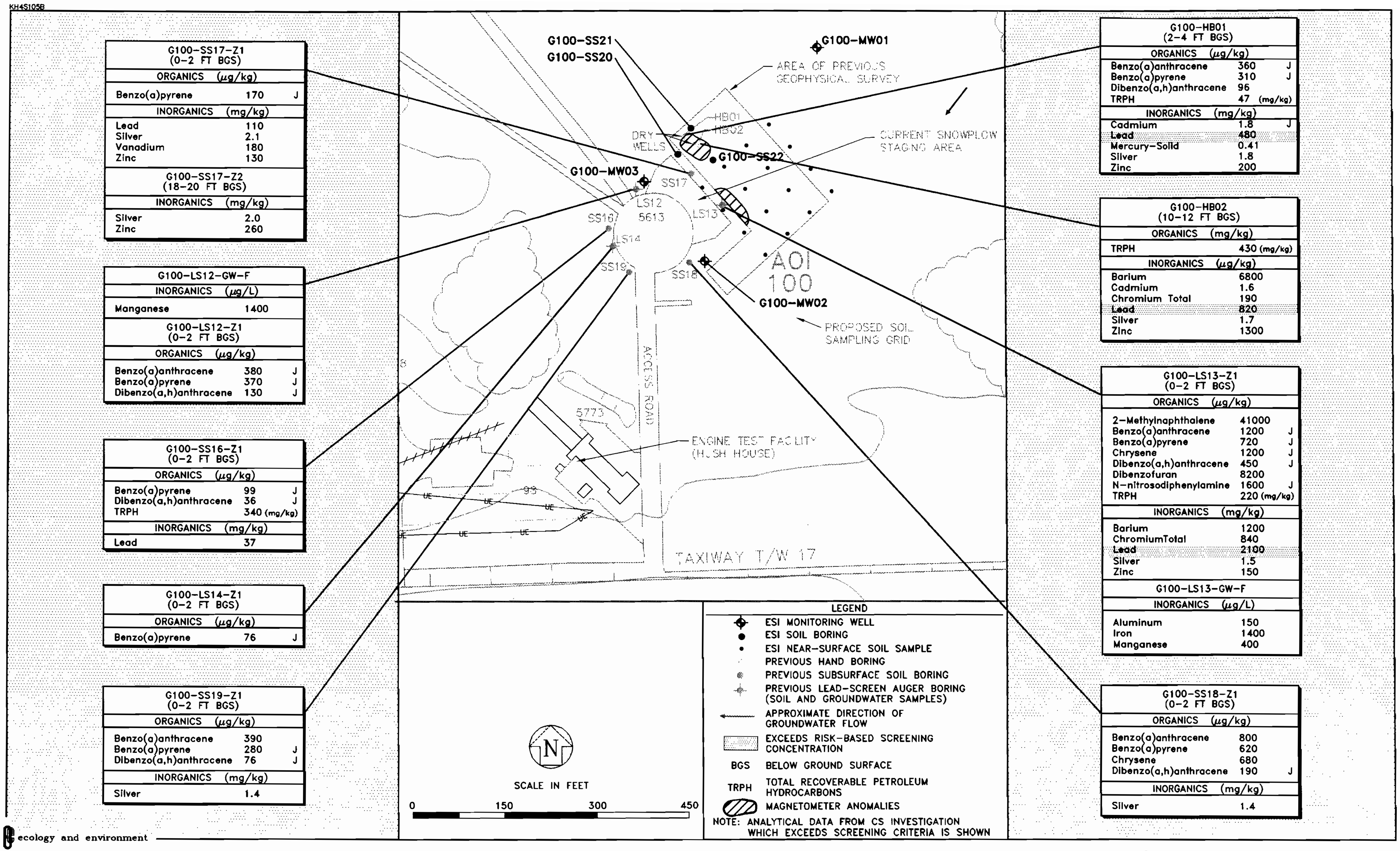
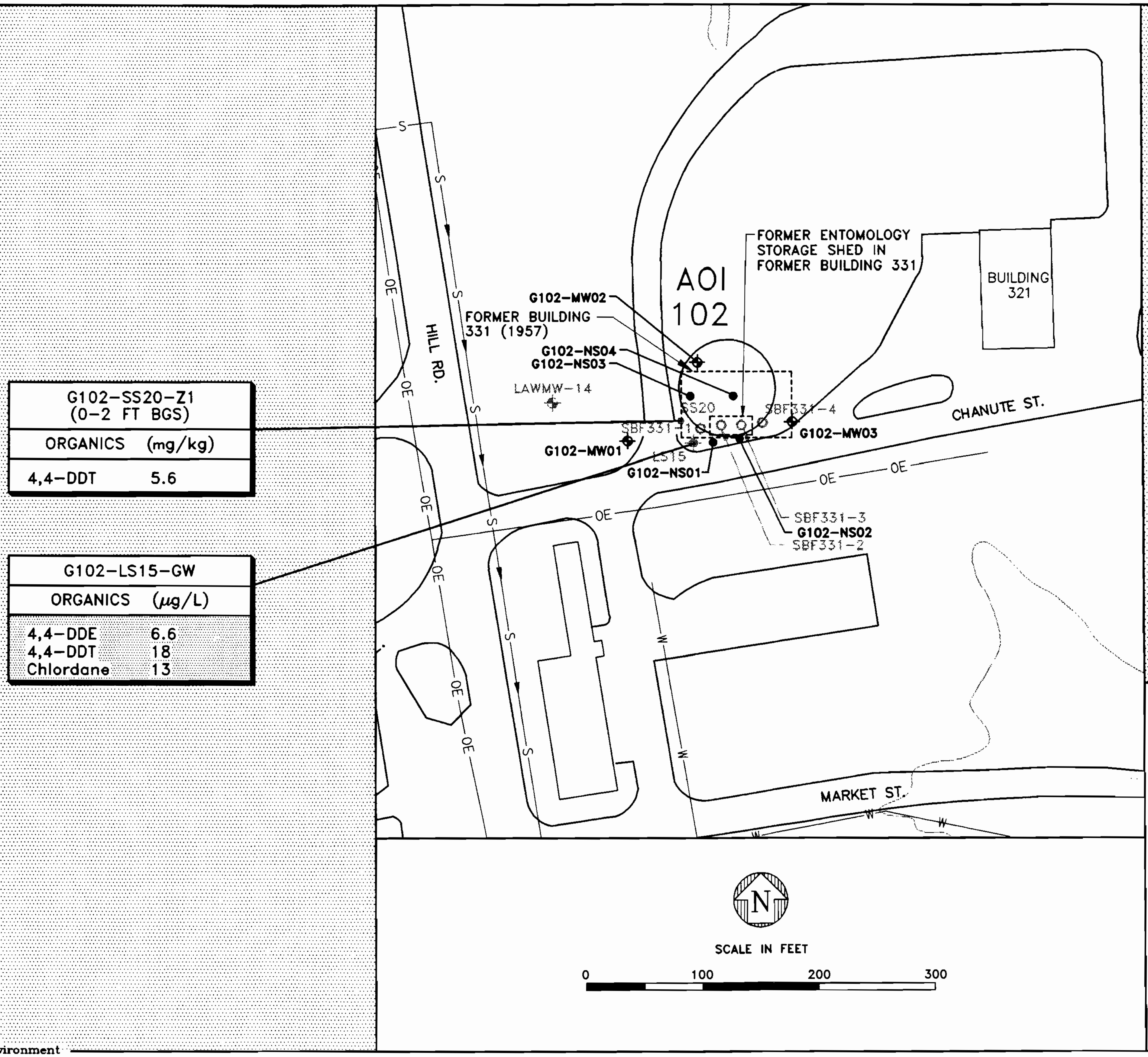


Figure 3-11 PAINT STAGING AREA NORTHEAST OF FORMER ENGINE TESTING FACILITY (AOI 100)

KH4S109B



G102-SS20-Z1 (0-2 FT BGS)	
ORGANICS	(mg/kg)
4,4-DDT	5.6

G102-LS15-GW	
ORGANICS	(µg/L)
4,4-DDE	6.6
4,4-DDT	18
Chlordane	13

LEGEND

●	ESI NEAR-SURFACE BORING
⊕	ESI MONITORING WELL
•	PREVIOUS GROUP I AOI CS SUBSURFACE SOIL BORING
⊕	PREVIOUS GROUP I AOI CS LEAD-SCREEN AUGER BORING (SOIL AND GROUNDWATER SAMPLES)
○	PREVIOUS IAG SOIL BORING
⊕	RI MONITORING WELL
▨	EXCEEDS RISK-BASED SCREENING CRITERIA
BGS	BELOW GROUND SURFACE

NOTES: 1. ANALYTICAL DATA FROM CS INVESTIGATION WHICH EXCEEDS SCREENING CRITERIA IS SHOWN.

2. ACCORDING TO THE E&E GROUNDWATER INTERPRETATION MAP DATED 4/10/96, THE EXISTENCE OF A GROUNDWATER DIVIDE WITH A NORTH/SOUTH ORIENTATION IS SUSPECTED IN PROXIMITY TO THIS SITE. BECAUSE OF THE PRESENCE OF THIS DIVIDE AND THE PROMINENT HILL JUST TO THE SOUTH OF THIS SITE, THE DIRECTION OF GROUNDWATER FLOW AT THIS LOCATION IS NOT KNOWN.

Figure 3-12 LINDANE SPILL SITE (AOI 102)

4 Field Sampling Plan (FSP) Part II: Field Methodology

4.1 Introduction

The field work for this investigation will include reconnaissance-type surveys (i.e., geophysics); near-surface (NS) soil sampling; drilling of soil borings and collection of subsurface soil (SS) samples, groundwater (GW) samples, and surface water (SW) and sediment (SD) samples. A truck-mounted drilling rig will be used to drill the subsurface borings. A geophysical survey will be performed by E & E using electromagnetic (EM) and total earth-field magnetic instruments to identify the presence or absence of buried metallic objects at AOI 17.

This section identifies the number of sample matrices to be collected and describes the STS to be used and the methodologies for geophysical surveying, drilling, and sample collection. Maps and aerial photos showing the AOI locations and types of samples to be collected at each AOI are provided in the previous section on Figures 3-1 through 3-12. A summary of samples and analytical parameters is presented in Table 2-1. The level of investigation at each AOI is based on the scope of work approved by NYSDEC and EPA. The identification of the samples to be collected and the respective analytical parameters are shown for each AOI in the previous section in Tables 3-1 through 3-10. The sample identifications on these tables have been generated in the Installation Restoration Program Information Management System (IRPIMS) format.

4.2 Sample Tracking System

E & E's STS will be used during the field sampling program. This database program assists in prefield planning and generates records and reports of the daily field progress and functions as an electronic database that will be used to tabulate analytical results in the written report.

In the prefield planning stage, the STS will provide tables of AOI-specific sample summaries, container and field preservation requirements, and QC method requirements. It will also generate sample jar labels. An STS database has been set up for the sampling program. Sample matrices and respective sample numbers, sample types, sample depths, and the analytical tests to be conducted are included in Tables 3-1 to 3-10. Additional STS information included in Appendix A are:

- Sample container requirements;
- Sample preservation methods and holding times;
- Example of STS-generated sample container labels; and
- Example of STS-generated daily report.

During the field activity, the STS will record which of the predetermined samples in the database were taken, when the samples were taken, field measurements, and other sampling notes. Sample substitutions or modifications to a predetermined sampling scheme can be made within STS if necessary.

The STS electronic sample record will be updated on a daily basis by the field team leader (FTL). Field survey coordinates will also be included in the database. Daily and weekly progress reports will be generated by the STS for reporting to the client on a regular basis.

Both the standard paper chain-of-custody (COC) form and an electronic file will be sent with each sample cooler to E & E's Analytical Services Center (ASC) in Lancaster, New York. Soil samples sent to the USACE Missouri River Division (MRD) Laboratory in Omaha, Nebraska will be accompanied by paper COC forms only. The STS will continue to track the field samples while laboratory analyses are performed at E & E's ASC. Analytical results from the ASC will be integrated into the STS to create an electronic database of chemical data results. An electronic data deliverable (EDD) of the analytical and QC data in the IRPIMS format will be generated using STS and E & E's Laboratory Management Information System (LABMIS). Data validation will be performed on all samples analyzed, and appropriate qualifiers will be added to the database.

STS will also be used to generate some of the sample-specific information necessary for the IRPIMS database. In particular, STS will provide the location identifier; the X and Y coordinates for the "BCHLDI" (location-defining information) data file; and the information for the "BCHSAMP" (environmental sample information) data file. STS does not track the complete set of QC analytical data. Consequently, the majority of the "BCHRES" (analytical results) and "BCHTEST" (sample preparation information) data files will be generated directly from E & E's LABMIS.

4.3 Field Notebooks

Field notebooks will contain information in a daily log format, including both site and task logs. The following information is included in site and task logs.

The site log is the responsibility of the project manager or the field team leader and will include a complete summary of the day's activity at the site. This information will include a record of personnel on site, including subcontractors, and daily objectives and work accomplished.

The task log will be the responsibility of each field team (e.g., drilling, geophysics, or sampling) and will include the following:

- Initials of the person making an entry and other personnel involved in the activity;
- Sampling location, depth, station number, date, time, and sample matrix;
- On-site measurement data for groundwater, such as pH, temperature, conductivity, and turbidity;
- Any sample preservatives used;
- Photographic information and field observations as appropriate; and
- Any unusual circumstances or difficulties.

No pages will be removed from the logbooks for any reason. If corrections are necessary, they will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction will be initialed and dated.

4.4 Geophysical Survey

A geophysical survey will be performed at AOI 17 to determine the presence or absence of buried metallic objects. The geophysical methods that will be used to survey this area will be electromagnetic (EM) and total earth-field magnetic surveys. The EM and magnetic survey will be performed using an EM31 ground conductivity meter and an EG&G 856 portable proton precession magnetometer, respectively.

EM31

The EM31 instrument has an effective penetration depth of 18 feet and an optimal sensitivity depth of 5.4 feet. The EM31 will respond to changes in natural ground conductivity, as well as the presence of buried material that is conductive. The EM31 measures conductivity in millisiemens (millimhos) per meter. A polycorder-type datalogger is used in conjunction with the EM31 to electronically store conductivity measurements taken.

Magnetometer

The magnetometer measures the earth's total magnetic field in gammas. Short wavelength anomalies in the total field are caused by the presence of ferrous metal objects such as steel drums. These anomalies are apparent when the magnetic data are reduced. Since the earth's magnetic field naturally fluctuates throughout each day (i.e., diurnal drift), background readings will be collected at an on-site base station(s). The location of the base station(s) will be in an area with minimal interference from man-made features (i.e., buried wastes or utilities, overhead powerlines, fences, buildings, etc.).

Geophysical Survey Grid and Data Collection

A geophysical survey grid will be established at AOI 17 using a tape measure and Brunton compass to place pin flags at the data collection stations. Permanent wood stakes will be driven into the ground at the four outer corners of the grids to later facilitate surveyors in locating the grids onto the site map (see Section 4.13). The stations and lines at AOI 17 will be spaced at 50-foot intervals (see Figure 3-6). The actual size, shape, and orientation of the survey grid may vary slightly from that illustrated in the figure based on site conditions (i.e., the presence of large trees and brush, etc.). Both EM31 and magnetometer readings will be recorded at each grid station at AOI 17. Once the survey is complete and the data is downloaded and verified, the pin flags will be removed.

Geophysical Data Reduction

Data from the EM31 and magnetometer will be downloaded using the software provided with the instruments. Prior to processing, magnetic data will be corrected for natural diurnal drift. Both EM31 and magnetometer data will be processed using *Surfer* Version 6.0 software (Golden Software 1995) and plotted as geophysical contour maps.

4.5 Near-Surface Soil Sampling

Near-surface (up to 2 feet BGS) soil samples will be collected using one of two methods: stainless-steel hand auger and/or 2- to 3-inch outer diameter (OD) split-spoon sampler. The stainless-steel hand auger will be used for the shallower soil samples (0 to 3 inches and 0 to 6 inches BGS) and the split-spoon will be used for the deeper (0 to 2 feet BGS) soil samples. Near-surface soil collection will be performed according to the following procedures:

Hand Auger Method

Equipment and Supplies:

- Stainless-steel hand auger;
- Precleaned, stainless-steel trowel;
- Precleaned, stainless-steel bowl;
- Precleaned glass sample containers (see Table 4-2), equipped with teflon-lined lids or septa and certified "clean" per OSWER Directive 9240.9-05; and
- Cooler with ice.

Sampling Procedure:

- Decontaminate the hand auger according to procedures outlined in Section 4.11 of this report prior to collection of each sample.
- Twist the hand auger into the ground to the desired sampling depth. Empty the barrel of the hand auger into a dedicated, precleaned, stainless-steel bowl each time it is filled until the total depth is achieved.

- Collect the VOC portion of the sample immediately after placing the soil in the bowl, then homogenize the remainder of the sample and distribute to the appropriate sample containers (see Table 4-2) using a stainless-steel sampling trowel.

- Immediately place the sample in a cooler with ice, cool, and then maintain sample temperature at 4°C.

Split-Spoon Sampler Method

Equipment and Supplies:

- Precleaned, 2- to3-inch OD, carbon steel split-spoon sampler;
- Split-spoon sample catcher;
- Split-spoon extension rod;
- Pounding cap;
- Pipe wrenches;
- Pounding sleeve;
- Sledge hammer;
- Tape measure;
- Precleaned, stainless-steel knife;
- Precleaned, stainless-steel bowl;
- Precleaned glass sample containers (see Table 4-2), equipped with teflon-lined lids or septae and certified "clean" per OSWER Directive 9240.9-05; and
- Cooler with ice.

Sampling Procedures:

- Decontaminate the split-spoon sampler according to procedures outlined in Section 4.11 of this report prior to collection of each sample.

- Assemble the split-spoon sampler. A sample catcher may be necessary to retain the sample. The catcher is placed in the bit of the sampler.

- Attach an extension rod/pounding cap to the top of the sampler.
- Place the sampler in a perpendicular position on the ground surface.
- Mark the exterior of the sampler to indicate the 2-foot interval.
- Using a sledge hammer or slam bar, drive the barrel into the ground. Do not drive past the 2-foot interval or compression of the sample will result.
- Record the length of the barrel used to penetrate the material being sampled.
- Withdraw the split spoon by lifting with pipe wrenches, and open. If a split sample is desired, a precleaned, stainless-steel knife should be used to divide the tube contents in half, longitudinally.
- Collect the VOC portion of the sample from the split-spoon sampler prior to compositing the soil, then place the remainder of the sample in a dedicated, precleaned, stainless-steel bowl, homogenize, and distribute to the appropriate sample containers (see Table 4-2) using a stainless-steel trowel.
- Immediately place the sample in a cooler with ice, cool, and then maintain sample temperature at 4°C.

4.6 Surface Water/Sediment Sampling Methods

Up to four surface water/sediment samples will be collected at AOI 9, three along the north bank of Sixmile Creek and one from an additional seep, if found, that has not been previously sampled. Details of both surface water and sediment collection procedures are described below.

Surface Water Sampling

Up to four surface water samples will be collected at the same locations as the sediment samples at AOI 9. At each surface water/sediment sampling location, the surface water sample will be collected first, followed by sediment sample to minimize turbidity. To avoid cross-contamination, sample collection will begin at downstream locations and proceed upstream.

Equipment and Supplies

The following equipment and supplies will be used for sample collection:

- pH, specific conductivity, temperature, and turbidity meters;
- Dedicated stainless-steel or glass beakers (500 milliliter [ml] minimum volume);
- Precleaned glass jars or vials, equipped with teflon-lined lids or septae and certified "clean" per OSWER Directive 9240.9-05; and
- Sample preservation solutions (see Table 4-2); and
- Cooler with ice.

All sampling equipment will be decontaminated between samples to prevent cross-contamination. If the sampling equipment is to be moved or used later, it will be wrapped in aluminum foil after decontamination.

Surface water samples will be collected as follows:

- Submerge the appropriate decontaminated container into the water. For volatiles, collect samples using the direct-fill method to minimize sample agitation and loss of volatile constituents. Volatile vials will be filled leaving no headspace and will be preserved with hydrochloric acid (HCl) to a pH of less than 2. For parameters other than volatiles, a precleaned dedicated stainless-steel or glass beaker may be used to transfer the water to the appropriate sample container;
- Measure pH, temperature, specific conductance and turbidity;
- Add preservatives to the necessary samples as indicated in Table 4-2; and
- Place samples into a cooler with ice, cool, and then maintain samples to 4°C.

Sediment Sampling

Equipment and Supplies

The following equipment and supplies will be used for sediment sample collection.

- A dedicated stainless-steel trowel;
- Stainless-steel mixing bowl; and

- Precleaned 40-milliliter vials and 8-ounce clear glass jars, equipped with teflon-lined lids or septa and certified "clean" per EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9240.0-05.

Sediment samples will be collected as follows:

- After decontaminating the trowel and following collection of the corresponding surface water sample, collect an adequate amount of sediment at the designated sample location.
- Collect samples to be analyzed for volatile organics first.
- Fill the sample bottles for chemical analysis for the parameters specified in the STS tables in Section 3;
- Immediately following collection, place samples into a cooler with ice, cool, and then maintain samples at 4°C.

4.7 Subsurface Logging, Subsurface Soil Sampling, and Groundwater-Screening Sampling Methods

The subsurface investigation includes collection of soil samples from subsurface soil borings and groundwater screening samples from temporary well borings drilled using hollow-stem auger (HSA) techniques. Subsurface soil sample depths (for chemical analyses) may vary from those planned, depending upon field instrument screening or visible staining. Groundwater samples will be collected near the surface of the water table in temporary wells using a bailer. Both filtered and unfiltered portions for metals analyses will be collected. Groundwater screening samples in boreholes with suspected petroleum hydrocarbons will be collected from the upper portion of the water column.

4.7.1 Subsurface Logging and Soil-Sampling Procedures

Subsurface soil samples will be collected from well bores for descriptive purposes and for subsequent laboratory analysis as specified in Table 2-1. Continuous split-spoon samples will be collected from each temporary and standard well bore to the depth of completion. All pertinent well drilling information will be recorded on a hazardous and toxic waste (HTW) drill log (see Figure 4-1). Subsurface logging will be performed according to the following procedures:

- Logs shall be prepared in the field, as borings are drilled, by a qualified, experienced geologist or geotechnical engineer. Each log shall be signed by the preparer;

- All log entries shall be printed. Photo reproductions shall be clear and legible. Illegible or incomplete logs will not be accepted by USACE. Copies shall be submitted to the USACE Kansas City District as borings are completed;

- Borehole depth information shall be from direct measurements accurate to 0.10 foot;

- Logs shall be prepared on the HTW drill log form;

- All information blanks in the log heading shall be completed;

- Log scale shall be 1 inch = 1 foot;

- Each and every material type encountered shall be described in column d of the log form;

- Unconsolidated materials shall be described as follows:
  - descriptive Unified Soil Classification System (USCS) classification;
  - consistency of cohesive materials or apparent density of noncohesive materials;
  - moisture content assessment (e.g., moist, wet, saturated, etc.);
  - color;
  - other descriptive features (e.g., bedding characteristics, organic materials, etc.); and
  - depositional type (e.g., alluvium, till, loess, etc.);.

- Rock materials shall be described in accordance with standard geologic nomenclature, including:

  - rock type;
  - relative hardness;
  - density;
  - texture;
  - color;
  - weathering;
  - bedding;
  - fractures, joints, and cavities; and
  - other descriptive features (e.g., fossils, pits, crystals, etc.)

- Stratigraphic/lithologic changes shall be identified in column d by a solid horizontal line at the appropriate scale depth on the log that corresponds to measured borehole depths at which changes occur, measured, and recorded to the nearest 0.1 foot. Gradational transitions, changes identified from cuttings, or methods other than direct observation and measurement shall be identified by a horizontal dashed line at the appropriate depth based upon the best judgment of the logger;

- Logs shall clearly show in column f the depth intervals from which all samples are retained;

- Logs shall clearly identify the depth at which water is first encountered, the depth to water at the completion of drilling, and the stabilized depth to water. The absence of water in borings shall also be indicated. Stabilized water level data shall include time allowed for levels to stabilize;

- Logs shall show borehole and sample diameters and depths at which drilling or sampling methods or equipment change;

- Logs shall show total depth of penetration and sampling. The bottom of the hole shall be so identified on the log by solid double lines from margin to margin with the notation "bottom of hole";

- Logs shall identify any drilling fluid losses, including depths at which they occur, rate of loss, and total volume lost;

- Logs shall show drilling fluids used, including, as appropriate:

    - source of makeup water;
    - drill fluid additives by brand and product name, and mixture proportions; and
    - type of filter for compressed air;

- Logs shall show depths and types of any temporary casing used;

- Logs shall identify any intervals of hole instability.

- Intervals of lost bedrock core shall be shown in column e. Intervals of intact soil sampling attempts shall also be shown in column e, including depths from which attempts were made and the length of the sample recovered from each attempt. Bedrock coring information shall also include:

    - start and stop time of each core run;
    - depth to top and bottom of each core run;
    - length of core recovered from each run; and
    - size and type of coring bit and barrel;

- Any special drilling or sampling problems shall be recorded on logs, including descriptions of problem resolutions;

- Logs shall include all other information relevant to a particular investigation, including but not limited to:

    - odors;
    - HNu/organic vapor analyzer (OVA) measurements;
    - any observed evidence of contamination in samples, cuttings or drilling fluids.

4.7.2 Hollow-Stem Auger (HSA) Methodology

All borings will be drilled to the top of the water table using HSA techniques. These techniques include the use of a minimum of 3¼-inch inner diameter (ID) hollow-stem augers to minimize borehole diameter, thus reducing the volume of soil cuttings. However, 4¼-inch ID hollow-stem augers may be used if needed. Continuous split-spoon samples will be collected in each boring until saturated conditions are encountered. A decontaminated 2-inch OD carbon steel split-spoon sampler will be used to collect each sample. If additional sample volume is required for split or duplicate samples, a 3-inch OD carbon steel split-spoon will be used. As previously stated, the shallow (Z1) sample for chemical analysis will be collected at the most contaminated interval (i.e., based on instrument readings, color, odor, etc.). If no contamination is detected, the Z1 sample will be taken from the 0- to 2-feet interval (BGS), unless otherwise specified in Table 2-1. The deeper (Z2) sample for chemical analysis will either be collected at an intermediate depth (in boreholes greater than 50 feet) or at the water table interface. If an intermediate sample is collected at a particular AOI, the water table interface sample (Z3) will be collected on an optional basis in the borings in which temporary wells are completed if contamination is suspected at that interval. These samples will be labeled, packaged, and preserved according to procedures outlined in Section 4.10 of the FSP and Sections 5 and 6 of the QAPjP.

Boreholes at AOIs 7 and 17 requiring a groundwater-screening sample will be drilled an additional 8 feet below the top of the water table. A decontaminated temporary 10-foot length of 2-inch ID polyvinyl chloride (PVC) screen (010 slot) followed by 2-inch ID PVC casing will be installed inside the augers so that the top 2 feet of screen is above the water table. The augers will then be removed from the ground.

The use of water during drilling is not expected to be necessary during this drilling program because of the relatively shallow depths (less than 40 feet BGS). However, in glacially derived terrain, variability of soil conditions among locations is not uncommon. Although unlikely at shallower depths, if lithostatic pressure exceeds hydrostatic pressure, flowing sand could result. If the use of water becomes necessary during drilling, clean, potable water will be used from one of the base fire hydrants. The site geologist will record the volume of water used. If water is used during the drilling of any of the monitoring wells, two times the amount used will be removed during well development. If water is used for drilling, one sample of the water will be collected from the fire hydrant and analyzed for the same parameters specified for in Table 4-2. Information regarding the source of water used and any impact on analytical results will be included in the draft and final reports.

All drilling and sampling equipment will be decontaminated according to the procedures outlined in Section 4.11 of this report between each borehole location.

4.7.3 Groundwater Screening Sampling Methods

Upon completion of the temporary well described in the above section, and after allowing groundwater inside the temporary well to stabilize, the temporary well will be purged with a bailer of three casing volumes, or to dryness, prior to sample collection to allow inflow of undisturbed formation water. After each volume is purged, the purge water will be tested for pH, temperature, conductivity, and turbidity. Field measurements of pH, temperature, conductivity, and turbidity will be taken and recorded upon sample collection. Turbidity readings will be performed for both filtered and unfiltered samples collected for metals analyses.

The VOC portion of the sample will be collected first, followed by the BNAs, using a decontaminated bailer. Bailing will be performed at a very slow rate to minimize volatilization and sample turbidity.

For filtered metals sampling, a pressurized barrel filter will be used in conjunction with an in-line 0.45-micron filter. The filtered groundwater will be passed through the barrel filter and pumped directly into the appropriate sample container.

All groundwater screening samples shall immediately be placed in a cooler with ice and properly preserved prior to sample shipment.

4.8 Permanent Monitoring Well Installation Methodology

Standard monitoring wells will be installed at AOIs 9, 16/193, 58/101, 90, 100, and 102. The standard monitoring well borings will be drilled according to the same general procedures outlined for the temporary well borings described in Section 4.7.2. However, the permanent monitoring well boreholes must be drilled with 4.25-inch ID HSAs. The wells will be completed according to the procedures in Section 4.8.1.

4.8.1 Well Design and Construction

4.8.1.1 Well Construction Materials

All monitoring wells will be constructed using the same materials as those used during the RI (Law Environmental 1996). Therefore, riser material will consist of new, 2-inch ID, threaded, flush-joint PVC pipe. The riser pipe will conform to ASTM D 1785 standards for

Schedule 40 pipe. Well screens will consist of new, 2-inch ID, commercially fabricated, threaded, flush-joint, factory slotted (0.010) PVC screen unless a different slot size is deemed appropriate and approved by USACE. A threaded PVC plug will be placed on the bottom of each well. Well material not certified as "clean" by the vendor and remaining in the sealed plastic cover will be decontaminated prior to installation. New, dedicated bladder pumps will be installed in each of the permanent monitoring wells after well construction is completed.

4.8.1.2 Screen Location

For standard monitoring wells, the top of the screen will be installed 2 feet above the water table to allow for seasonal fluctuations. All well screens will be 10 feet in length.

4.8.1.3 Filter Pack

A sand filter pack will be installed in the annular space between the boring and well screen. Filter pack design will be derived from data obtained from RI wells previously installed on the base. Based on geotechnical data from these wells, a filter pack will be selected following the methods prescribed in ASTM D 5092-90 and the EPA *Handbook of Suggested Practices for Design and Installation of Groundwater Monitoring Wells*. In addition, Table 1 in ASTM 5092 furnishes "Recommended (Achievable) Filter Pack Characteristics for Common Screen Slot Sizes". The screen size selected will retain at least 90% of the filter pack.

The filter pack will consist of clean, chemically inert, noncarbonated, well-sorted silica sand. Care will be taken to prevent bridging by continuously probing and measuring the thickness of the filter pack as it is placed. The sand filter pack will be placed from the bottom of the borehole to approximately 2 feet above the top of the well screen. In wells with the screen set close to the surface, height of the filter pack above the top of the screen may be modified (i.e., shortened).

4.8.1.4 Bentonite Seal

A bentonite pellet or granular bentonite seal will be installed in the annular space above the artificial filter pack. The seal will be 3 feet thick if set below the water table and 2 feet thick if set above the water table. In wells where the screen is close to the ground surface, a minimum of 1 foot of bentonite must be placed. The bentonite will be tamped (to prevent bridging) and hydrated with water from the approved water source (see Section 4.7.2) if placed above the water table. The bentonite seal will be allowed to hydrate a minimum of 12 hours prior to placement of the grout collar around the wells.

4.8.1.5 Plumbness and Alignment

All risers and screens will be set round, plumb, and true to line. The well assembly will be hung in the borehole prior to placement of the filter pack and not allowed to rest on the bottom of the hole so as to keep the well assembly straight and plumb. Centralizers will be installed in all wells greater than 20 feet in depth. Centralizers will be PVC or stainless steel and attached to the well casing via stainless-steel fasteners or strapping. Centralizers will not be attached to the well screen or the part of the well casing exposed to the granular filter or bentonite seal.

4.8.1.6 Grout Seal

A nonshrinking cement-bentonite grout mixture will be placed in the annular space from the top of the bentonite seal to 4 feet BGS, where possible, as specified by EPA Region II, to prevent possible damage to the well by frost heaving. Concrete will be added in the remaining annular space at the same time the protective casing and concrete pad are installed (see Section 4.8.1.7).

The cement-bentonite mixture will consist of portland cement (ASTM-C150) and clean water from the approved water source in the proportion of not more than 7 gallons of water per 94-pound bag of cement. Additionally, 3% by weight of bentonite powder will be added to the mixture to help reduce shrinkage. A tremie pipe will be used to place the grout mixture into the annular space until undiluted grout is at the required depth (i.e., 4 feet BGS).

4.8.1.7 Well Completion Details

The standard monitoring wells will be completed either 2 feet above ground surface or flush to ground surface, depending on the current use of the site. The aboveground completion will consist of a 6-inch-diameter, locking, protective steel casing. Prior to installation of the steel casing, a 4-inch diameter PVC casing will be placed in the borehole from the top of the grout seal to 0.5 foot above ground surface (or 0.5 foot BGS for flush-mount wells). Cement will be placed in the angular space between the edge of the borehole and the 4-inch PVC casing. The steel casing will then be placed in the cement and set 4 feet BGS and surrounded by a 3-foot by 3-foot by 4-inch concrete drainage pad. A weep hole will be drilled in the base of the protective casing, just above the concrete pad, and a vented PVC well cap will be placed on the inner casing. Three steel protective posts set 4 feet BGS in concrete will be installed equidistant around the locking protective casing outside the concrete drainage pad. The steel casing and posts will be painted with rust-inhibiting paint. The flush-mount completion will consist of a protective housing set flush to the ground surface surrounded by a concrete pad. The inner casing will be a few inches BGS, and capped with a water-tight locking cap. Figure 4-2 illustrates the proposed standard permanent well construction. New, dedicated bladder pumps will be installed in each of the permanent monitoring wells after well construction is completed.

4.8.1.8 Well Identification

Wells will be identified by a brass survey marker. The survey marker will be embedded in the cement well pad. A metal identification will also be mounted on each well casing, or under the manhole cap if flush-mounted, indicating the well identification number, well depth, and date of installation. The tags will be labeled with an inscription pen and attached with rivets or bolts to the well casings or manhole caps.

4.8.2 Well Development

Each new permanent monitoring well will be developed no sooner than 48 hours after grout placement. Temporary wells will not be developed since there is no sand filter pack. Development will be performed using bailers and/or submersible pumps until pH, temperature, and conductivity have stabilized and turbidity of the discharge is 50 nephelometric turbidity units (NTUs) or less. Development will be performed according to the procedure described below.

Equipment and Supplies

- Water level indicator;
- pH, temperature, conductivity, and turbidity meters;
- Precleaned, stainless-steel or teflon bailer;
- Surge block;

- Submersible pump;
- 55-gallon drums (if determined necessary [see Section 4.12 of this report]).

Development Procedures

- Measure static water level;
- Measure total depth of well;
- Calculate volume of water in well casing/screen and filter pack using the following equation:

  1 well volume (gal) = $[H_1 \times 0.16 \text{ gal/ft}] + [H_2 \times 1.08 \text{ gal/ft}]$

  Where: H1 = total height of the water column in the well

  H2 = height of the saturated sand pack

  This equation is based on the following assumptions:

  - 2-inch well diameter;
  - 40% sand filter pack porosity;
  - 8.5-inch borehole diameter.

- Surge, bail, and/or pump until pH, temperature, and conductivity are stable, turbidity is less than 50 NTUs, and a minimum of five well volumes plus two times the volume of water added to the well during drilling is removed. If these conditions are not achieved within a four-hour period, development will continue for another two hours. If the well is purged dry during development, development will cease and the well will be allowed to recharge. If recharge is slow, USACE will be notified and a modification of development procedures will be discussed.
- The development record will include the following:
  - Physical characteristics of the development water (i.e., pH, temperature, conductivity, turbidity) recorded at 30-minute intervals for the first two hours, and every hour thereafter;
  - Total quantity of water removed;
  - Static water level before and after development;
  - A 35-mm color slide of the final development water in a clear glass jar; and
  - Management of development water as described in Section 4.12 of this report.

Well development data will be recorded in the well development record section of the site geotechnical logbook (see Figure 4-3).

4.9 Groundwater Sampling at Permanent Monitoring Wells

Groundwater samples will be collected from the newly installed permanent monitoring wells. All samples from permanent wells will be sent to an off-site laboratory. In addition to laboratory analyses, field measurements will be taken at the wells. Procedures for groundwater sampling and field measurements are described below.

Equipment and Supplies

- Water level indicator;
- Dedicated submersible bladder pump and tubing;
- pH, conductivity, and temperature probe (YSI Model 600 XL or equivalent) and display instrumentation (YSI Model 610-D) and associated calibration solutions (pH buffers 4 and 7) and flow-through cell;
- Precleaned glass containers (see Table 4-2), equipped with teflon-lined lids or septae and certified "clean" per OSWER Directive 9240.9-05;
- Sample preservation solutions (see Table 4-2); and
- Cooler with ice.

Groundwater Sample Collection Procedure - Permanent Monitoring Wells

- Measure depth to water table and total depth of well with a water level indicator;
- Purge a minimum of five well volumes (see well development procedures for calculating well volume) or to dryness, prior to sample collection. Purging will be performed with a dedicated bladder pump;
- Record pH, temperature, conductivity, and turbidity, initially and after each well volume. If the purge water is turbid after five well volumes, purge a maximum of another two well volumes. If the purge water is still turbid upon completion of well purging, allow particles in the well casing to settle a minimum of 1 hour, but no longer than 24 hours prior to sample collection. Another set of pH, temperature, conductivity, and turbidity readings of the sample will be recorded upon sample collection.

- Collect groundwater sample following well purging (or sufficient recharge if purged dry). The VOC portion of the sample will be collected first, followed by SVOCs, then the remaining portions (if both parameters are required). Pumping will be performed at a very slow rate to minimize volatilization and turbidity;

- Properly preserve the sample as indicated in Table 4-2; and

- Immediately place sample in a cooler with ice, cool, and maintain sample temperature at 4°C.

Field Measurement Procedure

pH, conductivity, and temperature will be measured using a single unit, the YSI Model 600XL probe with YSI Model 610-D display instrumentation or equivalent. The 600XL probe contains separate pH, conductivity, and temperature probes in one unit.

Before use, the pH probe needs to be calibrated. This is done by placing the probe in pH 4, then pH 7 standard solutions, and adjusting the pH calibration knobs until the correct measurement is obtained. The probe should be rinsed with clean water between each calibration solution. Used calibration solution should be discarded.

After calibration, the probe is fitted into the flow-through cell provided with the instrument, using the included mounting hardware. The line from the in-well bladder pump is attached to one of the barbed hose fittings on the flow-through cell. A drainline is attached to the other fitting, with the effluent directed to a bucket. The bladder pump is then started. The maximum flow rate is about 0.5 gallon per minute. If the flow from the bladder pump cannot be adjusted to a flow this low, then some of the pumped water should be diverted via a tee fitting prior to introducing the water to the flow-through cell. Diverted groundwater will be directed to the effluent bucket. The pH readings will be recorded at a minimum of once every 5 minutes until the readings stabilize. If readings do not stabilize within 1 hour, the USACE site representative will be consulted. All measurements will be recorded in the field log books and supplied to the FTL for inclusion in the STS database. Thoroughly rinse the probe and flow-through chamber with clean water after use.

4.10 Sample Labeling, Packaging, and Custody

4.10.1 Sample Labeling

All samples will be assigned a unique sample identifier according to IRPIMS format requirements. The STS will be used to generate a label for each sample container that will contain the sample identifier, date of sample collection, the sampler's initials, analytical parameters, and type of preservation used. Any change in the label information prepared prior to the sample collection will be initialed by the sampler.

4.10.2 Sample Packaging

Preservation reagents will be added to sample containers prior to the collection or immediately after collection of the sample, as indicated on Table 4-2. The samples will be placed on ice immediately following collection and preservation and then maintained at 4°C during transport to the laboratory.

Sample containers will be placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. They will be placed in coolers supplied by E & E's ASC in such a manner as to eliminate the chance of breakage during shipment. Ice in plastic bags will be placed in the coolers to keep the samples at 4°C throughout shipment.

Sample shipment will be performed in strict accordance with all applicable United States Department of Transportation (DOT) regulations. The samples will be shipped to the ASC and MRD (split samples only) laboratories by an overnight courier service. Arrangements will be made with both the E & E and MRD laboratories' points-of-contact for samples that are to be delivered to a laboratory on a weekend so that holding times are not compromised.

4.10.3 Sample Custody

A sample is considered to be in custody under the following situations:

- The sample is directly in your possession;
- The sample is clearly in your view;
- The sample is placed in a locked location; or
- The sample is in a designated secure area.

In order to demonstrate that the samples and coolers have not been tampered with during shipment, adhesive custody seals will be used. The custody seals will be placed around the cap of each sample container and across the cooler lids in such a manner that they will be visibly disturbed upon opening of the sample container or cooler. The seals will be initialed and dated by field personnel when affixed to the container and cooler.

Documentation of the COC of the samples is necessary to demonstrate that the integrity of the samples has not been compromised between collection and delivery to the laboratory.

Each sample cooler will be accompanied by a COC record to document the transfer of custody from the field to the laboratory. All information requested in the COC record will be completed. In addition, the airbill number assigned by the overnight courier will be listed on the COC record. One copy of the COC form will be retained by the samplers and will be placed in the project records file. The remaining pages will be sealed in a plastic bag and placed inside of the cooler. Upon receipt at the laboratory, the COC forms will be completed. It is the responsibility of E & E's ASC to document the condition of custody seals and sample integrity upon receipt.

4.11 Equipment Decontamination

Decontamination of excavation, drilling, and subsurface sampling equipment will be performed prior to and after each excavation and boring location. The drilling subcontractor will construct a decontamination pad, which will include a high-pressure steam cleaner and a wastewater collection system. Specific attention will be given to the drilling assembly and augers. Drilling decontamination will consist of:

- High-pressure steam cleaning;
- Scrubbing with brushes if soil remains on equipment; and
- Steam rinsing.

Decontamination will be completed for split spoons between discreet sampling intervals as described below. Where no visible or field-measured evidence for contamination exists (e.g., an OVA reading), split spoons will be cleaned after each sample by the following method:

- Removing loose dirt;
- Scrubbing with brushes and Alconox;
- Rinsing with tap water (10% nitric acid when sampling for metals); and
- Double rinsing with deionized water.

If extensive contamination is evident at a boring location, the split spoons will also be cleaned and rinsed with high-pressure steam.

If there are no signs of contamination at a particular boring location, the decontamination water and sediments generated during drilling decontamination will be disposed of adjacent to the decontamination pad. However, all nitric acid rinse water will be segregated and containerized for future testing. If contamination is suspected, the decontamination water will be placed in 55-gallon drums and labeled accordingly.

4.12 Disposal of Investigation-Derived Waste (IDW)

Drill cuttings from boreholes will be disposed of in accordance with New York State Technical and Administrative Guidance Memorandum (TAGM) HWR-89-4032 issued by NYSDEC on November 21, 1989. A registry of all drums, a description of their sources and contents, and documentation of the analytical results from tests on the containerized solids will be provided to the client.

Investigation-derived soils and water will be field screened by visual inspection and the use of an OVA to determine initially whether these wastes are contaminated. Drill cuttings that are not contaminated (based on field screening) will be backfilled in the borehole. If potentially contaminated soils are identified by field screening, these soils will be containerized in DOT-approved 55-gallon drums.

Uncontaminated groundwater (based on field screening) will be disposed of adjacent to the boring or at a location approved by USACE. If potentially contaminated groundwater is identified by field screening, this water will be containerized in DOT-approved 55-gallon drums.

All drummed cuttings and water will be stored in a secure area on site until analytical results for the respective AOI are received. Drums from sites that are later determined to be clean will be disposed of on site by E & E at locations designated by Griffiss AFB and USACE. As a further safeguard, cuttings disposed of on site in bulk will be monitored for volatile emissions and fugitive dust emissions upon initial disposal. If any action level determined by the HASP is exceeded, corrective action such as interim cover or containerization will be implemented promptly. The HASP is presented in Appendix B. Based on analytical results, soil contained in drums from sites that E & E determines are contaminated will be characterized by toxicity characteristic leaching procedure (TCLP), corrosivity, ignitability, and reactivity analyses to determine the suitability of subsequent disposal methods. Groundwater contained in drums will potentially be analyzed for TCL VOCs, TCL BNAs, PCBs, pest/PCBs, TRPH, and TAL metals (see Table 4-1). If necessary, disposal of contaminated materials will be performed by the contractor under a contract modification.

4.13 Site Survey

A ground survey will be performed by a subcontractor to E & E to obtain horizontal locations of all geophysical survey grids, borings, and other sample locations and horizontal and vertical locations of all permanent monitoring wells and samples associated with surface water. The ground survey will utilize existing benchmarks located on Griffiss AFB. Horizontal measurements will be performed to an accuracy of 0.001 foot and vertical measurements to 0.01 foot. Survey results will be plotted on appropriate existing base maps and will be presented in the ESI Report.

Figure 4-1
DRILLING WATER SOURCE AND INVESTIGATION DERIVED WASTE (IDW) SAMPLE LISTING

Page 1 of 1

8/5/97

Griffiss AFB

										ANALYSES																								
EB Study Area-AOI #-	Phases	Sample Number	Samp. Date	Lab	Matrix	Depth	WP	Stat	Type	%Solids	Ag6010	Corrosi	Explosi	Hg7471	Ignitab	Metals	OrgCarb	PAHs	Pb+Cu	Pb6010	Pb7421	PCBs	Pest	PestPCB	Phosph	React-1	React-2	Sb6010	TALMet	TCLBNA	TCLVOC	TOC	TOX	TRPH
Basewide IDW	Group 3-ESI	GESI-DW01		ASC	Drill Water	0 -0	Y	O	N1																			X	X	X	X			
	Group 3-ESI	GIDW-DR01S		ASC	Soil	0 -0	Y	O	N1			X			X											X	X							
	Group 3-ESI	GIDW-DR01W		ASC	Groundwater	0 -0	Y	O	N1															X				X	X	X	X			X

Note: Depth is measured in feet.

Key:

AOI = Area of Interest
ASC = Analytical Services Center
EB Study Area = Environmental Baseline Study Area
EB1, EB2 = equipment rinsate
ESI = expanded site investigation
/D = duplicate sample
Eqpt = equipment
FD1 = field duplicate
FR1 = field replicate/split
GW = groundwater

GW-F = filtered groundwater
N1 = original
MRD = Missouri River Division laboratory
MS1 = matrix spike/matrix spike duplicate
RB = rinsate blank
Stat = split sample
/S = status (O = open; S = skipped; T = taken)
TB, TB1, TB2 = trip blank
WP = sample in the work plan (Y= yes; N= no)

ANALYSES:

Ag 6010 = silver by 6010
BNA = base neutrals/acid extractables
Corrosi = corrosivity
Explosi = explosivity
Hg 7471 = mercury by 7471
Ignitab = ignitability
Metals = short list of metals
OrgCarb = % organic carbon
Pb 7421, 6010 = lead by 7421 or 6010
PAHs = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl

Pb + Cu = lead and copper
Pest = pesticide
Phosph = phosphorus
React 1 = cyanide
React 2 = sulfide
TAL Met = target analyte list metals
TCL = target compound list
VOC = volatile organic compound
TOC = total organic carbon
TOX = total organic halogens
TRPH = total recoverable petroleum hydrocarbons

Table 4-2

SUMMARY OF SAMPLE CONTAINERS, AMOUNTS, PRESERVATION, AND HOLDING TIMES GRIFFISS AIR FORCE BASE

Method	Parameter	Sample Container[a,b,c]	Amount	Preservation	Holding Time	
					Extraction	Analysis
Water Samples						
SW 8240	Volatile organics	Three 40-mL glass VOA vials with teflon septae	Full; no headspace	HCl to pH < 2 Cool to 4°C	—	10 days
SW 8270	BNAs	Two 1-L amber glass bottles	Full	Cool to 4°C	5 days	40 days
SW 8080[d]	Pesticides/PCBs	Two 1-L amber glass bottles	Full	Cool to 4°C	5 days	40 days
SW 9060	Total Recoverable Petroleum Hydrocarbons	Two 1-L amber glass bottles	Full	Cool to 4°C HCl to pH <2	—	28 days
SW 6010	Total and Dissolved TAL Metals	One 1-L polyethylene bottle (total) One 1-L polyethylene bottle (dissolved)	Full Full	HNO_3 to pH < 2 (total) Cool to 4°C Filter w/0.45 μ (dissolved) $HN0_3$ to pH<2 Cool to 4°C	NA	6 months Mercury 26 days
Soils						
SW 8240	Volatile organics	Two 40 mL glass VOA vials with teflon septa	Full; no headspace	Cool to 4°C	NA	7 days
SW 8270	BNAs	One 8-oz. wide-mouth glass jar	Full	Cool to 4°C	5 days	40 days
SW 8080[d]	Pesticides/PCBs	One 8-oz. wide-mouth glass jar	Full	Cool to 4°C	5 days	40 days

Key at end of table.

Table 4-2

SUMMARY OF SAMPLE CONTAINERS, AMOUNTS, PRESERVATION, AND HOLDING TIMES GRIFFISS AIR FORCE BASE

Method	Parameter	Sample Container[a,b,c]	Amount	Preservation	Holding Time	
					Extraction	Analysis
EPA 160.3	% solids	One 8-oz. wide-mouth glass jar	Full	Cool to 4°C	—	—
SW 9060	Total Recoverable Petroleum Hydrocarbons	One 8-oz. wide-mouth glass jar	Full	Cool to 4°C	28 days	40 days
SW 6010[d]	Total TAL metals	One 8-oz. wide-mouth glass jar	Full	Cool to 4°C	NA	6 months; Mercury: 26 days
Lloyd Khan	Total Organic Carbon (TOC)	One 8-oz. wide-mouth glass jar	5g	Cool to 4°C	NA	NA

Note: Soil samples being analyzed for BNAs pesticides/PCBs, TAL metals, % solids, and total recoverable petroleum hydrocarbons require only one full 8-oz. jar for all parameters. If a sample is being analyzed for only one test, use the sample containers listed in the table.

[a] All containers to have teflon-lined lids; VOA containers to have teflon-lined septa.

[b] Samples chosen for quality assurance analysis require double the number of containers indicated.

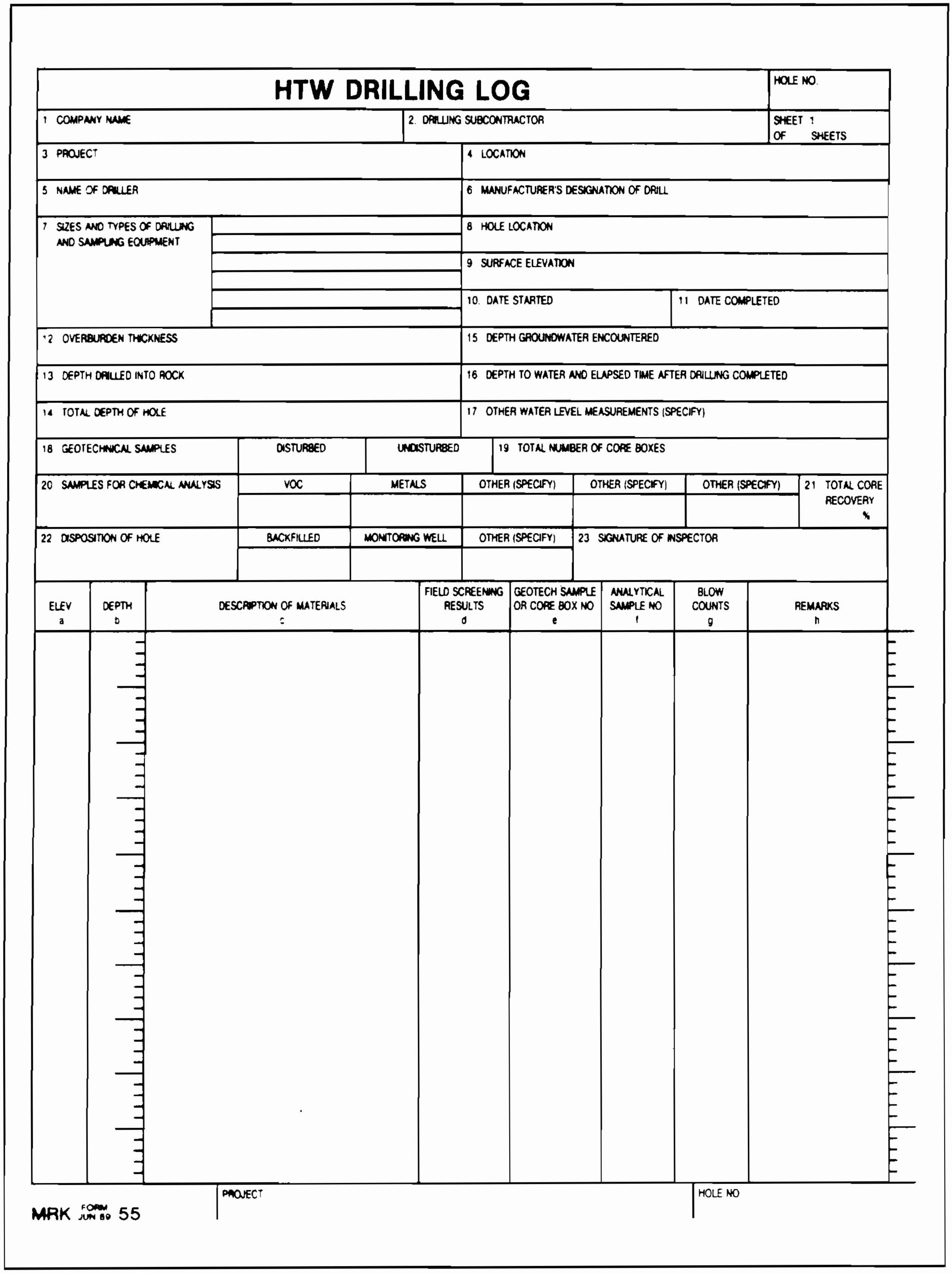
[c] Sample chosen for matrix spike/matrix spike duplicate requires four 1-L amber glass bottles.

[d] Field-screening methods.

Key:

BNA = Base-neutral-acid extractables.
g = Gram.
HCl = Hydrochloric acid.
HNO_3 = Nitric acid.
L = Liter.
NA = Not applicable.
PAHs = Polynuclear aromatic hydrocarbons.
PCBs = Polychlorinated biphenyls.
SW = United States Environmental Protection Agency, "Test Methods for Evaluating Solid Wastes," SW-846, Third Edition, 1986.
TAL = Target Analyte List.
TOC = Total organic carbon.
VOA = Volatile organic analysis.

02: KH4901\KH4_41.CDR



HTW DRILLING LOG		HOLE NO.
1 COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET 1 OF SHEETS

3 PROJECT	4 LOCATION
5 NAME OF DRILLER	6 MANUFACTURER'S DESIGNATION OF DRILL
7 SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8 HOLE LOCATION 9 SURFACE ELEVATION 10. DATE STARTED 11 DATE COMPLETED
12 OVERBURDEN THICKNESS	15 DEPTH GROUNDWATER ENCOUNTERED
13 DEPTH DRILLED INTO ROCK	16 DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14 TOTAL DEPTH OF HOLE	17 OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18 GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19 TOTAL NUMBER OF CORE BOXES			
20 SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21 TOTAL CORE RECOVERY %
22 DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23 SIGNATURE OF INSPECTOR		

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h

MRK FORM JUN 89 55	PROJECT	HOLE NO

Figure 4-1 HAZARDOUS AND TOXIC WASTE (HTW) DRILL LOG FORM

02: KH4901\KH4_42.CDR

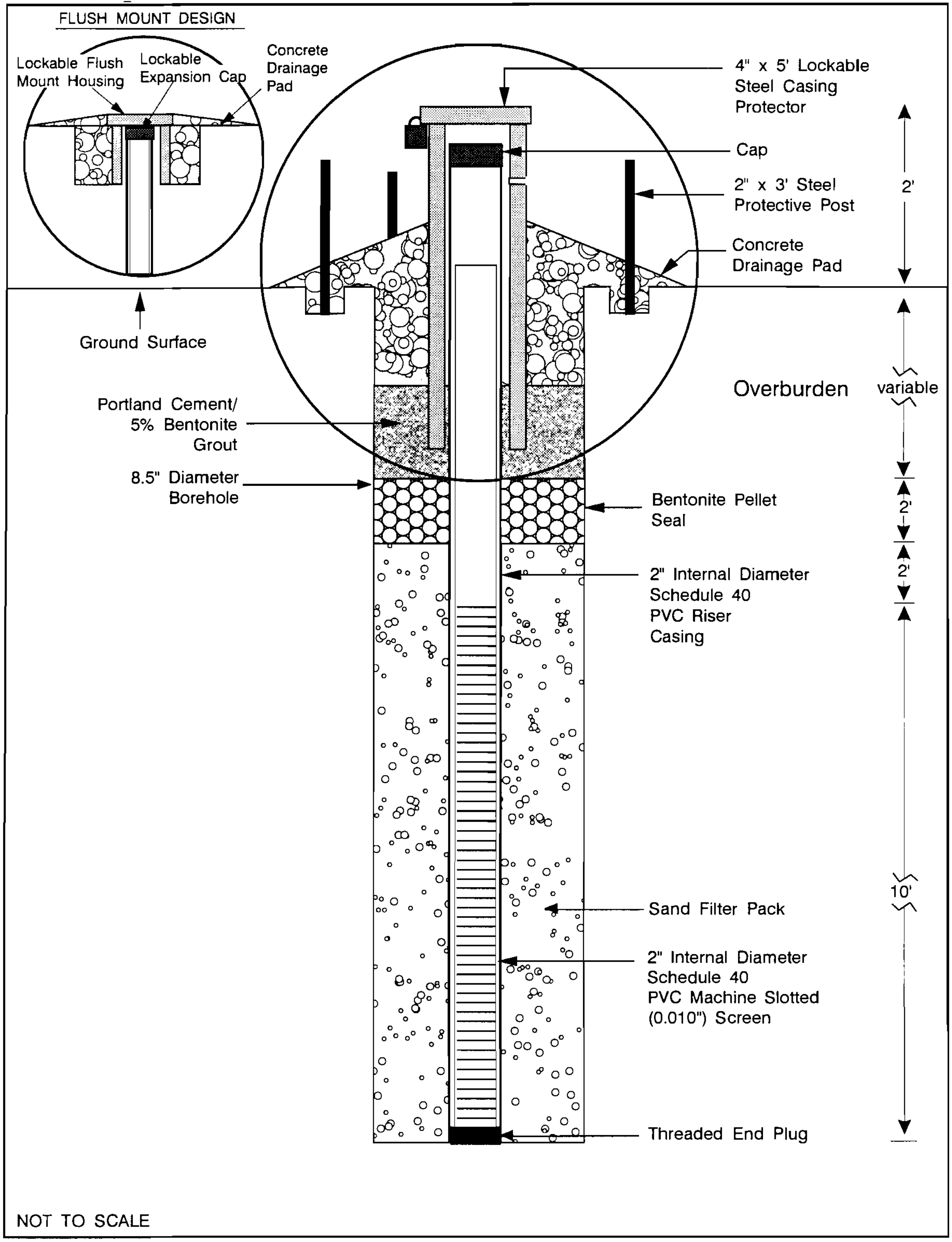


Figure 4-2 **PROPOSED CONSTRUCTION FOR STANDARD PERMANENT MONITORING WELLS**

WELL DEVELOPMENT RECORD

SITE ____________________ DATE ____________

LOCATION ____________________ WELL NO. ____________

____

MEASUREMENT OF WATER LEVEL AND WELL VOLUME

- Prior to sampling, the static water level and total depth of the well will be measured with a calibrated weighted line. Care will be taken to decontaminate equipment between each use to avoid cross contamination of wells.

- The number of linear feet of static water (difference between static water level and total depth of well) will be calculated.

- The static volume will be calculated using the formula:

$$V = Tr^2(0.163)$$

Where:
V = Static volume of well in gallons;
T = Depth of water in the well, measured in feet;
r = Inside radius of well casing in inches;
and 0.163 = A constant conversion factor which compensates for r^2h factor for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and (pi).
1 well volume (v) = _____ gallons.

Volume of Water in Casing or Hole

Diameter of Casing or Hole (in)	Gallons per Foot of Depth	Cubic Feet per Foot of Depth	Liter per Meter of Depth	Cubic Meters per Meter of Depth
1	0.041	0.0055	0.509	0.509 x10^{-3}
11/2	0.092	0.0123	1.142	1.142 x10^{-3}
2	0.163	0.0218	2.024	2.024 x10^{-3}
21/2	0.255	0.0341	3.167	3.167 x10^{-3}
3	0.367	0.0491	4.558	4.558 x10^{-3}
31/2	0.500	0.0668	6.209	6.209 x10^{-3}
4	0.653	0.0873	8.110	8.110 x10^{-3}
41/2	0.826	0.1104	10.260	10.260 x10^{-3}
5	1.020	0.1364	12.670	12.670 x10^{-3}
51/2	1.234	0.1650	15.330	15.330 x10^{-3}
6	1.469	0.1963	18.240	18.240 x10^{-3}
7	2.000	0.2673	24.840	24.840 x10^{-3}
8	2.611	0.3491	32.430	32.430 x10^{-3}
9	3.305	0.4418	41.040	41.040 x10^{-3}
10	4.080	0.5454	50.670	50.670 x10^{-3}
11	4.937	0.6600	81.310	61.310 x10^{-3}
12	5.875	0.7854	72.960	72.960 x10^{-3}
14	8.000	1.0690	99.350	99.350 x10^{-3}
16	10.440	1.3960	129.650	129.650 x10^{-3}
18	13.220	1.7670	164.180	164.180 x10^{-3}
20	16.320	2.1820	202.680	202.680 x10^{-3}
22	19.750	2.6400	245.280	245.280 x10^{-3}
24	23.500	3.1420	291.850	291.850 x10^{-3}
26	27.580	3.6870	342.520	342.520 x10^{-3}
28	32.000	4.2760	397.410	397.410 x10^{-3}
30	36.720	4.9090	456.020	456.020 x10^{-3}
32	41.780	5.5850	518.870	518.870 x 10^{-3}
34	47.160	6.3050	585.680	585.680 x10^{-3}
36	52.880	7.0690	656.720	856.720 x10^{-3}

1 Gallon = 3.785 liters
1 Meter = 3.281 feet
1 Gallon water weighs 8.33 lbs. = 37.785 kilograms
1 Liter water weighs 1 kilogram = 2.205 pounds
1 Gallon per foot of depth = 12.419 liters per foot of depth
1 Gallon per meter of depth = 12.419 x 10^{-3} cubic meters per meter of depth

INITIAL DEVELOPMENT WATER

WATER LEVEL (TOIC) ____________________
WELL DEPTH (TD) ____________________
COLOR ____________________
ODOR ____________________
CLARITY ____________________

FINAL DEVELOPMENT WATER

WATER LEVEL (TOIC) ____________________
WELL DEPTH (TD) ____________________
COLOR ____________________
ODOR ____________________
CLARITY ____________________

DESCRIPTION OF DEVELOPMENT TECHNIQUE ____________________

____

____

Figure 4-3 WELL DEVELOPMENT RECORD

WELL DEVELOPMENT - PARAMETER MEASUREMENTS

TIME	TOTAL VOL. WITHDRAWN		pH	COND. (umhos/cm)	TEMP. (C)	TURB. (NTU)	COMMENTS
	GALS.	BORE VOL.					

DEVELOPED BY: ______________________________ DATE ______________

Figure 4-3 WELL DEVELOPMENT RECORD (Cont.)

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A

Examples of Sample Tracking System (STS) Tables

8/1/95

Sample Container Requirements

Container Type	Analysis		Number of Containers Required	
Amber Glass 1 L	Eqpt. Washwater	[PEST]	1	
Amber Glass 1 L	Eqpt. Washwater	[TCL BNA]	13	
Amber Glass 1 L	Eqpt. Washwater	[TRPH]	10	
Amber Glass 1 L	Groundwater	[PEST]	1	
Amber Glass 1 L	Groundwater	[TCL BNA]	42	
Amber Glass 1 L	Groundwater	[TRPH]	26	
Amber Glass 1 L	Soil	[TRPH]	2	
Amber Glass 1 L	Surface Water	[TCL BNA]	7	
Amber Glass 1 L	Surface Water	[TRPH]	7	
Amber Glass 1 L	Water/QC Matrix	[TCL BNA]	2	
Amber Glass 1 L	Water/QC Matrix	[TRPH]	1	
*** TOTAL OF Amber Glass 1 L				**112**
Glass Septa Jar 2 oz.	Eqpt. Washwater	[MERCURY]	1	
Glass Septa Jar 2 oz.	Soil	[MERCURY]	6	
Glass Septa Jar 2 oz.	Soil/QC Matrix	[MERCURY]	1	
*** TOTAL OF Glass Septa Jar 2 oz.				**8**
HDPE Bottle 1 L	Eqpt. Washwater	[Lead]	1	
[illegible] Bottle 1 L	Eqpt. Washwater	[TAL Metals]	9	
[illegible] Bottle 1 L	Groundwater	[TAL Metals]	39	
HDPE Bottle 1 L	Soil/QC Matrix	[TAL Metals]	1	
HDPE Bottle 1 L	Surface Water	[TAL Metals]	7	
HDPE Bottle 1 L	Water/QC Matrix	[TAL Metals]	1	
*** TOTAL OF HDPE Bottle 1 L				**58**
Clear Glass Jar 4 oz.	Sediment	[TCL BNA]	7	
Clear Glass Jar 4 oz.	Soil	[TCL BNA]	92	
Clear Glass Jar 4 oz.	Soil/QC Matrix	[TCL BNA]	4	
*** TOTAL OF Clear Glass Jar 4 oz.				**103**
Clear Glass Jar 8 oz.	Eqpt. Washwater	[PCBs]	6	
Clear Glass Jar 8 oz.	Groundwater	[PCBs]	13	
Clear Glass Jar 8 oz.	Sediment	[Solids] [TRPH]	7	
Clear Glass Jar 8 oz.	Soil	[Lead] [Solids]	24	
Clear Glass Jar 8 oz.	Soil	[PCBs] [Solids]	5	
Clear Glass Jar 8 oz.	Soil	[PCBs] [Solids] [TRPH]	39	
Clear Glass Jar 8 oz.	Soil	[PEST] [Solids]	6	
Clear Glass Jar 8 oz.	Soil	[Solids]	31	
Clear Glass Jar 8 oz.	Soil	[Solids] [TRPH]	28	
C[illegible]lass Jar 8 oz.	Soil	[TRPH]	6	
[illegible] Glass Jar 8 oz.	Soil/QC Matrix	[Lead] [Solids]	1	
Clear Glass Jar 8 oz.	Soil/QC Matrix	[PCBs] [Solids] [TRPH]	1	
Clear Glass Jar 8 oz.	Soil/QC Matrix	[PCBs] [TRPH]	1	
Clear Glass Jar 8 oz.	Soil/QC Matrix	[PEST] [Solids]	1	

5/3/95

Sample Holding Times

Matrix	Test Name	Max Hold Times		Preservation Method
Eqpt. Washwater				
	PAH	7	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	PAH	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	PCB	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TAL Metals		days until extraction	2 Drops 1:1 HCl per VOA
			days until analysis	
	TCL BNA Non-CLP	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL BNAs Non-CLP	7	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL PESTICIDES		days until extraction	Cool to 4 Deg. Cent.
			days until analysis	
	TCL PESTICIDES	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TOT RECOVERABLE PETROL. HYDRO.		days until extraction	Cool to 4 Deg. Cent.
		28	days until analysis	
	TOT RECOVERABLE PETROL. HYDRO.	28	days until extraction	5 mL per L 1:1 H2SO4 to pH<2
			days until analysis	
	TOTAL SOLIDS		days until extraction	Cool to 4 Deg. Cent.
		7	days until analysis	
Sediment				
	PAH	7	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	PAH	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	PCB	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TAL Metals		days until extraction	2 Drops 1:1 HCl per VOA
			days until analysis	
	TCL BNA Non-CLP	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL BNAs Non-CLP	7	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL PESTICIDES		days until extraction	Cool to 4 Deg. Cent.
			days until analysis	
	TCL PESTICIDES	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	

5/3/95

Sample Holding Times

Matrix	Test Name	Max Hold Times		Preservation Method
Soil				
	TCL BNA Non-CLP	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL BNAs Non-CLP	7	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL PESTICIDES		days until extraction	Cool to 4 Deg. Cent.
			days until analysis	
	TCL PESTICIDES	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TOT RECOVERABLE PETROL. HYDRO.		days until extraction	Cool to 4 Deg. Cent.
		28	days until analysis	
	TOT RECOVERABLE PETROL. HYDRO.	28	days until extraction	5 mL per L 1:1 H2SO4 to pH<2
			days until analysis	
	TOTAL SOLIDS		days until extraction	Cool to 4 Deg. Cent.
		7	days until analysis	
Soil/QC Matrix				
	PAH	7	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	PAH	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	PCB	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TAL Metals		days until extraction	2 Drops 1:1 HCl per VOA
			days until analysis	
	TCL BNA Non-CLP	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL BNAs Non-CLP	7	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TCL PESTICIDES		days until extraction	Cool to 4 Deg. Cent.
			days until analysis	
	TCL PESTICIDES	14	days until extraction	Cool to 4 Deg. Cent.
		40	days until analysis	
	TOT RECOVERABLE PETROL. HYDRO.		days until extraction	Cool to 4 Deg. Cent.
		28	days until analysis	
	TOT RECOVERABLE PETROL. HYDRO.	28	days until extraction	5 mL per L 1:1 H2SO4 to pH<2
			days until analysis	
	TOTAL SOLIDS		days until extraction	Cool to 4 Deg. Cent.
		7	days until analysis	

Ecology & Environment, Inc.

Job: KB8000 Site: Griffiss AFB

Study Area 4-AOI-81 (WSA) -

Sample ID: G081-SS20 -Z2 LAB: ASC

Sample Date: ___/___/___ @ ___:___ Initials ______

Preservative
Cool 4 C

95042022571375

[TCL BNA]

Clear Glass Jar 4 oz.

Ecology & Environment, Inc.

Job: KB8000 Site: Griffiss AFB

Study Area 4-AOI-81 (WSA) -

Sample ID: G081-SS20 -Z2 LAB: ASC

Sample Date: ___/___/___ @ ___:___ Initials ______

Preservative
Cool 4 C

95042022571375

[Solids] [TRPH]

Clear Glass Jar 8 oz.

B Health and Safety Plan

Ecology and Environment, Inc., Amendment to:

Law Environmental Health and Safety Plan for Griffiss Air Force Base

Amended: August 1997

The Griffiss Air Force Base Draft Final Primary Report Remedial Investigation Planning Documents Volume IV Health and Safety Plan July 1993 is amended as follows:

Pg 1-1, Para 1.1 SCOPE OF HEALTH AND SAFETY PLAN The work plan must be modified to include the tasks to be performed by E & E. The site-specific Field Operations Plan (FOP) (volume III) will be utilized when site-specific information pertaining to health and safety is needed.

Pg 2-1, Para 2.2 CONTAMINANT CHARACTERIZATION An additional probable contaminant of concern is hydrogen sulfide.

Pg 2-8, Para 2.3 ON-SITE TASKS TO BE PERFORMED On-site tasks to be performed during this work period are 1) Geophysical survey, 2) Near-surface soil sampling, 3) Surface water/sediment sampling, 4) Soil borings, 5) Subsurface soil sampling, 6) Groundwater sampling, 7) Investigation derived waste (IDW) sampling (if needed), and 8) Decontamination. Tasks 1and 8 are nonintrusive. All other tasks will be considered intrusive activities.

Pg 3-11, Table 3-1 OSHA PEL for cadmium was reduced to 0.005 mg/m^3.

Pg 3-21, Para 3.6 ACTION LEVELS Action levels and monitoring equipment are identified in the modified HASP attached.

Pg 3-25, Para 3.6.2 ACTION LEVELS: OXYGEN Oxygen levels will be monitored during drilling continuously using a combination LEL/O_2. (An EXOTOX 40 will not be used).

Pg 4-1, Para 4.0 ACCIDENT PREVENTION E & E's safety meetings are held at least daily. This is noted in the HASP.

Pg 5-2, Para 5.2 SITE SAFETY OFFICER E & E's Site Safety Officer at Griffiss AFB projects will be identified in E & E's Site-Specific HASP.

Pg 5-2, Para 5.3 MEDICAL CONSULTANT E & E's medical consultant is Dr. Richard V. Lee, the Corporate Medical Director.

Pg 6-2, Para 6.1.3.1 CORPORATE HEALTH AND SAFETY OFFICER Dr. Paul Jonmaire is the Corporate Health and Safety Director at E & E.

Pg 6-3, Para 6.1.4 CPR/FIRST AID TRAINING REQUIREMENTS This is an annual requirement of all E & E field personnel.

Pg 8-1, Section 8.0 MEDICAL SURVEILLANCE E & E's policy of medical surveillance is attached and is found in the attached HASP.

Pg 9-1, Section 9.0 EXPOSURE MONITORING/AIR SAMPLING PROGRAM The equipment used during field operations is listed in the attached HASP.

Pg 15-2, Para 15.2 PERSONNEL ROLES AND LINES OF AUTHORITY Emergency telephone numbers for E & E personnel and the MedTox system are located in the attached HASP.

NOTE: The amendment will contain a modified version of Ecology and Environment, Inc., (E & E) Health and Safety Plan (HASP) attached to this document.

ecology and environment, inc.

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Project: Former Griffiss AFB

Project No.: KH-4000

TDD/PAN No.:

Project Location: Former Griffiss Air Force Base New York

Proposed Date of Field Activities: Fall 1997

Principal In Charge: Gerald A. Strobel, P.E.

Task Order Manager: Thomas Ferraro, P.G.

Original Prepared by: B. Wright

Date Prepared: 22 Apr 1995 (updated 2 Jul 96 and 29 Jul 97)

Approved by: T. Siener

Date Approved: August 7, 1997

1. INTRODUCTION

1.1 POLICY

It is E & E's policy to ensure the health and safety of its employees, the public, and the environment during the performance of work it conducts. This site-specific health and safety plan (SHASP) establishes the procedures and requirements to ensure the health and safety of E & E employees for the above-named project. E & E's overall safety and health program is described in *Corporate Health and Safety Program for Toxic and Hazardous Substances* (CHSP). After reading this plan, applicable E & E employees shall read and sign E & E's Site-Specific Health and Safety Plan Acceptance form.

This SHASP has been developed for the sole use of E & E employees and is not intended for use by firms not participating in E & E's training and health and safety programs. Subcontractors are responsible for developing and providing their own safety plans.

This SHASP has been prepared to meet the following applicable regulatory requirements and guidance:

Applicable Regulation/Guidance
29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER)
Other:

1.2 SCOPE OF WORK

Description of Work: On-site tasks associated with field investigations at the Griffiss AFB will vary with each site. Activities that may be conducted during field work include:

Non-Intrusive Activities	Intrusive Activities
Geophysical Surveys	Near-Surface Soil Sampling
	Surface Water/Sediment Sampling
Decontamination	Soil Borings
	Subsurface Soil Sampling
	Groundwater Sampling
	Investigation Derived Waste (IDW) Sampling

Equipment/Supplies: Attachment 1 contains a checklist of equipment and supplies that will be needed for this work.

The following is a description of each numbered task:

Task Number	Task Description
1	Geophysical Surveys
2	Near-Surface Soil Sampling
3	Surface Water/Sediment Sampling
4	Soil Borings
5	Subsurface Soil Sampling
6	Groundwater Sampling
7	IDW Sampling (optional)
8	DECON
9	

1.3 SITE DESCRIPTION

Site Map: A site map or sketch is attached at the end of this plan.

Site History/Description (see project work plan for detailed description):

Griffiss AFB has been closed under the Base Realignment and Closure (BRAC). During the Expanded Site Investigation program, E & E will be conducting both intrusive and non-intrusive tasks.

Is the site currently in operation? ☒ Yes ☐ No

Locations of Contaminants/Wastes: This HASP contains information pertinent to general conditions at Griffiss AFB. The Field Operations Plan (FOP's) (Volume III) from Law Environmental, Inc., contain site-specific information pertaining to health and safety procedures to be implemented at each Area of Concern (AOC).

Types and Characteristics of Contaminants/Wastes:

☒ Liquid
☐ Flammable/Ignitable
☐ Explosive
☐ Medical/Pathogenic

☒ Solid
☒ Volatile
☐ Reactive
Other:

☐ Sludge
☐ Corrosive
☐ Carcinogenic

☐ Gas/Vapor
☐ Acutely Toxic
☐ Radioactive

2. ORGANIZATION AND RESPONSIBILITIES

E & E team personnel shall have on-site responsibilities as described in E & E's standard operating procedure (SOP) for Site Inspection. The project team, which is planned at the time this HASP is issued, is identified below. Depending on availability, changes in personnel may be required when the field work commences.

Name	Site Role/Responsibility
Don Johnson	Project Geologist/Field Team Leader FTL
TBD	Site Safety Officer
Robert Meyers	Field Geologist
Richard Watt	Geophysicist
Gene Florentino	Geophysicist

3. TRAINING

Prior to work, E & E team personnel shall have received training as indicated below. As applicable, personnel shall have read the project work plan, sampling and analysis plan, and/or quality assurance project plan prior to project work.

Training	Required
40-Hour OSHA HAZWOPER Initial Training and Annual Refresher (29 CFR 1910.120)	X
Annual First Aid/CPR	X
Hazard Communication (29 CFR 1910.1200)	X
40-Hour Radiation Protection Procedures and Investigative Methods	

Training	Required
8-Hour General Radiation Health and Safety	
Radiation Refresher	
DOT and Biannual Refresher	
Other:	

4. MEDICAL SURVEILLANCE

4.1 MEDICAL SURVEILLANCE PROGRAM

E & E field personnel shall actively participate in E & E's medical surveillance program as described in the CHSP and shall have received, within the past year, an appropriate physical examination and health rating.

E & E's health and safety record (HSR) form will be maintained on site by each E & E employee for the duration of his or her work. E & E employees should inform the site safety officer (SSO) of any allergies, medical conditions, or similar situations that are relevant to the safe conduct of the work to which this SHASP applies.

4.2 RADIATION EXPOSURE

4.2.1 External Dosimetry

Thermolu inescent Dosimeter (TLD) Badges: TLD badges are required to be worn by all E & E field personnel on all sites where radiation is a potential concern.

Pocket Dosimeters:

Other:

4.2.2 Internal Dosimetry

☐ Whole body count ☐ Bioassay ☐ Other

Requirements:

4.2.3 Radiation Dose

Dose Limits: E & E's radiation dose limits are stated in the CHSP. Implementation of these dose limits may be designated on a site-specific basis.

Site-Specific Dose Limits:

ALARA Policy: Radiation doses to E & E personnel shall be maintained as low as reasonably achievable (ALARA), taking into account the work objective, state of technology available, economics of improvements in dose reduction with respect to overall health and safety, and other societal and socioeconomic considerations.

5. SITE CONTROL

5.1 SITE LAYOUT AND WORK ZONES

Site Work Zones: Refer to the maps (Figures 1-2 and 1-3) in the Field Sampling Plan for designated work areas.

Normally, the hazardous waste site will be divided into three zones: Zone 1 - Exclusion Zone; Zone 2 - Contamination Reduction Zone; and Zone 3 - Support Zone. These zones will be established on the basis of contamination potential, ranging from the highest levels of contamination in the exclusion zone to little or no contamination potential in the support zone. All zones will be defined and marked on the site map. Barricades and placards will be used when necessary to control access to all three zones.

The exclusion zone, the area of active site investigation (i.e., the area immediately surrounding each borehole), presents the highest risk of worker exposure. Personnel entering this zone will be required to wear the previously mandated level of protection. In some instances, more than one level of protection will be required within the same zone, depending on the tasks to be performed.

The contamination reduction zone will be a transition zone between the contaminated and clean zones. Decontamination of equipment and clothing will occur in this zone.

The support zone will be considered the noncontaminated or clean area. Support equipment will be located in this zone.

Site Access Requirements and Special Considerations:

Illumination Requirements:

TBD

Sanitary Facilities (e.g., toilet, potable water):

Available in Building 520.

On-Site Communications:

Hand-held radio and telephone (Building 520).

Other Site-Control Requirements:

Conformance with existing site security policies (Oneida County Sheriff Patrol).

5.2 SAFE WORK PRACTICES

Daily Safety Meeting: A daily safety meeting will be conducted for all E & E personnel and documented on the Daily Safety Meeting Record form or in the field logbook. The information and data obtained from applicable site characterization and analysis will be addressed in the safety meetings and also used to update this SHASP, as necessary.

Work Limitations: Work shall be limited to a maximum of 12 hours per day. If 12 consecutive days are worked, at least one day off shall be provided before work is resumed. Work will be conducted in daylight hours unless prior approval is obtained and the illumination requirements in 29 CFR 1910.120(m) are satisfied.

Weather Limitations: Work shall not be conducted during electrical storms. Work conducted in other inclement weather (e.g., rain, snow) will be approved by project management and the regional safety coordinator or designee.

Other Work Limitations:

Buddy System: Field work will be conducted in pairs of team members according to the buddy system.

Line of Sight: Each field team member shall remain in the line of sight and within verbal communication of at least one other team member.

Eating, Drinking, and Smoking: Eating, drinking, smoking, and the use of tobacco products shall be prohibited in the exclusion and contamination reduction areas, at a minimum, and shall only be permitted in designated areas.

Contamination Avoidance: Field personnel shall avoid unnecessary contamination of personnel, equipment, and materials to the extent practicable.

Sample Handling: Protective gloves of a type designated in Section 7 will be worn when containerized samples are handled for labeling, packaging, transportation, and other purposes.

Vermiculite Handling: Respiratory protection (i.e., high-efficiency particulate air filtration) is recommended if vermiculite is used to package samples into shipping containers (some vermiculite contains low concentrations of asbestos).

Other Safe Work Practices:

6. HAZARD EVALUATION AND CONTROL

6.1 PHYSICAL HAZARD EVALUATION AND CONTROL

Potential physical hazards and their applicable control measures are described in the following table for each task.

Hazard	Task Number	Hazard Control Measures
Biological (flora, fauna, etc.)	1,2,3,4,5,6,7,8	• Potential hazard: Poison Ivy/Oak; Ticks • Establish site-specific procedures for working around identified hazards. • Other:
Cold Stress	N/A	• Provide warm break area and adequate breaks. • Provide warm noncaffeinated beverages. • Promote cold stress awareness. • See *Cold Stress Prevention and Treatment* (attached at the end of this plan if cold stress is a potential hazard).
Compressed Gas Cylinders	2,3,4,5,6,7	• Use caution when moving or storing cylinders. • A cylinder is a projectile hazard if it is damaged or its neck is broken. • Store cylinders upright and secure them by chains or other means. • Other:
Confined Space	N/A	• Ensure compliance with 29 CFR 1910.146. • See SOP for Confined Space Entry. Additional documentation is required. • Other:
Drilling	4,5	• See SOP for Health and Safety on Drilling Rig Operations. Additional documentation may be required. • Other: • Other:
Drums and Containers	4,5,6,7,8	• Ensure compliance with 29 CFR 1910.120(j). • Consider unlabeled drums or containers to contain hazardous substances and handle accordingly until the contents are identified. • Inspect drums or containers and assure integrity prior to handling. • Move drums or containers only as necessary; use caution and warn nearby personnel of potential hazards.

Hazard	Task Number	Hazard Control Measures
		• Open, sample, and/or move drums or containers in accordance with established procedures; use approved drum/container-handling equipment. • Other:
Electrical	4,5	• Ensure compliance with 29 CFR 1910 Subparts J and S. • Locate and mark energized lines. • De-energize lines as necessary. • Ground all electrical circuits. • Guard or isolate temporary wiring to prevent accidental contact. • Evaluate potential areas of high moisture or standing water and define special electrical needs. • Other:
Excavation and Trenching	N/A	• Ensure that excavations comply with and personnel are informed of the requirements of 29 CFR 1926 Subpart P. • Ensure that any required sloping or shoring systems are approved as per 29 CFR 1926 Subpart P. • Identify special personal protective equipment (PPE) (see Section 7) and monitoring (see Section 8) needs if personnel are required to enter approved excavated areas or trenches. • Maintain line of sight between equipment operators and personnel in excavations/trenches. Such personnel are prohibited from working in close proximity to operating machinery. • Suspend or shut down operations at signs of cave in, excessive water, defective shoring, changing weather, or unacceptable monitoring results. • Other: • Other:
Fire and Explosion	4,5	• Inform personnel of the location(s) of potential fire/explosion hazards. • Establish site-specific procedures for working around flammables. • Ensure that appropriate fire suppression equipment and systems are available and in good working order. • Define requirements for intrinsically safe equipment. • Identify special monitoring needs (see Section 8). • Remove ignition sources from flammable atmospheres. • Coordinate with local fire-fighting groups regarding potential fire/explosion situations. • Establish contingency plans and review daily with team members. • Other:
Heat Stress	1,2,3,4,5,6,7,8	• Provide cool break area and adequate breaks. • Provide cool noncaffeinated beverages. • Promote heat stress awareness. • Use active cooling devices (e.g., cooling vests) where specified. • See *Heat Stress Prevention and Treatment* (attached at the end of this plan if heat stress is a potential hazard).
Heavy Equipment Operation	4,5	• Define equipment routes, traffic patterns, and site-specific safety measures. • Ensure that operators are properly trained and equipment has been properly inspected and maintained. Verify back-up alarms. • Ensure that ground spotters are assigned and informed of proper hand signals and communication protocols. • Identify special PPE (Section 7) and monitoring (Section 8) needs.

Hazard	Task Number	Hazard Control Measures
		• Ensure that field personnel do not work in close proximity to operating equipment. • Ensure that lifting capacities, load limits, etc., are not exceeded.
		• Other:
Heights (Scaffolding, Ladders, etc.)	N/A	• Ensure compliance with applicable subparts of 29 CFR 1910. • Identify special PPE needs (e.g., lanyards, safety nets, etc.) • Other:
Noise	2,4,5	• Establish noise level standards for on-site equipment/operations. • Inform personnel of hearing protection requirements (Section 7). • Define site-specific requirements for noise monitoring (Section 8). • Other:
Overhead Obstructions	2,4,5	• Wear hard hat. • Other:
Power Tools	4,5	• Ensure compliance with 29 CFR 1910 Subpart P. • Other:
Sunburn	1,2,3,4,5,6,7,8	• Apply sunscreen. • Wear hats/caps and long sleeves. • Other:
Utility Lines	4,5	• Identify/locate existing utilities prior to work. • Ensure that overhead, underground, and nearby utility lines are at least 25 feet away from project activities. • Contact utilities to confirm locations, as necessary. • Other:
Weather Extremes	1,2,3,4,5,6,7,8	• Potential hazards: • Establish site-specific contingencies for severe weather situations. • Provide for frequent weather broadcasts. • Weatherize safety gear, as necessary (e.g., ensure eye wash units cannot freeze, etc.). • Identify special PPE (Section 7) needs. • Discontinue work during severe weather. • Other:
Other:		• •
Other:		• •

N/A - Not applicable
* To be determined during daily health and safety meetings based on site conditions.

6.2 CHEMICAL HAZARD EVALUATION AND CONTROL

6.2.1 Chemical Hazard Evaluation

Potential chemical hazards are described by task number in Table 6-1. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Table 6-1

POTENTIAL CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
4,5	H_2S (hydrogen sulfide)	10 ppm; 15 ppm (Ceil.)	10 ppm (Ceil.)	10 ppm; 15 ppm (Ceil)		Inhal, Ing, Contact	Apnea, Eye Irritation, Irrit. Resp, System, Dizzy, HA, Irritability	Rotten Eggs		10.46 eV
See attachment B-A for other potential chemical hazards of concern.										

6.2.2 Chemical Hazard Control

An appropriate combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below published exposure levels (see Section 6.2.1).

Applicable Engineering/Administrative Control Measures:

PPE: See Section 7.

6.3 RADIOLOGICAL HAZARD EVALUATION AND CONTROL

6.3.1 Radiological Hazard Evaluation

Potential radiological hazards are described below by task number. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Task Number	Radionuclide	DAC (μCi/ml)	Route(s) of Exposure	Major Radiation(s)	Energy(s) (MeV)	Half-Life
4,5 (AOI 17)	Unknown	Unknown	Dermal	Unknown	Unknown	Unknown

6.3.2 Radiological Hazard Control

Engineering/administrative controls and work practices shall be instituted to reduce and maintain employee exposures to a level at or below the permissible exposure/dose limits (see Sections 4.2.3 and 6.3.1). Whenever engineering/administrative controls and work practices are not feasible or effective, any reasonable combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below permissible exposure/dose limits.

Applicable Engineering/Administrative Control Measures:

PPE: See Section 7.

7. LEVEL OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

7.1 LEVEL OF PROTECTION

The following levels of protection (LOPs) have been selected for each work task based on an evaluation of the potential or known hazards, the routes of potential hazard, and the performance specifications of the PPE. On-site monitoring results and other information obtained from on-site activities will be used to modify these LOPs and the PPE, as necessary, to ensure sufficient personnel protection. The authorized LOP and PPE shall only be changed with the approval of the regional safety coordinator or designee. Level A is not included below because Level A activities, which are performed infrequently, will require special planning and addenda to this SHASP.

Task Number	B	C	D	Modifications Allowed
1			X	No hard hat/safety glasses, Tyvek optional
3,4,5,6,8			X	Splash protection
7		(X)		No respirator required if OVA readings do not exceed background in breathing zone

Note: Use "X" for initial levels of protection. Use "(X)" to indicate levels of protection that may be used as site conditions warrant.

7.2 PERSONAL PROTECTIVE EQUIPMENT

The PPE selected for each task is indicated below. E & E's PPE program complies with 29 CFR 1910.120 and 29 CFR 1910 Subpart I and is described in detail in the CHSP. Refer to 29 CFR 1910 for the minimum PPE required for each LOP.

	Task Number/LOP								
PPE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Full-face APR Ultra Twin		(X)	(X)	(X)	(X)	(X)	(X)	(X)	
PAPR									
Cartridges:									
H									
GMC-H		(X)	(X)	(X)	(X)	(X)	(X)	(X)	
GMA-H									
Other:									
Positive-pressure, full-face SCBA									
Spare air tanks (Grade D air)									
Positive-pressure, full-face, supplied-air system									
Cascade system (Grade D air)									
Manifold system									
5-Minute escape mask									
Safety glasses		X	X	X	X	X	X	X	
Monogoggles									
Coveralls	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	

PPE	Task Number/LOP								
	1	2	3	4	5	6	7	8	9
Protective clothing:									
Tyvek		(X)	(X)	(X)	(X)	X	X	X	
Saranex						(X)	(X)	(X)	
Other:									
Splash apron									
Inner gloves:									
Cotton									
Nitrile		(X)	(X)	(X)	(X)	(X)	(X)	(X)	
Latex									
Other:									
Outer gloves:									
Viton									
Rubber									
Neoprene			X	(X)	(X)	X	X	X	
Nitrile									
Other:									
Work gloves	(X)								
Safety boots	X	X	X	X	X	X	X	X	
Neoprene safety boots (as per ANSI Z41)									
Boot covers (type: Disposable booties)			(X)	(X)	(X)	(X)	X	X	
Hearing protection (type:)			(X)	(X)					
Hard hat		(X)		X	X				
Face shield									
Other:									
Other:									

8. HEALTH AND SAFETY MONITORING

Health and safety monitoring will be conducted to ensure proper selection of engineering/administrative controls, work practices, and/or PPE so that employees are not exposed to hazardous substances at levels that exceed permissible exposure/dose limits or published exposure levels. Health and safety monitoring will be conducted using the instruments, frequency, and action levels described in Table 8-1. Health and safety monitoring instruments shall have been appropriately calibrated and/or performance-checked prior to use.

Table 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[a]	
☐ PID (e.g., HNu IS-101) ☒ FID (e.g., OVA 128-GC)	2,3,4,5,6,7	Volatile Organic Vapors	See Pertinent AOIs	Continuously During drilling as need for other tasks	**Unknown Vapors** Background to 1 ppm: Level D 1 to 5 ppm above background: Level C 5 to 500 ppm above background: Level B >500 ppm above background: Level A	**Contaminant-Specific**
Oxygen Meter/Explosimeter	4,5	Explosive atmospheres	See Pertinent AOIs	Continuously during drilling	**Oxygen** <19.5% or >25.0%: Evacuate area; eliminate ignition sources; reassess conditions. 19.5 to 25.0%: Continue work in accordance with action levels for other instruments.	**Explosivity** $\leq$10% LEL: Continue work in accordance with action levels for other instruments; monitor continuously for combustible atmospheres. >10% LEL: Evacuate area; eliminate ignition sources; reassess conditions.
Radiation Alert Monitor (Rad-mini or RAM-4)	1,4,5	Radiation	See Pertinent AOIs	Continuously	<0.1 mR/hr: Continue work in accordance with action levels for other instruments. $\geq$0.1 mR/hr: Evacuate area; reassess work plan and contact radiation safety specialist.	
Mini-Ram Particulate Monitor	N/A		See Pertinent AOIs		**General/Unknown** Evaluate health and safety measures when dust levels exceed 2.5 milligrams per cubic meter.	**Contaminant-Specific**
H_2S	4,5	H_2S	See Pertinent AOIs	Continuously	$\geq$4 ppm: Leave area and consult with SSO.	

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[a] Unless stated otherwise, airborne contaminant concentrations are measured as a time-weighted average in the worker's breathing zone. Acceptable concentrations for known airborne contaminants will be determined based on OSHA/NIOSH/ACGIH and/or NRC exposure limits.

9. DECONTAMINATION PROCEDURES

All equipment, materials, and personnel will be evaluated for contamination upon leaving the exclusion area. Equipment and materials will be decontaminated and/or disposed and personnel will be decontaminated, as necessary. Decontamination will be performed in the contamination reduction area or any designated area such that the exposure of uncontaminated employees, equipment, and materials will be minimized. Specific procedures are described below.

Equipment/Material Decontamination Procedures (specified by work plan): One or a combination of the following—High-pressure steam, alconox soap, 10% nitric acid rinse, deionized water.

Ventilation: All decontamination procedures will be conducted in an open, well-ventilated area.

Personnel Decontamination Procedures:

PPE Requirements for Personnel Performing Decontamination:

Personnel Decontamination in General: Following appropriate decontamination procedures, all field personnel will wash their hands and face with soap and potable water. Personnel should shower at the end of each work shift.

Disposition of Disposable PPE: Disposable PPE must be rendered unusable and disposed of in an appropriate manner.

Disposition of Decontamination Wastes (e.g., dry wastes, decontamination fluids, etc.): As specified in the work plan and contract scope of work.

10. EMERGENCY RESPONSE

This section contains additional information pertaining to on-site emergency response and does not duplicate pertinent emergency response information contained in earlier sections of this plan (e.g., site layout, monitoring equipment, etc.). Emergency response procedures will be rehearsed regularly, as applicable, during project activities.

10.1 EMERGENCY RESPONSIBILITIES

All Personnel: All personnel shall be alert to the possibility of an on-site emergency; report potential or actual emergency situations to the team leader and SSO; and notify appropriate emergency resources, as necessary.

Team Leader: The team leader will determine the emergency actions to be performed by E & E personnel and will direct these actions. The team leader also will ensure that applicable incidents are reported to appropriate E & E and client project personnel and government agencies.

SSO: The SSO will recommend health/safety and protective measures appropriate to the emergency.

Other:

10.2 LOCAL AND SITE RESOURCES (including phone numbers)

Ambulance: AMCARE Ambulance Service, Inc. 315/339-5600

Hospital:
Rome Hospital, Rome NY
911 (emergency)
(315)338-7000, (315)336-1234

Directions to Hospital (see Figure 10-1 attached at the end of this plan):

Exit base through Mohawk Gate (west side) on Mohawk drive. Go west approximately one mile, and turn left on Black River Boulevard. Hospital is on right within 0.25 miles.

Poison Control: Poison Control Center, Rome 800/252-5655

Police Department: Oneida County Sheriff, Ext. 3710

Fire Department: Griffiss AFB Fire Department, Ext. 7117

Client Contact: AFBCA/OL-X, Environmental Section, Building 301, Ext. 2275

Site Contact: AFBCA/OL-X, Environmental Section, Building 301, Ext. 2275

On-Site Telephone Number: 315/330-2275

Cellular Telephone Number: TBD

Radios Available:

Other:

10.3 E & E EMERGENCY CONTACTS

E & E Emergency Response Center (24 Hours):	716/684-8940	
Corporate Health and Safety Director, Dr. Paul Jonmaire:	716/684-8060 (office) 716/655-1260 (home)	
Regional Office Contact:		(office)
		(home)
Other:		(office)
		(home)

10.4 OTHER EMERGENCY RESPONSE PROCEDURES

On-Site Evacuation Signal/Alarm (must be audible and perceptible above ambient noise and light levels):

On-Site Assembly Area: Building 145

Emergency Egress Route to Get Off Site: Nearest gate or as directed by base security (Oneida County Sheriff).

Off-Site Assembly Area: N/A

Preferred Means of Reporting Emergencies: Two-way radio and telephone.

Site Security and Control: In an emergency situation, personnel will attempt to secure the affected area and control site access.

Emergency Decontamination Procedures: Emergency eyewash will be available in first aid kit(s). Clean running water will be available in Building 145.

PPE: Personnel will don appropriate PPE when responding to an emergency situation. The SSO and Section 7 of this plan will provide guidance regarding appropriate PPE.

Emergency Equipment: Appropriate emergency equipment is listed in Attachment 1. Adequate supplies of this equipment shall be maintained in the support area or other approved work location.

Incident Reporting Procedures: Notify site safety officer and field team leader. Appropriate incident reports will be completed by these personnel.

ATTACHMENT 1
EQUIPMENT/SUPPLIES CHECKLIST

INSTRUMENTATION	No.
OVA	1
Thermal desorber	
O_2/explosimeter w/cal. kit	1
Photovac tip	
HNu (probe: eV)	
Magnetometer	1
Pipe locator	
Weather station	
Draeger tube kit (tubes:)	
Brunton compass	1
Real-time cyanide monitor	
Real-time H_2S monitor	1
Heat stress monitor	
Noise equipment	
Personal sampling pumps and supplies	
MiniRam dust monitor	
Mercury monitor	
Spare batteries (type:)	
EM31	1
EM61	
RADIATION EQUIPMENT/SUPPLIES	
Documentation forms	
Portable ratemeter	
Scaler/ratemeter	
1" NaI gamma probe	
2" NaI gamma probe	
ZnS alpha probe	
GM pancake probe	
Tungsten-shielded GM probe	
Micro R meter	
Ion chamber	
Alert monitor	1
Pocket dosimeter	
Dosimeter charger	
Radiation warning tape	
Radiation decon supplies	
Spare batteries (type: ____________________)	

EMERGENCY EQUIPMENT	No.
First aid kit	2
Stretcher	
Portable eye wash	2
Blood pressure monitor	
Fire blanket	
Fire extinguisher	1
Thermometer (medical)	
Spill kit	
DECONTAMINATION EQUIPMENT	
Wash tubs	2
Buckets	
Scrub brushes	2
Pressurized sprayer	
Spray bottle	2
Detergent (type: Alconox)	1
Solvent (type: HN03 [10%])	1
Plastic sheeting	1
Tarps and poles	
Trash bags	1
Trash cans	
Masking tape	
Duct tape	1
Paper towels	1
Face mask	1
Face mask sanitizer	
Step ladders	
Distilled water	
Deionized water	1

ATTACHMENT 1
EQUIPMENT/SUPPLIES CHECKLIST

SAMPLING EQUIPMENT		**MISCELLANEOUS (Cont.)**	
8-oz. bottles	TBD	Gatorade or equivalent	TBD
Half-gallon bottles	TBD	Tables	
VOA bottles	TBD	Chairs	
String		Weather radio	
Hand bailers	5	Two-way radios	4
Thieving rods with bulbs	3	Binoculars	
Spoons	6	Megaphone	
Knives	2	Cooling vest	
Filters	24		
Bottle labels	TBD		
		SHIPPING EQUIPMENT	
		Coolers	TBD
MISCELLANEOUS		Paint cans with lids, 7 clips each	
Pump (hand)	1	Vermiculite	
Surveyor's tape		Shipping labels	TBD
100' Fiberglass tape		DOT labels:	
300' Nylon rope		"Up"	TBD
Nylon string		"Danger"	TBD
Surveying flags	TBD	"Inside Container Complies ..."	TBD
Camera	1	Hazard Group	
Film	1	Strapping tape	TBD
Bung wrench	1	Baggies	TBD
Soil auger	1	Custody seals	TBD
Pick		Chain-of-custody forms	TBD
Shovel		Federal Express forms	TBD
Catalytic heater		Clear packing tape	4
Propane gas		Permanent markers	6
Banner tape	1		
Surveying meter stick			
Chaining pins and ring			
Logbooks (large, small)	8		
Required MSDSs			
Intrinsically safe flashlight	1		
Potable water			

PLOT HOSP

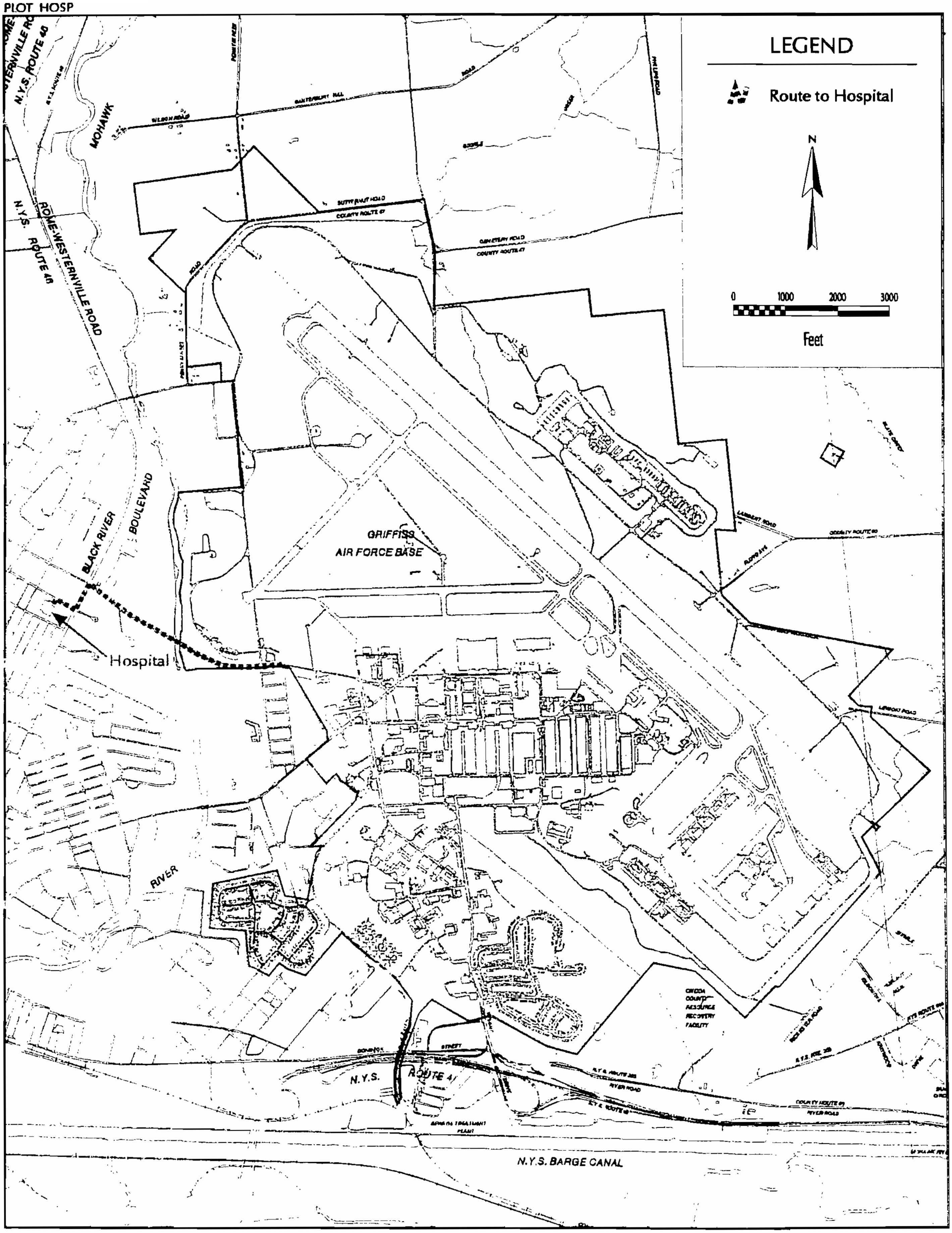

Figure 10-1   Route to Hospital from Griffiss AFB

IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN AT GRIFFISS AFB
Rome, New York

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/ LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
CLASS: HALOGENATED SOLVENTS								
Bromodichloromethane	NA	NA	NE	NA/NA	NA	NA	NA	Acute: NA Chronic: Carcinogenic in mice
Carbon tetrachloride	2 [Ca]	5 [A2] [skin]	300	NC/NC	21-100	77	11.47	Acute: CNS depression, nausea, vomiting, liver or kidney damage, skin irritation Chronic: Fatigue, lassitude, giddiness, anxiety, headache, muscle twitching, liver damage, in animals: liver cancer
Chlorobenzene	75	10	2,400	9.6/1.3	0.21	77	9.07	Acute: Irritation of skin, eyes, or nose, drowsiness, incoordination, in animals: liver, lung, or kidney damage Chronic: Neurotoxicity, numbness, cyanosis, hyperaesthesia, muscle spasms
Chloroform	2 [Ca]	10 [A2]	1,000	NC/NC	205-307	33	11.42	Acute: Lassitude, GI disturbances, dizziness, mental dullness, coma Chronic: Liver enlargement, kidney damage, cancer
1,2-trans-Dichloroethene	200	200	4,000	12.8/5.6	0.085	33	9.65	Acute: Eye and skin irritant, central nervous system depression, dizziness, nausea and vomiting Chronic: Liver and kidney dysfunction
Trichloroethylene	50	50	1,000	10.5/8	50	83	9.45	Acute: Eye and skin irritant, vertigo, visual distortions, fatigue, giddiness, tremor, nausea Chronic: heart, CNS, liver damage

NOTES:

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*** : H_2S strong odor, noticeable at low concentrations, is a poor warning sign as it may cause olfactory paralysis; some persons are congenitally unable to smell H_2S.
A1 : Confirmed human carcinogen
A2 : Suspected human carcinogen (ACGIH)
ACGIH : American Conference of Governmental Industrial Hygienists
B : Time to reach 1% breakthrough (tested at 1000 ppm, 50% relative humidity, 22°C, and 53 L/min
C : Ceiling limit
Ca : Carcinogen (NIOSH)
CNS : Central nervous system
CP : Combustible in dust or powdered form
FMP : 5 minute maximum peak in any two hours
GI : Gastrointestinal
IDLH : Immediately Dangerous to Life or Health

mg/m³ : milligrams per cubic meter
NA : Not Available
NC : Noncombustible solid or liquid
NCRP : National Council on Radiation Protection
NE : No evidence found for the existence of an IDLH (NIOSH)
NIOSH : National Institute for Occupational Safety and Health
NR : Not relevant
OSHA : Occupational Safety and Health Administration
ppm : parts per million
skin : Recognized as having potential for dermal absorption
ST : Short term exposure limit
TMP : 30-minute maximum peak
Ukn : Unknown
V : Varies according to compound
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IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN AT GRIFFISS AFB

Rome, New York

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Methyl bromide	5 [skin] [Ca]	5 [skin]	2,000	16/10	80-4,000 mg/m^3	NA	10.54	Acute: Eye, skin, and nasal irritant, nausea, vomiting, vertigo, sleepiness, hand tremor, coma, convulsions Chronic: Lethargy, muscle pain, vision, speech, sensory disturbances, confusion
Methyl chloride	50 100 [ST] [Ca]	50 [skin] 100 [ST]	10,000	17.4/8.1	21 mg/m^3	0.05	11.28	Acute: CNS depression, kidney and liver damage, coma, seizures Chronic: Speech difficulty, nausea, headache, dizziness, blurred vision, carcinogen
Methylene chloride	500 1,000 [C] 2,000 [FMP]	50 [A2]	5,000	22/14	214	NA	11.32	Acute: Fatigue, weakness, sleepiness, lightheadedness, numbness or tingling of limbs, nausea, irritation eyes, skin Chronic: In animals: slight liver damage, lung and liver tumors
Ortho-dichlorobenzene	50 [C]	50 [C] [skin]	1,000	9.2/2.2	50	109	9.06	Acute: Irritation of nose or eyes, liver or kidney damage, skin blister Chronic: In rodents: kidney changes, decreased survival
1,1,2,2-Tetrachloro-1,2-difluoroethane	500	500	15,000	NC/NC	NA	NA	11.30	Acute: Irritation of skin, conjunctivitis, pulmonary edema Chronic: NA
1,2,4-Trichlorobenzene	5 [C]	5 [C]	NA	NA/NA	NA	NA	≅9.1	Acute: Moderately irritating to eyes and mucous membranes of respiratory system. Drowsiness, incoordination, narcosis, headaches. Chronic: NA

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Rome, New York

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/ LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Tetrachloroethylene	25 [Ca]	50 200 [ST]	500	NC/NC	5	107	9.32	Acute: Irritation of eyes, nose, or throat, nausea, flush face, neck, vertigo, dizziness, incoordination, headache, somnolence, skin erythema Chronic: Kidney and liver damage, carcinogen
1,1,2-Trichloro-1,2,2-trifluoroethane	1,000 1,250 [ST]	1,000 1,250 [ST]	4,500	**/**	NA	NA	11.99	Acute: Irritation of throat, drowsiness, dermatitis Chronic: NA
1,1,1-Trichloroethane (Methyl chloroform)	350 450 [ST]	350 450 [ST]	1,000	12.5*/7.5*	100	40	11.00	Acute: Headache, lassitude, central nervous system depression, poor equilibrium, irritation of eyes, dermatitis, cardiac arrhythmias Chronic: Liver toxicity in animals
1,1,2-Trichloroethane	10 [skin] [Ca]	10 [skin]	500	NC/NC	NA	72	11.00	Acute: Irritation of nose or eyes, central nervous system depression Chronic: Liver or kidney damage, carcinogen
Trichloroethylene	50 200 [ST] [Ca]	50 200 [ST]	1,000	10.5 [77°F]/ 8 [77°F]	50	107	9.45	Acute: Headache, vertigo, visual disturbance, tremors, somnolence, nausea, vomiting, irritation of eyes, dermatitis, cardiac arrhythmias, paresthesia Chronic: In animals: lung and liver cancer

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Rome, New York

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Trichlorofluoromethane	1,000 [C]	1,000 [C]	10,000	NC/NC	5	NA	11.77	Acute: Incoordination, tremors, dermatitis, frostbite, cardiac arrhythmias, cardiac arrest Chronic: NA
Vinyl chloride	1 5 [C] [Ca]	5 [A1]	NE	33/3.6	260	3.8	9.99	Acute: Eye and skin irritant, nausea, lightheadedness, dulling of vision and hearing Chronic: Cancer (liver, lung, CNS, lymphatic system), Raymond's phenomenon, liver damage
CLASS: NONHALOGENATED SOLVENTS								
Acetone	750 1,000 [ST]	750 1,000 [ST]	20,000	13/2.5	100	37	9.69	Acute: Irritation of eyes, nose, or throat, headache, dizziness, dermatitis Chronic: Conjunctivitis, pharyngitis, bronchitis, gastritis, gastroduodenitis, liver lesions, kidney lesions
Bis(2-ethylhexyl) phthalate (di-sec-octyl phthalate)	5 mg/m³ 10mg/m³ [ST]	5 mg/m³ 10 mg/m³ [ST]	Ukn [Ca]	Ukn/0.3% [474°F]	NA	115	NA	Acute: Eye and mucous membrane irritant Chronic: In rodents: liver damage, reproductive organ damage
n-Butyl alcohol (Butanol)	50 [C] [skin]	50 [C] [skin]	8,000	11.2/1.4	NA	115	10.04	Acute: Irritation of eyes, nose, or throat, headache, vertigo, drowsiness, corneal inflammation, blurred vision, lacrimation, photophobia, dry cracked skin Chronic: NA

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Carbon disulfide	4 12 [ST] [skin]	10 [skin]	500	50.0/1.3	0.05 mg/m^3	NA	10.08	Acute: Dizziness, headache, poor sleep, fatigue, nervousness, anorexia, low weight, eye, skin burns, dermatitis Chronic: Psychosis, Parkinson-like syndrome, vision changes, coronary heart disease, gastritis, kidney, liver damage
Cresols, Cresylic acid	5 [skin]	5 [skin]	250	Ukn/ 1.4 (o) 1.1 (m) 1.1 (p) [300°F]	0.65 (o-isomer) (water) 0.26 (o-isomer) (air) 0.00028 (m) 0.0455 (p)	NA	8.93 (o) 8.98 (m) 8.97 (p)	Acute: CNS effects, confusion, depression, respiratory failure, dyspnea, irregular rapid respiration, weak pulse, skin or eye burns, dermatitis, lung, liver, or kidney damage Chronic: Systematic poisoning; vomiting, difficulties in swallowing, loss of appetite, headache, dizziness and skin absorption
Cyclohexane	300	300	10,000	8/1.3	1.435 mg/m^3	69	9.88	Acute: Irritation of eyes or respiratory system, drowsiness, dermatitis, narcosis, coma Chronic: CNS depression
Diethylphthalate	5 mg/m^3	5 mg/m^3	NE	NA	None	NA	NA	Acute: Nose and throat irritant, conjunctivitis, dizziness, nausea Chronic: Mutagen and teratogen in animal species
Ethanol	1,000	1,000	NE	NA	0.34-9,690 mg/m^3	28	NA	Acute: Defatting of skin leading to dermatitis, mild eye and nose irritant Chronic: Tremor, fatigue, Cirrhosis

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IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN AT GRIFFISS AFB
Rome, New York

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/ LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
2-Ethoxyethanol (EGEE)	200 [skin]	5 [skin]	6,000	15.6 [200°F]/ 1.7 [200°F]	NA	77	NA	Acute: In animals: pulmonary irritation, blood system effects, liver, kidney, or lung damage, irritation of eyes Chronic: CNS depression
Ethyl acetate	400	400	10,000	11.5/2.0	0.0196-665 mg/m^3	67	10.01	Acute: Irritation of eyes, nose, or throat, narcosis, dermatitis Chronic: ND
Ethyl benzene	100 125 [ST]	100 125 [ST]	2,000	6.7/1.0	140	84	8.76	Acute: Irritation of eyes or mucous membrane, headache, dermatitis, narcosis, coma Chronic: Liver, kidney, CNS effects
Ethyl ether	400 500 [ST]	400 500 [ST]	19,000	36.0/1.9	0.99-3 mg/m^3	NA	9.53	Acute: Dizziness, drowsiness, headache, excited, narcosis, nausea, vomiting, irritation of eyes, upper respiratory system, or skin Chronic: ND
Isobutyl alcohol (Isobutanol)	50	50	8,000	10.6 [202°F]/ 1.7 [123°F]	NA	NA	10.12	Acute: Irritation of eyes or throat, headache, drowsiness, skin irritation or cracking Chronic: ND
Methyl alcohol (Methanol)	200 250 [ST] [skin]	200 250 [ST] [skin]	25,000	36/6.0	53.3	NR	10.84	Acute: Eye irritation, headache drowsiness, lightheadedness, nausea, vomiting, visual disturbance Chronic: Blindness

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IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN AT GRIFFISS AFB
Rome, New York

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/ LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Methyl ethyl ketone (2 Butanone)	200 300 [ST]	200 300 [ST]	3,000	11.4 [200°F]/ 1.4 [200°F]	10	82	9.54	Acute: Irritation of eyes, nose, or throat, headache, dizziness, vomiting Chronic: Dermatitis, peripheral neuropathy
Methyl isobutyl ketone (Hexone)	50 75 [ST]	50 75 [ST]	3,000	8.0 [200°F]/ 1.2 [200°F]	0.41-193 mg/m³	NA	9.30	Acute: Irritation of eyes or mucous membrane, headache, narcosis, coma, dermatitis Chronic: NA
Nitrobenzene	1 [skin]	1 [skin]	200	Ukn/ 1.8 [200°F]	5.94	NA	9.92	Acute: Anoxia, irritation of eyes, dermatitis, anemia Chronic: NA
2-Nitropropane	10 [Ca]	10 [A2]	2,300	11.0/2.6	17.5-1,029 mg/m³	NA	10.71	Acute: Headache, anorexia, nausea, vomiting, diarrhea, irritation of respiratory system Chronic: Carcinogen
Pyridine	5	5	3,600	12.4/1.8	0.17	119	9.27	Acute: Headache, nervousness, dizziness, insomnia, nausea, anorexia, frequent urination, eye irritation, dermatitis Chronic: Liver or kidney damage

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CLASS: PETROLEUM FUEL CONSTITUENTS								
Benzene	1 5 [ST]	10 [A2]	3,000	7.9/1.3	4.68	73	9.24	Acute: Irritation of eyes, nose, or respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis; abdominal pain Chronic: Bone marrow depression, carcinogen
Coal tar pitch volatiles (PAHs)	0.2 mg/m³ [Ca]	0.2 mg/m³ [A1]	700 mg/m³	V	V	V	V	Acute: Dermatitis, bronchitis Chronic: Lung, skin, urinary tract cancers
Ethyl benzene	100 125 [ST]	100 125 [ST]	2,000	6.7/1.0	140	84	8.76	Acute: Irritation of eyes, mucous membrane, headache, dermatitis, narcosis, coma Chronic: Liver and kidney damage
Naphthalene	10 15 [ST]	10 15 [ST]	500	5.9/0.9	0.084	NA	8.12	Acute: Eye and skin irritant, nausea, vomiting, headache, confusion, sweating, abdominal pain, jaundice, kidney damage Chronic: Kidney damage, cataracts
Toluene	100 150 [ST]	50 150 [ST]	2,000	7.1/1.2	0.17	94	8.82	Acute: Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis Chronic: CNS effects, brain dysfunction, liver and kidney damage

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Xylene (o-,m-,p-isomers)	100 150 [ST]	100 150 [ST]	1,000	7.0/ 1.1 (o) 1.0 (m) 1.1 (p)	0.05	NA (o) 99 (m) NA (p)	8.56 (o) 8.54 (m) 8.44 (p)	Acute: Dizziness, excitement, drowsiness, incoordination, staggering gait, irritation of eyes, nose, or throat, eye disorders, anorexia, nausea, vomiting, abdominal pain, dermatitis Chronic: Lung and liver effects
Total Petroleum Hydrocarbons (as gasoline)	300 500 [ST]	300 500 [ST]	NE	NA/NA	0.25	NR	NR	Acute: Irritation of upper respiratory tract, depression of central nervous system, irregular heartbeat, irritation of mucous membrane Chronic: Ukn
CLASS: METALS/INORGANICS								
Aluminum (dust)	15 mg/m³	10 mg/m³	NE	NC/NC	NA	NR	NR	Acute: Dermatitis, eczema, conjunctivitis, mucus membrane/upper respiratory Irritation Chronic: Pneumoconiosis, Alzheimer's disease, dialysis dementia
Antimony, and compounds	0.5 mg/m³	0.5 mg/m³	80 mg/m³	CP/CP	NA	NR	NA	Acute: Skin and eye irritant, nausea, vomiting, death after large oral doses Chronic: Pulmonary edema, EKG changes, red blood cell changes, hypertension

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Arsenic	0.01 mg/m³ [Ca]	0.2 mg/m³ [Ca]	100 mg/m³	CP/CP	NR	NR	NR	Acute: Nasal septum ulceration, dermatitis, respiratory irritation, GI disturbances Chronic: Peripheral neuritis, hyperpigmentation of skin, carcinogen
Barium (soluble compounds)	0.5 mg/m³	0.5 mg/m³	1,100 mg/m³	NC/NC	NR	NR	NR	Acute: Upper respiratory tract irritation, gastroenteritis, muscle spasms, slow pulse, extrasystoles, hypokalemia, eye and skin irritant, skin burns Chronic: Hypertension
Beryllium	0.002 mg/m³ 0.005 mg/m³ 0.025 mg/m³ [C][Ca][TMP]	0.002 mg/m³ [A2]	10 mg/m³	CP/CP	NR	NR	NR	Acute: Respiratory symptoms, weakness, fatigue, weight loss Chronic: Pneumonitis, berylliosis, carcinogen
Cadmium	0.2 mg/m³ 0.6 mg/m³ [C] [Ca]	0.05 mg/m³	50 mg/m³	CP/CP	NR	NR	NR	Acute: Pulmonary edema, dyspnea, cough, tight chest, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea Chronic: Lung fibrosis, emphysema, proteinuria, mild anemia, carcinogen

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Chromium	1 mg/m^3	0.5 mg/m^3	NE	CP/CP	NR	NR	NR	Acute: Sneezing, throat irritation, bronchial spasm, skin ulcers, GI irritation, nausea, vomiting, severe diarrhea, hemorrhage (oral form) Chronic: Nasal perforation, chronic inflammation of respiratory tract, lung cancer
Copper (dusts)	1 mg/m^3	1 mg/m^3	NE	CP/CP	NR	NR	NR	Acute: Irritation of mucous membranes in nose and pharynx, nasal perforation, eye irritation, metallic taste, dermatitis, metal fume fever Chronic: NA
Cyanide [skin]	5 mg/m^3	5 mg/m^3	50 mg/m^3	NC/NC	2-5	NR	NR	Acute: Weakness, headache, confusion, nausea, vomiting, increased respiratory rate, eye and skin irritation, asphyxiation, death Chronic: Weakness, vertigo, nausea, rapid pulse, headache, flushing of face, gastric distress
Hydrogen Sulfide	10 15[ST]	10 15[ST]	300 ppm	44.0/4.0; flammable gas	0.0047***	NR	10.46 eV	Symptoms: Eye, respiratory irritant, may cause immediate coma - with or without convulsions, inhibition of cytochrome oxidase - causing death from respiratory failure, headache, dizziness, staggering gait
Iron	10 mg/m^3	1 mg/m^3	NE	NC/NC	NR	NR	NR	Acute: Oral-GI distress, liver damage Chronic: Benign pneumoconiosis

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Rome, New Y

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Lead	0.05 mg/m³	0.15 mg/m³	700 mg/m³	NC/NC	NR	NR	NR	Acute: Weakness, lassitude, insomnolence, facial pallor, anorexia, low weight, constipation, abdominal pain, colic, anemia, irritation of eyes, hypotension Chronic: Malnutrition, gingival lead line, tremor, paralysis of wrist or ankles, brain disorder, nerve disorder
Manganese, dust and compounds	5 mg/m³ [C]	5 mg/m³	NE	Ukn/Ukn	NR	NR	NR	Acute: Lung irritation, cough Chronic: Manganism (neurological disease), symptoms are weakness, lethargy, speech disturbances, clumsy gait, hallucinations, psychosis, muscle rigidity
Mercury (compounds)	0.01 mg/m³ 0.03 mg/m³ [ST] [skin]	0.1 mg/m³ [skin]	10 mg/m³	NR/NR	NR	NR	NR	Acute: Incoordination, vision, hearing disturbance, spastic, jerky, dizziness, salvation, lacrimation, nausea, vomiting, diarrhea, constipation, skin burns, emotional distress Chronic: In animals: decreased weight gain, kidney damage
Nickel (dust and compounds)	0.1 mg/m³ (sol) 1 mg/m³ (insol) [Ca]	0.1 mg/m³ (sol) 1 mg/m³ (insol)	NE	NC/NC	NR	NR	NR	Acute: Headache, vertigo, nausea, vomiting, gastric pain, substernal pain, cough, cyanosis, weakness, leukocytosis, delirium, convulsion Chronic: Lung lesions, asthmatic disease, immune system changes, lung and nasal cancers

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Selenium, and compounds	0.2 mg/m³	0.2 mg/m³	Ukn	Ukn/Ukn	NR	NR	NA	Acute: Lung and eye irritation, pallor, irritability, giddiness, GI effects Chronic: Pulmonary edema, possible liver and kidney damage
Silver (dust and compounds)	0.01 mg/m³	0.1 mg/m³ (dust) 0.01 mg/m³ (sol)	NE	CP/CP	NR	NR	NR	Acute: Blue-gray eyes, nasal septum, throat, skin, irritation of skin or ulceration, gastrointestinal disturbance Chronic: Ukn
Strontium	NA	NA	NE	NA/NA	NR	NR	NA	Acute: Oral-erthythmias, cardiac arrest, concentration in bone tissue Chronic: Bone cancer
Vanadium (dust)	0.05 mg/m³	0.05 mg/m³	70 mg/m³	NC/NC	NR	NR	NR	Acute: Eye irritation, green tongue, metallic taste, eczema, cough, fine rales, wheezing, bronchitis, dyspnea, throat irritation Chronic: Possible CNS effects
Zinc (as ZnO dust)	5 mg/m³ 10 mg/m³ [ST]	10 mg/m³	NE	NA/NA	NR	NR	NR	Acute: Metal fume fever, GI distress Chronic: Alveolar tissue damage

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CLASS: PESTICIDES								
Alpha-BHC	NA	NA	1,000 mg/m³	NA/NA	0.088 (water)	NA	NA	Acute: Lung irritation, headache, heart and blood disorders, convulsions Chronic: Liver disease, liver cancer
Beta-BHC	NA	NA	1,000 mg/m³	NA/NA	0.00032 (water)	NA	NA	Acute: Headache, vertigo, convulsions, coma, blood and heart disorders Chronic: Liver and kidney disease, possible mutagenic activity, liver cancer
Carbaryl (Sevin®)	5 mg/m³	5 mg/m³	600 mg/m³	NA/NA	NA	NA	NA	Acute: Nausea, vomiting, dizziness, headache, difficulty in breathing, weakness, tremor, blurred vision, convulsions, nasal discharge Chronic: CNS effects, neuropathy
Chlordane	0.5 mg/m³ [skin][Ca]	0.5 mg/m³ [skin]	500 mg/m³	NA/NA	NA	NA	Ukn	Acute: Blurred vision, confusion, ataxia, cough, delirium, abdominal pain, nausea, vomiting, diarrhea, irritability, tremor, convulsions, anuria Chronic: Genotoxicity, decreased fertility (in animals), liver tumors in mice

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DDT	1 mg/m³ [skin][Ca]	1 mg/m³	NE	Ukn/Ukn	0.35	NA	Ukn	Acute: Movements of the tongue, lips, face, tremor, apprehension, dizziness, confusion, malaise, headache, fatigue, convulsions, vomiting, eye and skin irritant Chronic: Cancer
Diazinon	NA	0.1 mg/m³ [skin]	5,000	NC/NC	NA	NA	NA	Acute: Moderate organophosphate insecticide toxicity (see malathion for symptoms) Chronic: Minimal toxicity
Dieldrin	0.25 mg/m³ [skin] [Ca]	0.25 mg/m³ [skin]	450 mg/m³	NA/NA	0.041	NA	NA	Acute: Headache, dizziness, nausea, vomiting, malaise, sweating, limb jerks, convulsions, coma Chronic: Liver and kidney damage in animals, liver cancer in mice
Endosulfan	0.1 mg/m³ [skin]	0.1 mg/m³ [skin]	NE	NA/NA	NA	NA	NA	Acute: Dyspnea, cyanosis, GI distress, hyperactivity, salivation, tremor, convulsions Chronic: Neurotoxicity (EEG changes, brain damage), kidney damage in animals
Endrin	0.1 mg/m³ [skin]	0.1 mg/m³ [skin]	2,000 mg/m³	NA/NA	0.28-6.4 mg/m³	NA	NA	Acute: Muscle twitching, dizziness, confusion, seizures Chronic: Pneumonia, respiratory effects, increased liver enzymes

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NIOSH : National Institute for Occupational Safety and Health
NR : Not relevant
OSHA : Occupational Safety and Health Administration
ppm : parts per million
skin : Recognized as having potential for dermal absorption
ST : Short term exposure limit
TMP : 30-minute maximum peak
Ukn : Unknown
V : Varies according to compound
°C : degrees Celsius
°F : degrees Fahrenheit

IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN AT GRIFFISS AFB
[illegible] York

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/ LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Heptachlor	0.5 mg/m^3 [skin] [Ca]	0.5 mg/m^3 [skin]	700 mg/m^3	NA/NA	0.3 mg/m^3	NA	NA	Acute: Liver toxicity (increased liver weight, increased enzyme levels), hypoactivity, tremors, ataxia, convulsions, EEG changes Chronic: Kidney, adrenal, blood effects, in animals: fetotoxic, carcinogenic
Lindane (gamma-BHC)	0.5 mg/m^3 [skin]	0.5 mg/m^3 [skin]	1,000 mg/m^3	NA/NA	12 mg/kg (water)	NA	Ukn	Acute: Eye, nose and throat irritant, headache, nausea, clonic convulsion, respiratory difficulty, cyanosis, aplastic anemia, skin irrit[illegible] spasms Chronic: Nausea, spasms, [illegible] dyscrasia, aplastic anemia, liver damage
Malathion	10 mg/m^3 [skin]	10 mg/m^3 [skin]	5,000 mg/m^3	Ukn/Ukn	13.5 mg/m^3	NA	NA	Acute: Headache, wheezing, tightness in chest, pinpoint pupils, blurred vision, nausea, vomiting, lacrimation, salivation, diarrhea, tremors, weakness Chronic: Pulmonary edema, dermatitis, decreased cholinesterase levels
CLASS: MISCELLANEOUS								
Phenol	5 [skin]	5 [skin]	250	Ukn/1.8	0.05	NA	8.50	Acute: Eye, nose and throat irritant, anorexia, weakness, muscle aches, pain, dark urine, cyanosis, skin burns, dermatitis, tremor, convulsions, twitching, ochronosis Chronic: Liver and kidney damage

NOTES:

* :	Noncombustible liquid; however the vapor will burn
** :	Noncombustible liquid at ordinary temperatures, but the gaseous form will ignite and burn weakly at 1256° F
*** :	H_2S strong odor, noticeable at low concentrations, is a poor warning sign as it may cause olfactory paralysis; some persons are congenitally unable to smell H_2S.
A1 :	Confirmed human carcinogen
A2 :	Suspected human carcinogen (ACGIH)
ACGIH :	American Conference of Governmental Industrial Hygienists
B :	Time to reach 1% breakthrough (tested at 1000 ppm, 50% relative humidity, 22°C, and 53 L/min
C :	Ceiling limit
Ca :	Carcinogen (NIOSH)
CNS :	Central nervous system
CP :	Combustible in dust or powdered form
FMP :	5 minute maximum peak in any two hours
GI :	Gastrointestinal
IDLH :	[illegible]iately Dangerous to Life or Health

mg/m^3 :	milligrams per cubic meter
NA :	Not Available
NC :	Noncombustible solid or liquid
NCRP :	National Council on Radiation Protection
NE :	No evidence found for the existence of an [illegible])
NIOSH :	National Institute for Occupational Safety and Health
NR :	Not relevant
OSHA :	Occupational Safety and Health Administration
ppm :	parts per million
skin :	Recognized as having potential for dermal absorption
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TMP :	30-minute maximum peak
Ukn :	Unknown
V :	Varies according to compound
°C :	degrees Celsius
°F :	degrees Fahrenheit

IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN AT GRIFFISS AFB
Rome, New York

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/ LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Asbestos	0.2 fiber/cm [Ca]	Amosite 0.5 fiber/cc crocidolite 0.2 fiber/cc [A1]	NE	NA/NA	NR	NA	NA	Acute: Dyspnea Chronic: Interstitial fibrosis, restricted pulmonary function, finger clubbing, [Ca] lung cancer, mesothelioma
Ethylene Glycol	50 [C]	50 [C]	NA	Ukn/3.2	NR	NA	10.56	Acute: Eye, nose, and throat irritant, peculiar taste, headache, nausea, vomiting, diarrhea, dyspnea, cyanosis, pulmonary edema, EKG abnormalities, drowsiness, weakness, skin and eye burns, frost bite Chronic: Loss of appetite, lymphocytosis, decreased urine output, involuntary eye movements
Propylene Glycol	NA	NA	NA	NA/NA	NR	NA	NA	Acute: Eye, nose and throat irritant, CNS depressant, headache, nausea Chronic: Ukn
Methane	NR	NR	NA	5/15	NA	NA	12.98	Acute: Coma, asphyxiation Chronic: Ukn
Polychlorinated Biphenyls (PCBs) 42% Chlorine	1 mg/m³ [skin][Ca]	1 mg/m³ [skin]	10 mg/m³	Ukn/Ukn	NR	NA	Ukn	Acute: Eye irritant, liver damage Chronic: Liver function damage, chloracne, hyperpigmentation, cancer in animals

NOTES:

* : Noncombustible liquid; however the vapor will burn
** : Noncombustible liquid at ordinary temperatures, but the gaseous form will ignite and burn weakly at 1256° F
*** : H_2S strong odor, noticeable at low concentrations, is a poor warning sign as it may cause olfactory paralysis; some persons are congenitally unable to smell H_2S.
A1 : Confirmed human carcinogen
A2 : Suspected human carcinogen (ACGIH)
ACGIH : American Conference of Governmental Industrial Hygienists
B : Time to reach 1% breakthrough (tested at 1000 ppm, 50% relative humidity, 22°C, and 53 L/min
C : Ceiling limit
Ca : Carcinogen (NIOSH)
CNS : Central nervous system
CP : Combustible in dust or powdered form
FMP : 5 minute maximum peak in any two hours
GI : Gastrointestinal
IDLH : Immediately Dangerous to Life or Health

mg/m³ : milligrams per cubic meter
NA : Not Available
NC : Noncombustible solid or liquid
NCRP : National Council on Radiation Protection
NE : No evidence found for the existence of an IDLH (NIOSH)
NIOSH : National Institute for Occupational Safety and Health
NR : Not relevant
OSHA : Occupational Safety and Health Administration
ppm : parts per million
skin : Recognized as having potential for dermal absorption
ST : Short term exposure limit
TMP : 30-minute maximum peak
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V : Varies according to compound
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IMPORTANT PROPERTIES OF CONSTITUENTS OF CONCERN AT GRIFFISS AFB
Rome, New York

Constituent	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	UEL (%)/ LEL (%)	Odor Threshold (ppm)	Respirator Cartridge Breakthrough Time (min)[B]	Ionization Potential (eV)	Health Hazards (Acute/Chronic)
Polychlorinated Biphenyls (PCBs) 54% Chlorine	0.5 mg/m³ [skin] [Ca]	0.5 mg/m³ [skin]	5 mg/m³	Ukn/Ukn	NR	NA	NA	Acute: Sore throat, skin rash, GI distress, eye irritation, headache Chronic: Male infertility, liver function fluctuations, hyperpigmentation, chloracne, cancer in animals
Radioactive Wastes	5 rem/yr [NCRP]	NA	100 rem [NCRP]	NR/NR	NR	NA	NA	Acute: Anorexia, nausea, vomiting, diarrhea, apathy, increased heart beat rate, fever, headache, blood cell destruction, GI epithelial cell sloughing, bone marrow damage, chromosomal damage Chronic: Cancer, mutations, birth defects
Dioxins	NA	NA	NA	NA	NA	NA	NA	Acute: Irritation of skin, eyes and nose; drowsiness; incoordination Chronic: Cancer, mutagenic, birth defects
Tetrahydrofuran	200 250 [ST]	200	20,000 (explosive)	2/11.8	NA	NA	9.45	Acute: Irritation of eyes and upper respiratory system, nausea, dizziness, headache Chronic: Central nervous system effects

REFERENCES:
ACGIH, Threshold Limit Values, 1991-1992.
NIOSH, Pocket Guide to Chemical Hazards, 1990.
OSHA, Permissible Exposure Limits, 29 CFR 1910.1000.
Sittig, Hazardous and Toxic Effects of Industrial Chemicals, 1979.
ATSDR, Toxicological Profiles for Constituents, 1987-1991.

NOTES:
* : Noncombustible liquid; however the vapor will burn
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*** : H_2S strong odor, noticeable at low concentrations, is a poor warning sign as it may cause olfactory paralysis; some persons are congenitally unable to smell H_2S.
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ACGIH : American Conference of Governmental Industrial Hygienists
B : Time to reach 1% breakthrough (tested at 1000 ppm, 50% relative humidity, 22°C, and 53 L/min
C : Ceiling limit
Ca : Carcinogen (NIOSH)
CNS : Central nervous system
CP : Combustible in dust or powdered form
FMP : 5 minute maximum peak in any two hours
GI : G[illegible]intestinal
IDLH : [illegible]iately Dangerous to Life or Health

mg/m³ : milligrams per cubic meter
NA : Not Available
NC : Noncombustible solid or liquid
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ST : Short term exposure limit
TMP : 30-minute maximum peak
Ukn : Unknown
V : Varies according to compound
°C : degrees Celsius
°F : degrees Fahrenheit

FEB 20 1980

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing,
Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME MALLINCKRODT, INC.	**EMERGENCY TELEPHONE NO.** 606/987-7000
ADDRESS *(Number, Street, City, State, and ZIP Code)* P.O. Box M, Paris, KY 40361	
CHEMICAL NAME AND SYNONYMS SULFURIC ACID	**TRADE NAME AND SYNONYMS** Oil of Vitriol
CHEMICAL FAMILY Inorganic Acid	**FORMULA** H_2SO_4

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.) Decomposes	640°	SPECIFIC GRAVITY ($H_2O=1$)	1.84
VAPOR PRESSURE (mm Hg.) @ 145.8°C	1mm	PERCENT, VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR=1)	2.8	EVAPORATION RATE (______ =1)	
SOLUBILITY IN WATER INFINITELY!	CAUTION!	Always add acid slowly to water. Never add water to acid.	
APPEARANCE AND ODOR Clear, colorless, syrupy liquid. Odorless.			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA
Dry chemical on the acid. Water on combustiles nearby.

SPECIAL FIRE FIGHTING PROCEDURES
Care should be taken not to spray water into acid as it produces heat and steam, and results in spattering.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Highly reactive and capable of igniting finely divided combustible materials on contact. CORROSIVE MATERIAL. See Sec. VI

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
TWA: 1mg/m^3 Toxicity: Oral-Rat-LD_{50} - 2140 mg/Kg.

EFFECTS OF OVEREXPOSURE
Corrosive to all body tissue. Can cause severe acid burns. Inhalation and ingestion of fumes can cause damage to lungs.

EMERGENCY AND FIRST AID PROCEDURES
EYES AND SKIN: Flush contact parts with copious amounts of water. Call physician. INGESTION: Call physician. Administer copious amounts of water if patient is conscious. Do not induce vomiting. INHALATION: Give artificial respiration if victim is not breathing. Call physician.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (Materials to avoid) Water, carbides, chlorates, fulminates, nitrates, picrates, powdered metals and finely divided combustible materials.

HAZARDOUS DECOMPOSITION PRODUCTS Sulfur oxides.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Cover the contaminated surface with sodium bicarbonate or a soda ash, slaked lime mixture (50-50). Mix and add water if necessary to form a slurry. Scoop up slurry and wash down the drain with excess water. Wash site with soda ash solution.

WASTE DISPOSAL METHOD
Add very slowly to large volume of agitated solution of soda ash and slaked lime. Add neutralized solution to excess running water.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
Gas mask or respirator with acid gas cartridges.

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General) X	OTHER
PROTECTIVE GLOVES Rubber		EYE PROTECTION Splash-proof goggles or face shield.

OTHER PROTECTIVE EQUIPMENT Wear full rubber protective clothing.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Separate from items listed under INCOMPATABILITY above. Protect against physical damage and water.

OTHER PRECAUTIONS

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U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME MALLINCKRODT, INC.	EMERGENCY TELEPHONE NO. 606/987-7000
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. Box M, Paris, KY 40361	
CHEMICAL NAME AND SYNONYMS NITRIC ACID	TRADE NAME AND SYNONYMS Aqua Fortis, Azotic Acid
CHEMICAL FAMILY Inorganic Acid	FORMULA HNO_3

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	186.8°F	SPECIFIC GRAVITY (H_2O=1)	1.502
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (_____ =1)	-
SOLUBILITY IN WATER	Infinitely	Molecular Weight	63.02
APPEARANCE AND ODOR	Clear to slightly yellow liquid. Characteristic odor.		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA
Use water spray; wear self-contained breathing apparatus.

SPECIAL FIRE FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARDS
Increases the flammability of combustible, organic and readily oxidizable materials.
Oxidizer and corrosive! Reacts violently with acetic acid and acetic anhydride.
Refer also to Sec. VI and IX.

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
TWA 2ppm

EFFECTS OF OVEREXPOSURE
Causes discoloration and corrosion of contact areas. May cause severe burns. Vapors are highly irritating to eyes, skin and mucous membranes. Inhalation of vapors may cause acute or chronic pulmonary problems.

EMERGENCY AND FIRST AID PROCEDURES
Inhalation: Call doctor and give artificial respiration if victim is not breathing.
Ingestion: Call doctor, and if patient is conscious give large quantities of water. DO NOT INDUCE VOMITING.
Skin and Eye Contact: Immediately wash well with water and call doctor.

SECTION VI - REACTIVITY DATA

STABILITY	**UNSTABLE**		**CONDITIONS TO AVOID**
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)* Strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

HAZARDOUS DECOMPOSITION PRODUCTS
Oxides of nitrogen.

HAZARDOUS POLYMERIZATION	**MAY OCCUR**		**CONDITIONS TO AVOID**
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Cover surface with soda ash, slaked lime mixture (50-50). Mix and add water if necessary. Scoop up slurry and wash down drain with excess water. Wash site with soda ash solution.

WASTE DISPOSAL METHOD
Add slowly to large volume of soda ash solution with agitation. Add neutralized solution to running water and flush to sewer in a concentration which local sewer ordinances allow.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
Organic vapor canister or self-contained apparatus.

VENTILATION	**LOCAL EXHAUST**	**SPECIAL**
	MECHANICAL *(General)* X	**OTHER**

PROTECTIVE GLOVES Rubber Gloves	**EYE PROTECTION** Face shield or splash-proof goggles.

OTHER PROTECTIVE EQUIPMENT Rubber boots and apron.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Protect against physical damage. Separate from metallic powders, carbides, hydrogen sulfide and turpentine, organic acids and all combustibles, and all other readily oxidizable materials. Provide good ventilation and protect from direct sunlight.

OTHER PRECAUTIONS

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U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

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MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME MALLINCKRODT, INC.	EMERGENCY TELEPHONE NO. 606-987-7000
ADDRESS *(Number, Street, City, State, and ZIP Code)* P.O. Box M Paris, Kentucky 40361	
CHEMICAL NAME AND SYNONYMS Hydrochloric Acid	TRADE NAME AND SYNONYMS Muriatic Acid
CHEMICAL FAMILY Inorganic Acid	FORMULA HCl (aqueous soln)

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)		SPECIFIC GRAVITY (H_2O=1)	1.18
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR=1)	1.3	EVAPORATION RATE (water =1) about	1
SOLUBILITY IN WATER Infinitely	miscible		
APPEARANCE AND ODOR	Clear, colorless solution, pungent odor of hydrogen chloride.		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA
Any media suitable for extinguishing the supporting fire.

SPECIAL FIRE FIGHTING PROCEDURES
Wear full protective clothing and self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Contact with metals produces hydrogen which forms explosive mixtures with air.
Strongly corrosive.

(Continued on reverse side)

SECTION V · HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE 5 ppm (ceiling)

EFFECTS OF OVEREXPOSURE
Concentrated solutions cause severe burns; permanent visual damage may occur. Inhalation: Cough, choking, inflamation of respiratory tract. Ingestion: corrosion of mucous membranes, nausea, vomiting, diarrhea.

EMERGENCY AND FIRST AID PROCEDURES
Skin contact: Water flush immediately and call doctor. Inhalation: Give artificial respiration if breathing has stopped; call doctor. Eye Contact: Immediately wash with water for 15 minutes; call doctor. Ingestion: Call doctor; if patient is conscious, give water. Do not induce vomiting!

SECTION VI · REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)*
Alkalis and metals, acetic anhydride, ethylenediamine, NH_4OH, chlorosulfonic acid.

HAZARDOUS DECOMPOSITION PRODUCTS
Fumes of hydrogen chloride and hydrogen in contact with metals; chlorine from oxidizers.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII · SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Cover contaminated surface with sodium bicarbonate or a soda ash, slaked lime mixture (50-50). Mix and add water if necessary to form a slurry. Scoop up slurry a wash down drain with excess water. Wash site with soda ash solutions.

WASTE DISPOSAL METHOD
Neutralize and dilute in large amount of water. Wash to sewer with excess water.

SECTION VIII · SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
Gas mask with acid vapor canister or self-breathing apparatus.

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)* X	OTHER

PROTECTIVE GLOVES Rubber	EYE PROTECTION Goggles

OTHER PROTECTIVE EQUIPMENT Rubber suit or lab coat.

SECTION IX · SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Protect against physical damage. Store in a cool, well-ventilated place, separate from all oxidizing agents.

OTHER PRECAUTIONS

PAGE (2)
GPO 930-346

Form OSHA-20
Rev. May 72

C Quality Assurance Project Plan

Quality Assurance Project Plan for Expanded Site Investigation at Griffiss Air Force Base, Rome, New York

Contract No. DACW41-94-D-0091
Delivery Order No. 0022

August 1997

Prepared for:

U.S. ARMY CORPS OF ENGINEERS KANSAS CITY DISTRICT
601 East 12th Street
Kansas City, Missouri 64106

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
368 Pleasant View Drive
Lancaster, New York 14086

Table of Contents

Section Page

C Quality Assurance Project Plan C-1

1 Introduction C-1-1

2 Project Description C-2-1
  2.3 Project Scope and Objectives C-2-1

3 Project Organization and Responsibility C-3-1
  3.1 Project Organization C-3-1
    3.1.1 Ecology and Environment, Inc. C-3-1
    3.1.2 Analytical Services Center C-3-1

4 Data Use and QA Objectives for Measurement Data C-4-1
  4.1 Data Use C-4-1

5 Sampling Procedures C-5-1
  5.1 Order of Sample Collection C-5-1

  5.2 Sample Labels C-5-1

  5.3 Sample Identification C-5-2

6 Sample Chain-of-Custody, Packing, and Transportation C-6-1

7 Analytical Procedures C-7-1

8 Calibration Procedures C-8-1
  8.1 Calibration Procedures For the Field Instruments C-8-1

  8.2 Laboratory Instrument Calibration Procedures C-8-1

9 Data Reporting, Evaluation, and Reduction C-9-1
    9.1.4 Data Reporting C-9-1

Table of Contents (Cont.)

Section Page

10 Internal QC Checks for Field and Laboratory Operations C-10-1
    10.1 Field QC Samples C-10-1

    10.3 Control Limits C-10-1

11 Performance and System Audits C-11-1

12 Preventative Maintenance C-12-1

13 Data Assessment Procedures C-13-1

14 Corrective Action C-14-1

15 Quality Assurance Reports C-15-1

16 Bibliography C-16-1

Appendix

C-A Resumes of Key Personnel C-A-1

C-B Ecology and Environment, Inc., Analytical Services Center Master Quality Assurance Plan (MQAP) C-B-1

C-K Internal QC Procedures and Acceptance Criteria—Additions C-K-1

C-L List of Analytes of Interest and Detection Limits C-L-1

C-M Control Limits for Analytical Methods—Updates C-M-1

List of Tables

Table Page

1-1 QAPjP Appendices C-1-3

2-1 Areas of Interest C-2-3

3-1 Names, Addresses, and Telephone Numbers of Key Project Personnel C-3-3

7-1 Analytical Methods, Expanded Site Investigation, Griffiss AFB, Rome, New York C-7-2

See Appendix C-B (MQAP) for relevant table page numbers.

C-K-1 Summary of Internal Quality Control Procedures and Quality Control Acceptance Criteria C-K-3

C-L-1 Detection Limits for Analytes of Interest Total Metals and Miscellaneous Analytes C-L-3

C-L-2 Detection Limits for Analytes of Interest Organic Methods C-L-6

C-M-7 Percent Recovery Limits for Metals (updated) C-M-3

C-M-9 Percent Recovery Limits for Semivolatiles for EPA Method 8270 . . . . C-M-4

C-M-13 QC Acceptance Criteria for EPA Method 8310 . . . . C-M-5

List of Illustrations

Figure Page

5-1 Sample Custody Seal/Labels C-5-4

6-1 Sample Chain-of-Custody Record C-6-2

14-1 QA/QC Discrepancy Form C-14-2

1 Introduction

Griffiss Air Force Base (AFB) is a former Air Combat Command Installation covering 3,539 acres located in the Mohawk River Valley near Rome, New York. Standard United States Air Force (USAF) operations involving the use of toxic and hazardous substances has resulted in some contamination to the site soils and groundwater.

The purpose of this expanded site investigation (ESI) at 10 areas of interest (AOIs) and confirmatory sampling (CS) at two AOIs is to investigate and evaluate whether past or present activities at these 12 sites may impact public health and the environment. The results of this study will be used to determine whether these sites should be added to the current list of AOIs that require no further study (NFS) or to develop appropriate remedial plans, if necessary.

This Quality Assurance Project Plan (QAPjP) is part of the ESI planning documents prepared for the project "ESI at Griffiss Air Force Base (GAFB), Rome, New York." As directed in the scope of work and to avoid duplication of effort, Ecology and Environment, Inc., (E & E) has developed this QAPjP as an addendum to the information contained in the Law Engineering and Environmental Services, Inc., (Law Environmental) Volume IIA, Sampling and Analysis Plan/QAPjP (Law Environmental QAPjP) (July 1993). The Law QAPjP was developed specifically for RI activities; therefore, some of the data uses, analytical methods, and sampling activities are not applicable to the CS activities that will also be performed during the ESI program. The Law Environmental QAPjP has been tailored via this addendum to be applicable to the ESI and CS components of the work. This addendum documents changes, modifications, or new procedures and practices to be used that are applicable to activities included under the ESI program. Specific section replacement elements of the Law Environmental QAPjP have been indented and single-spaced. Applicable appendices are listed in Table 1-1.

Project work is to be performed by E & E. Analytical work will be conducted by E & E's Analytical Services Center (ASC). E & E's ASC Master Quality Assurance Plan (MQAP) is provided in this document as a replacement Appendix B. Soil, sediment, surface

(MQAP) is provided in this document as a replacement Appendix B. Soil, sediment, surface water, and groundwater samples will be collected and sent to the ASC for analysis. Waste characterization samples also will be sent to E & E's ASC for analysis.

Detection limits and other quality control (QC) criteria are formulated in accordance with United States Environmental Protection Agency (EPA) methods and on a project- and laboratory-specific basis. Project-specific requirements are incorporated into this QAPjP.

Table 1-1

QAPjP APPENDICES

Appendix	Description	E & E Equivalent
A	Resumes	Replaced; E & E Appendix A
B	Princeton Testing Laboratory QAPP	Replaced, E & E's ASC MQAP
C	CTM Analytical Laboratories, Ltd., QAPP	Not applicable
D	Controls for Environmental Pollution, Inc., QAPP	Not applicable
E	Roy F. Weston, Inc., QAPP	Not applicable
F	Strontium 89/90 Method	Not applicable
G	Glycol Method APC-44 NYSDOH	No change, not provided
H	Lipid In Fish Method	Not applicable
I	Daphnia Magna Method	Not applicable
J	Microtox Standard Assay Method	Not applicable
K	Internal QC Procedures and Acceptance Criteria	No change for applicable methods, additions provided
L	List of Analytes of Interest and Detection Limits	Replaced, E & E Appendix L
M	Control Limits for Analytical Methods	Updated, additions provided, E & E Appendix M
N	Work and Test Procedures for Field Notebook	Replaced in Section 3, FSP
O	Quadrel Services, Inc., QAPP	Not applicable
P	Target Environmental Services, Inc., QAPP	Not applicable

Key:

ASC = Analytical Services Center.
E & E = Ecology and Environment, Inc.
FSP = Field Sampling Plan.
MQAP = Master Quality Assurance Plan.
NYSDOH = New York State Department of Health.
QAPjP = Quality Assurance Project Plan.
QAPP = Quality Assurance Program Plan.
QC = Quality control.
SOP = Standard operating procedure.

E & E appendices that replace the Law Environmental appendices in Table 1-1 are included in the back of this document.

2 Project Description

The information on site location, history and environmental setting presented in Sections 2.1 and 2.2 of the Law Environmental QAPjP is applicable to activities conducted under the ESI program. An addition to Table 2-1 of the Law Environmental QAPjP, *List of Installation Restoration Program Sites*, has been provided as Table 2-1 in this plan that lists the AOIs where sampling will be performed during the ESI. Additional information that is provided in the Law Environmental QAPjP such as the AOI locations and Field Tasks and Rationale are provided in Section 2.2 of E & E's ESI Field Sampling Plan. Modifications to Section 2.3 of the Law Environmental QAPjP are provided below:

2.3 Project Scope and Objectives

The purpose of this ESI program is to investigate and evaluate whether past or present activities at 12 AOIs at Griffiss AFB may impact public health and the environment. The data will be used to determine whether these AOIs should be recommended for NFS or to develop remedial plans, if necessary. The scoping of the project included a review of historical data—including records, documents, drawings, photographs, and previous sampling data. Groundwater data were used to determine whether sufficient data exist to determine the direction of groundwater flow and whether the groundwater at a particular AOI has been impacted by certain site operations.

The field portion of the ESI program will include a geophysical survey, near-surface soil, and surface water/sediment sample collection, and the drilling of subsurface borings and subsurface soil sampling using a truck-mounted drill rig and hollow-stem auger techniques. Permanent wells will be installed in certain borings to allow for collection of groundwater samples. At AOIs where CS is to be performed, temporary wells will be installed in certain borings to allow for collection of groundwater samples for screening purposes.

Table 2-1

AREAS OF INTEREST

AOI	Description
7	Southeast Skyline Housing Probable Landfill
9	Weapons Storage Area (WSA) Landfill
16/193	Coal Storage and Debris Deposition Area West of Building 7/ Former Building P5 Tank Cleaning and Cutting Area
17	Disposal Area Northeast of Hardfill 49c
24	CE Road Paint Dump Areas
58/101	P3/Building 14 Railroad Loading/Unloading and Storage Area/ Building 3 Fuel Dumping Area
67	Former Storage Area Beneath Building 700
90	Industrial Soils Pad Area
100	Paint Staging Area Northeast of Former Engine Testing Facility
102	Lindane Spill Site

Key:

AOI = Area of Interest.

3 Project Organization and Responsibility

The information on key individuals presented in Section 3.2 of the Law Environmental QAPjP are applicable to E & E quality assurance (QA) personnel roles and responsibilities for individuals required for this project. Names of E & E personnel are listed in Table 3-1. Modifications to Section 3.1 are provided below:

3.1 Project Organization

The primary subcontractors involved in the work activities for this project are described below. Appendix A contains resumes for key E & E personnel.

3.1.1 Ecology and Environment, Inc.

E & E will provide project management, sampling, and data evaluation and reporting. Subcontractor names will be provided at a later date.

3.1.2 Laboratory Analysis

Sample analysis will be performed by E & E's ASC. The ASC's MQAP is presented in Appendix B.

Table 3-1

NAMES, ADDRESSES, AND TELEPHONE NUMBERS OF KEY PROJECT PERSONNEL

U.S. Army Corps of Engineers Project Manager: Commander U.S. Army Engineer District, Kansas City Attn: CEMRK-EP-EA (Mr. Frank McStay) 601 East 12th Street, Room 842 Kansas City, MO 64106-2896
Point of Contact On Site: Commander AFBCA/OL-X (Mr. Michael McDermott) 153 Brooks Road Rome, NY 13441-4105 (315) 330-2275
Ecology and Environment, Inc., Project Principal Mr. Gerald A. Strobel, P.E. 368 Pleasantview Drive Lancaster, NY 14086 (716) 684-8060
Ecology and Environment, Inc., Delivery Order Manager Mr. Thomas Ferraro, P.G. 368 Pleasantview Drive Lancaster, NY 14086 (716) 684-8060
Ecology and Environment, Inc., Field Team Leader, Project Geologist Mr. Donald A. Johnson, P.G. 368 Pleasantview Drive Lancaster, NY 14086 (716) 684-8060
Ecology and Environment, Inc., Health and Safety Officer Mr. Tom Siener, CIH 368 Pleasantview Drive Lancaster, NY 14086 (716) 684-8060
Ecology and Environment, Inc., Project Chemist Ms. Lynn Hess 368 Pleasantview Drive Lancaster, NY 14086 (716) 684-8060
Ecology and Environment, Inc., Laboratory Director Mr. Gary Hahn 4493 Walden Avenue Lancaster, NY 14086 (716) 685-8080

4 Data Use and QA Objectives for Measurement Data

The data generated for this project must be of sufficient quality and quantity to meet the overall objectives of the project, including investigation of AOIs for pertinent parameters of contamination; evaluation of contamination with regard to actual or potential hazards to public health and the environment; preparation of recommendations for no further study (NFS) or to develop further assessment or remedial plans, if necessary; and documentation of the findings and results of all work. The information presented in Sections 4.3 and 4.2 of the Law Environmental QAPjP is applicable to the activities anticipated under this investigation. Modifications to Section 4.1 are provided below:

4.1 Data Use

The data acquired for the project will be used as the baseline data for the following purposes:

- Site Characterization - The data will be used to determine the nature and extent of contamination. Characterization of the AOIs will use data generated by the collection and analyses of environmental samples.
- Health and Safety - Real-time field data will be used to establish the level of protection needed for the work party, other site-related personnel, and the public. This data will be gathered by the use of flame ionization detectors (FIDs), explosimeters, and oxygen meters during intrusive activities.
- The data will be used to evaluate need for no further action or additional investigation or to support the development of remedial plans, if necessary.

5 Sampling Procedures

The current field work for the ESI includes a geophysical survey, near-surface soil sampling, soil borings, subsurface soil sampling, groundwater sampling, equipment decontamination, and management of investigation-derived material. These functions and the procedures used to perform field investigation activities are described in detail in Section 3 of E & E's ESI Work Plan. Sections of the Law Environmental QAPjP applicable to activities anticipated under this investigation are described below. The information regarding sample containers, preservation, and holding times provided on Tables 5-1 and 5-2 of the Law Environmental QAPjP are applicable for all parameters included under this investigation except as noted below.

Method SW 8310 for polynuclear aromatic hydrocarbons (PAHs) requires the same sample containers, preservation, and holding times provided for Method SW 8270 in Tables 5-1 and 5-2 of the Law Environmental QAPjP. Method SW 8260 for volatile organics has a holding time of 10 days for preserved waters instead of 7 days because analysis does not include acrolein and acrylonitrile. Updated tables are provided in the FSP.

5.1 Order of Sample Collection

The sampling order described in Section 5 of the Law Environmental QAPjP will be used for the applicable parameters.

5.2 Sample Labels

The sampling labels will be pre-printed using E & E's Sample Tracking System (STS) or hand-written as needed. A copy of E & E's sampling labels are provided as Figure 5-1. The information provided on the label is indicated in the Figure 5-1.

5.3 Sample Identification

The site identification numbering system for the Griffiss AFB samples is summarized as follows:

Sample Identification

Individual samples will be identified by a unique alphanumeric code. Normal field samples (non-quality control) will be numbered according to the following convention:

G = the project site, Griffiss AFB (1 character)
016 = the AOI site number, AOI #16 (3 digit number)
SS = the sample type, subsurface (2 characters)
Z1 = sequential number qualifying whether a sample is the first or second depth sample from a borehole or whether a sample is a soil, groundwater, or a filtered groundwater sample from an LSA boring.

The sample type codes for this project include:

DR = drum
GS = soil gas
GW = groundwater
SD = sediment
SG = soil grab
SS = subsurface soil
SW = surface water

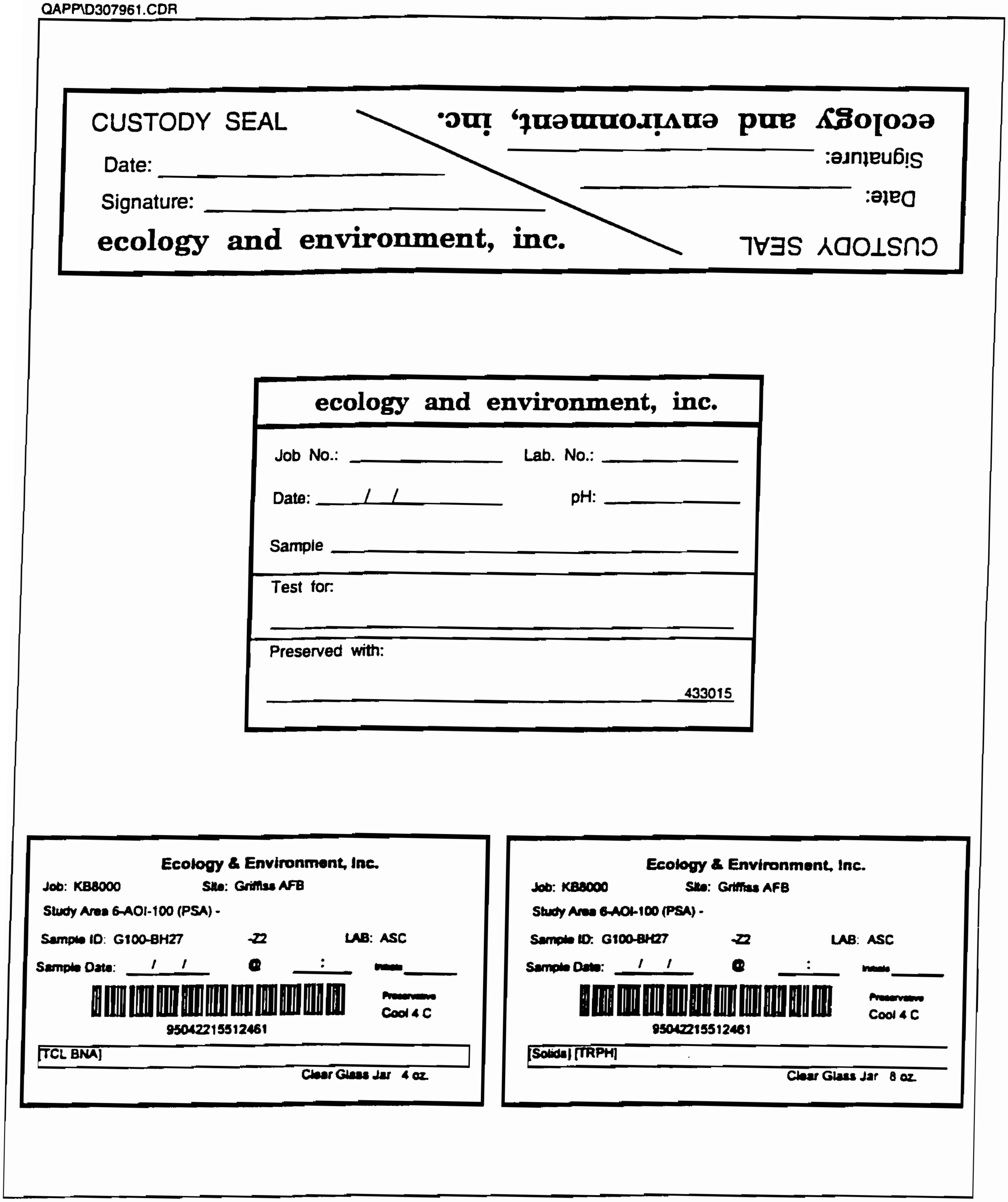
(A separate sample matrix code which matches the codes required by Installation Restoration Program Information Management System [IRPIMS] is attached to the sample in a separate field.)

The samples are maintained in the STS in two parts. The first nine digits of the normal sample name are unique to a horizontal surface location. This is equivalent to the LOCID in the IRPIMS database. In STS, this location identifier is called the client_id. The "-Z1" portion of the sample identifier is kept in a separate field called the sample_id in STS. This was done to facilitate creation of IRPIMS data files.

The quality control samples are also identified in a manner to maximize efficiency of creating files that satisfy IRPIMS database requirements. Field duplicates and field splits, are all named with a client_id/LOCID suffix of "S" for split or "D" for duplicate. Field equipment rinsate samples, and trip blanks are all named with a client_id/LOCID of "FIELDAC." Lab quality control samples, in this case matrix spike/matrix spike duplicates, are all defined with a client_id/LOCID of "LABQC."

In order to differentiate from which subsurface location the duplicates and MS/MSD samples are taken, the second half of the sample number represents the sample location. For example, "FIELDQC-SS04-GW" is the MS/MSD of the water sample from boring SS04. The qualifier added for trip blanks and rinsate blanks is "TB-yy" or "RB-yy," where yy represents the AOI number.

QAPP\D307961.CDR



CUSTODY SEAL

Date: ____________________

Signature: ____________________

ecology and environment, inc.

ecology and environment, inc.

Signature: ____________________

Date: ____________________

CUSTODY SEAL

ecology and environment, inc.

Job No.: ____________ Lab. No.: ____________

Date: ___/___/___ pH: ____________

Sample ____________________

Test for:

Preserved with:

433015

Ecology & Environment, Inc.

Job: KB8000 Site: Griffiss AFB

Study Area 6-AOI-100 (PSA) -

Sample ID: G100-BH27 -Z2 LAB: ASC

Sample Date: ___/___/___ @ ___:___ Initials ______

Preservative

Cool 4 C

95042215512461

[TCL BNA]

Clear Glass Jar 4 oz.

Ecology & Environment, Inc.

Job: KB8000 Site: Griffiss AFB

Study Area 6-AOI-100 (PSA) -

Sample ID: G100-BH27 -Z2 LAB: ASC

Sample Date: ___/___/___ @ ___:___ Initials ______

Preservative

Cool 4 C

95042215512461

[Solids] [TRPH]

Clear Glass Jar 8 oz.

SAMPLE CUSTODY SEAL/LABELS

6 Sample Chain-of-Custody, Packing, and Transportation

The information on sample custody presented in Section 6 of the Law Environmental QAPjP is applicable to activities anticipated under this investigation except as noted below.

- Figure 6-2, Custody Seal—See Figure 5-1 of this QAPjP;
- Figure 6-3, Chain-of-Custody Record—Replaced (see Figure 6-1 of this QAPjP);
- Figure 6-4, Cooler Receipt Form—See Figure 2-3 of the ASC MQAP, p. 2-127 (the ASC MQAP is attached to this QAPjP as Appendix B);
- Figure 6-5, Request for Analysis Form—The Request-for-Analysis Form used by Law Environmental is a part of the E & E Chain-of-Custody Form and in electronic format (see Figure 6-1 and description below) for E & E's ASC. The Request-for-Analysis form will be used for shipments to the United States Army Corps of Engineers (USACE) Missouri River Division (MRD) laboratory.

In addition to the sample custody procedures specified by the Law Environmental QAPjP, E & E will utilize a field sample tracking system program to document sample requirements and collection information. An electronic sample request file indicating the client identification, sample data, and applicable test codes will be sent with each shipment of samples. The laboratory will transfer the electronic information to the laboratory management information system during sample log-in and verify the information against the hard-copy chain-of-custody.

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CHAIN-OF-CUSTODY

Page _____ of _____

Project No.:	Project Name:	Project Manager:
Samplers: (Signatures)		Field Team Leader:

STATION NUMBER	DATE	TIME	SAMPLE TYPE			SAMPLE INFORMATION	STATION LOCATION	NUMBER OF CON-TAINERS	REMARKS
			COMP	GRAB	AIR	EXPECTED COMPOUNDS			

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Ship Via	
Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Relinquished By: (Signature)	Date/Time	Received By: (Signature)	BL/Airbill Number:	Date
Relinquished By: (Signature)	Date/Time	Received for Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time	Received for Laboratory By: (Signature)		

Distribution: Original Accompanies Shipment: Copy to Coordinator Field Files

*See CONCENTRATION RANGE on back of form.

Figure 6-1 SAMPLE CHAIN-OF-CUSTODY RECORD

3079_CC PM5

7 Analytical Procedures

The analytical procedures to be used in the investigation of the AOIs are provided in Table 7-1. The required QC procedures, QC samples, QC acceptance criteria, and corrective actions applicable to each analytical method are summarized in Appendix K of the Law Environmental QAPjP and for polynuclear aromatic hydrocarbons (PAHs) in Appendix K of this QAPjP. Detection limits and analytes of interest for this project are summarized in Appendix L of this QAPjP. Control limits are summarized in Appendix M of the Law Environmental QAPjP or as updated in Appendix M of this QAPjP. The information presented in the following sections of the Law Environmental QAPjP is applicable to the activities anticipated under this investigation:

- Sections 7.1.1.3, 7.1.1.4, 7.1.1.7, 7.1.1.8, 7.1.1.9, and 7.1.1.10; and
- Sections 7.1.3.1, 7.1.3.2, 7.1.3.3, 7.1.3.14, 7.1.3.15, and 7.1.3.16.

Table 7-1

ANALYTICAL METHODS
EXPANDED SITE INVESTIGATION PROGRAM
GRIFFISS AFB, ROME, NEW YORK

Matrix	Parameter	Method
Field Screening Analyses		
Water	pH	EPA 150.1
	Specific Conductance	EPA 120.1
	Temperature	EPA 170.1
	Turbidity	EPA 180.1
Off-Site Analytical Laboratory Analyses		
Water	Volatile Organic Compounds	SW 5030/8260
	Semivolatile Organic Compounds	SW 3510/8270
	Pesticides/PCBs	SW 3510/8081
	PAHs	SW 8310
	Metals[a]	SW 6010[b]
	Mercury	SW 7470
	Phosphorus	EPA 365.2
	TRPH	EPA 418.1
Soils/Sediments	Volatile Organic Compounds	SW 5030/8260
	Semivolatile Organic Compounds	SW 3550/8270
	Pesticides/PCBs	SW 3550/8081
	Metals[a]	SW 6010[b]
	Mercury	SW 7471
	Phosphorus	EPA 365.2
	TRPH	SW 9073
	% solids	EPA 160.3

Key at end of table.

Table 7-1 (Cont.)

[a] Total Metals (all are Target Analyte List [TAL] metals):

Aluminum, Al
Antimony, Sb
Arsenic, As
Barium, Ba
Beryllium, Be
Cadmium, Cd
Calcium, Ca
Chromium, Cr
Cobalt, Co
Copper, Cu
Iron, Fe
Lead, Pb
Magnesium, Mg
Manganese, Mn
Mercury, Hg
Nickel, Ni
Potassium, K
Selenium, Se
Silver, Ag
Sodium, Na
Thallium, Tl
Vanadium, V
Zinc, Zn

[b] If the PQLs cannot be met, antimony and thallium may be analyzed using methods 704 and 784, respectively.

Key:

ASTM = American Society of Testing and Materials, Annual Book of ASTM standards, 1986.
EPA = United States Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes*, EPA, 1983.
M = Modified.
NYSDOH = New York State Department of Health, *APC44: Tentative Method for the Determination of Glycol in Water*, Rev. 5/91.
PAHs = Polynuclear aromatic hydrocarbons.
PCBs = Polychlorinated biphenyls.
SW = *Test Methods for Evaluating Solid Wastes Physical/Chemical Methods*, Solid Waste 846, 1986.
TRPH = Total recoverable petroleum hydrocarbons.

8 Calibration Procedures

Table 7-1 lists the applicable analytical methods used for the investigation of the AOIs. Information on methods added for this project is provided in Appendix K of this QAPjP. The information on laboratory and field instrumentation presented in Section 8 and Appendix K of the Law Environmental QAPjP is applicable to the activities anticipated under this investigation for applicable parameters except as noted below:

8.1 Calibration Procedures For the Field Instruments

Each field instrument will be calibrated using methods and at frequencies described in Section 2.6 of the E & E ASC MQAP.

8.2 Laboratory Instrument Calibration Procedures

Calibration procedures for laboratory instrumentation included in Appendix K are applicable except as follows:

- Method SW-846 6010 initial calibration of the inductively coupled argon plasma spectrometer uses a two-point curve per manufacturers specifications followed by analysis of additional standards to establish linearity of the instrument over a four-point curve.

9 Data Reporting, Evaluation, and Reduction

The information on data reporting, evaluation, and reduction presented in Section 9 of the Law Environmental QAPjP is applicable to activities anticipated under this investigation except as noted below:

9.1.4 Data Reporting

E & E's laboratory management information system (LABMIS) is used for the processing of all information in the laboratory, including sample log in, sample sign out to and back from individual analysts, data storage and reporting, and sample disposal. LABMIS is equivalent to the system described in this section with additional detail provided in Section 4 of E & E's MQAP provided as Appendix B to this addendum.

If the sample analysis exceeded holding times, data will be rejected. The samples will be recollected and reanalyzed for the methods where holding times have been exceeded. Exception to acceptance of such data will be determined by the USACE chemist on a case-by-case basis. In that case, data will be flagged appropriately.

The following additional criteria apply to data evaluation and reporting for this project:

- All instruments will be calibrated as per method requirements, and the information will be documented and stored at the laboratory.
- Initial calibration and continuous calibration checks will be run. If the checks are out of method compliance, appropriate actions will be taken until the checks are in compliance. Summary tables for calibration will be submitted with the report.
- Ion-abundance criteria must be met for all range of masses for applicable methods as per method requirement. This information will be kept on file and will be retrieved when the data is suspect.

- LCS % recovery criteria must be met as per method requirements. If LCS % recovery criteria is outside the QC control limit, corrective action will be followed until LCS recoveries are acceptable. Data will be rejected automatically, when LCS recoveries are outside the QC control limit.

- Internal standards, surrogates, and spike recoveries must be within QC required limits. If recoveries are out of method specified limits, appropriate corrective actions will be taken and documented. Data shall be rejected automatically if no corrective actions are taken. If the recoveries are still out after all possible corrective actions have been taken, the data shall be flagged appropriately.

- Tentatively identified compounds (TICs) are to be reported.

- Dilution Factor: If the sample is diluted, the appropriate multiplier shall be used for MDL. In addition, the data for undiluted sample must be reported along with the diluted sample data.

- Concentrations reported between PQL and MDL will be flagged J.

- Serial Dilution and/or Method of Standard Addition process will be utilized as per method requirement and for those samples when metal interference is detected. Appropriate dilution will be performed to comply with established MDL and project requirements. All the data will be reported.

- All data results will be signed by an individual analyst and group leader. The SDG package will be signed by the QA officer. All case narrative and corrective action reports will be signed by the QA officer.

- The SDG data package will be numbered numerically with proper table of contents.

The ASC project manager will designate up to 20% of the samples that will be reported in a complete data package consistent with EPA Contract Laboratory Program (CLP) - type requirements. The samples will be analyzed according to the specified methods. NYSDEC must select samples prior to submission of the samples for analysis.

10 Internal QC Checks for Field and Laboratory Operations

Field QC samples required for the AOIs are provided in Tables 3-1 to 3-9 of E & E's CS Field Sampling Plan. The information on internal QC checks presented in Section 10 of the Law Environmental QAPjP is applicable to activities anticipated under this investigation except as noted below:

10.1 Field QC Samples

Equipment rinsates will be collected for both aqueous and nonaqueous nondedicated sampling equipment. Neither ambient conditions blanks nor field blanks are anticipated. Trip blanks will accompany shipments of water samples that are designated for volatile organic analysis. Trip blanks will accompany shipments sent to the E & E ASC and the MRD laboratories.

10.3 Control Limits

Control limits are provided in Appendix M of the Law Environmental QAPjP or as updated in Appendix M of this QAPjP. For SW8270 modified Table M-9 is provided.

11 Performance and System Audits

The criteria and procedures for performance and system audits are fully presented in Section 11 of the Law Environmental QAPjP and are applicable to activities anticipated under this investigation.

A single system audit of field activities will be scheduled under this investigation.

12

Preventative Maintenance

The preventative maintenance program presented in Section 12 of the Law Environmental QAPjP is applicable to activities anticipated under this investigation.

13 Data Assessment Procedures

Procedures used to assess data accuracy, precision, and completeness presented in Section 13 of the Law Environmental QAPjP are applicable to activities anticipated under this investigation.

14

Corrective Action

The procedures for corrective actions presented in Section 14 of the Law Environmental QAPjP are applicable to activities anticipated under this investigation. An example of E & E's corrective action form is provided in this QAPjP as a replacement for Figure 14-1 in the Law Environmental QAPjP.

A description of documentation procedures used during the field activities is presented in Section 4.3 of E & E's CS Field Sampling Plan.

ecology and environment, inc.

QA/QC DISCREPANCY

Laboratory Section ______________ Date of Analysis ______________

Type of Analysis ______________ Book ________ Page ________

Job No.(s) ______________

Sample(s) Affected ______________

Submitted To ______________ By ______________

Date ______________ Request Further Action ☐ YES* ☐ NO

*Complete Follow up Report Within Two Weeks

Date Closed ______________

Standard	________	Recovery	High	Low	Error in C-O-D	________
Surrogate	________	Recovery	High	Low	Incorrect Preservation	________
Spike	________	Recovery	High	Low	Samples Warm	________
EPA Known	________	Recovery	High	Low	Headspace in VOA Vial	________
Replicate	________	RPD Outside Limits			Damaged Shipment	________
Lab Blank	________	Contaminated With			Other	________

Hold Time Violation ________ / ________ Days

Run Outside Clock ________ / ________ Hrs.

Analytical Sequence Error ________

Insufficient QC Analyzed ________

Transcription Error ________

Calculation Error ________

Problem Explanation ______________

Corrective Action ______________

Follow Up Report ______________

Corrective Action Approved: ______________ Date ______________

______________ Date ______________

QA Review Completed ______________ Date ______________ Report Date ______________

Distribution: Sheet 1 (White) - Job File
Sheet 2 (Green) - ASC Manager
Sheet 3 (Canary) - QA Coordinator

Figure 14-1 QA/QC DISCREPANCY FORM

15 Quality Assurance Reports

QA reports, checklists, and memoranda presented in Section 15 of the Law Environmental QAPjP are applicable to activities anticipated under this investigation.

The regulators (NYSDEC/EPA) shall received 20% of the samples in a data package equivalent to EPA CLP format for review.

16 Bibliography

Law Engineering and Environmental Services, Inc., 1995, Draft Primary Report, *Remedial Investigation Report, Griffiss Air Force Base, New York*, Kennesaw, Georgia.

__________, July, 1993, Volume IIA, Sampling and Analysis Plan/Quality Assurance Project Plan.

Tetra Tech, Inc., 1994, Basewide Environmental Baseline Study, Griffiss Air Force Base, Rome, New York. Pasadena, California.

C-A Resumes of Key Personnel

THOMAS E. FERRARO **Delivery Order Manager**

EDUCATION:

M.S.,	Geology, Oklahoma State University at Stillwater
B.S.,	Geology, James Madison University
B.S.,	Earth Science Education, Slippery Rock State College

EXPERIENCE:

The manager of E & E's field support group, Mr. Ferraro has 15 years' experience. He specializes in the performance of remedial investigation/feasibility studies (RI/FSs) and the planning/ implementation of remedial action programs.

For Carborundum Corporation in Niagara Falls, New York, Mr. Ferraro managed E & E's RI/FS concerning contamination of groundwater in fractured Lockport dolomite bedrock by volatile organic compounds (VOCs). Responsible for project scheduling, cost control, and client/agency liaison, he led all technical aspects of the work, including groundwater modeling and evaluation of data obtained from 30 monitoring wells, interpretation of pump test data, and assessment of contaminant transport; report preparation; and implementation of initial remedial measures (tank cleaning and vacuum extraction of soil contaminants). Mr. Ferraro subsequently assisted Carborundum during the negotiation of the consent order for remedial action. He is managing the phased remediation of the bedrock aquifer and the innovative use of soil vapor extraction (SVE) to remediate VOC contamination of low-permeability soil within the unsaturated aquifer. Mr. Ferraro developed the SVE design based on site-specific contaminant characteristics, the extent of contamination, soil characteristics, depth to groundwater, emission control requirements, and site cleanup goals. Low-permeability surface soil was covered with a temporary liner and injected with air to increase system effectiveness.

Mr. Ferraro managed the RI/FS for the Schilling Farm site in Michigan. To address VOC, polychlorinated biphenyl, and heavy metal contamination, the RI included installation/sampling of 10 monitoring wells; a statistical characterization of surface and nearsurface soil by use of quick-turnaround, in-field soil-gas and inductively coupled argon plasma analyses; performance of surface geophysical surveys; wetland delineation; residential well sampling; and stream and sediment sampling. The field data were used in air and groundwater models to support the risk assessment and FS.

As the hydrogeology task leader for the Berks Sand Pit in Pennsylvania, Mr. Ferraro planned and managed a supplemental groundwater investigation to further characterize the vertical and areal extent of VOC contamination in fractured bedrock. The work involved installation/sampling of 10 well nests and performance of packer production tests for deep wells. Mr. Ferraro also led the data interpretation, design/siting of recovery wells, and performance of pumping tests to determine the recovery well capture area. Following the evaluation of the pumping test data, Mr. Ferraro managed the installation of additional downgradient monitoring wells to define the distal portion of the contaminant plume. To remediate this portion of the plume, he also managed the installation and pump testing of three additional recovery wells.

DONALD A. JOHNSON **Field Team Leader/Project Geologist**

EDUCATION:

B.S., Geology, State University of New York College at Buffalo

EXPERIENCE:

Mr. Johnson has 11 years' experience in the design/installation of groundwater monitoring-well networks, including the determination of aquifer characteristics by pump and slug testing; performance of geophysical investigations, including electromagnetic conductivity (EM), portable proton magnetometer, and ground-penetrating radar (GPR) surveys; performance of real- and integrated-time air monitoring, and performance/supervision of multimedia environmental sampling.

In support of E & E's Superfund Alternative Remedial Contracting Strategy program for Region III of the United States Environmental Protection Agency (EPA), Mr. Johnson was the hydrological predesign task leader for the remediation of solvent-contaminated groundwater at the Hellertown site in Pennsylvania. He supervised the drilling and installation of a deep bedrock extraction well and six bedrock monitoring wells to evaluate the extent of off-site contaminant migration. He also led packer and pump testing of the aquifer of concern and assisted in the interpretation of borehole geophysical logs. He supervised the modification of the on-site treatment system for solvent-contaminated groundwater brought to the surface by the pump testing. Throughout the fieldwork, he provided liaison with on-site representatives of both EPA and the Pennsylvania Department of Environmental Resources.

For E & E's remedial investigation/feasibility study (RI/FS) for the New York State Department of Environmental Conservation (NYSDEC) at the Madison Wire site in New York State, Mr. Johnson was on-site geologist and site safety officer. He was responsible for the drilling/installation of 38 soil borings and eight groundwater monitoring wells; test pit excavation; trenching; soil, sediment, and water sampling; and air monitoring to determine appropriate levels of personnel protection. He also performed all phases of the geophysical surveys, which included portable proton magnetometer, EM, and GPR surveys.

As site project manager for two NYSDEC Phase II engineering investigations at inactive hazardous waste sites, Mr. Johnson supervised all fieldwork, including test boring and groundwater monitoring-well installation; soil, water, surface water, and waste sampling; and site surveying/mapping. He also was responsible for project budget tracking and preparation of the final reports, which include updated Hazard Ranking System (HRS) documentation. In addition, in preparation for drilling activities at 14 NYSDEC Phase II sites, Mr. Johnson led geophysical (magnetometer, EM, and GPR) investigations and preparation of the associated reports. He was a member of the E & E team that conducted NYSDEC Phase I investigations (file searches, agency contact/interviews, site inspections/photodocumentation, ambient air monitoring, computation of preliminary federal HRS scores for site cleanup, and identification of data gaps) at over 40 sites.

THOMAS G. SIENER, CIH **Health and Safety Officer**

EDUCATION:

B.S., Biology, Purdue University

EXPERIENCE:

A Certified Industrial Hygienist with 21 years' experience, Mr. Siener is the manager of E & E's industrial hygiene/air quality group. He approves the selection of site health and safety officers and reviews their performance and air quality monitoring activities. He has directed major, multisite industrial hygiene programs; managed numerous surveys involving the sampling, quantification, and characterization of indoor and outdoor airborne pollutants; evaluated exposures to chemical and physical agents; developed air monitoring programs; and provided technical guidance for the development of recommendations and engineering controls to reduce exposure. A specialist in the preparation of site-specific safety plans, he routinely provides quality assurance for industrial hygiene-related activities in the United States and overseas.

On behalf of E & E's standby contract with the New York State Department of Environmental Conservation (NYSDEC), Mr. Siener reviewed/approved site-specific safety plans, led development of air monitoring and industrial hygiene procedures, and directed/performed safety and industrial hygiene field audits. As site safety auditor for E & E's remedial investigation/feasibility study (RI/FS) for the Madison Wire/Orban Industries site, he conducted industrial hygiene sampling for volatile organic compounds, in order to confirm the cause of high organic vapor analyzer readings. He provided health and safety support for the RI/FS for the Wellsville-Andover Landfill and for the five-year operation and maintenance program at the Dewey Loeffel Landfill. Throughout New York State, Mr. Siener also provided health and safety reviews and audits for numerous NYSDEC Phase II investigations at hazardous waste sites.

For the City of New York, he provided industrial hygiene/toxicological leadership during RI activities and the cleanup of mercury contamination at approximately 100 underground waterline valve chambers that were scattered throughout seven New York boroughs and the Catskill region. Mr. Siener conducted site inspections, evaluated the results of laboratory analyses, conducted hazard assessments, established health and safety protocol, led the development of site-specific safety plans and emergency procedures, trained cleanup contractor personnel in the safety procedures, and headed the E & E industrial hygiene team that monitored all on-site cleanup contractor activities.

During the construction of the 26th Ward Water Pollution Control Plant municipal sludge dewatering facility addition in New York City, Mr. Siener directed a field team in the collection of soil-gas and ambient air samples for cyanide analysis. Based on the analytical results, he recommended personal protective equipment levels, monitoring devices, and work procedures for the excavation crews.

LYNN M. HESS **Project Chemist**

EDUCATION:

B.A., Chemistry/Biology, State University College of New York at Buffalo

EXPERIENCE:

Ms. Hess has held several positions since joining E & E's Analytical Services Center (ASC) in 1983. Since 1993, as a quality assurance (QA) officer, she has been evaluating Contract Laboratory Program (CLP) data packages to ascertain contract and protocol compliance. She works with project and laboratory management personnel to establish data quality objectives and ensure that project-specific goals are met, reviews data validation reports and resolves discrepancies, reviews corrective actions with project managers, and identifies final action items and areas of concern.

From 1988 to 1993, at the ASC, Ms. Hess provided laboratory project management to support E & E's multisite program for the Federal Aviation Administration in Alaska; the remedial investigation/feasibility study (RI/FS) for the Naval Training Center Bainbridge and the investigation of the Naval Recreation Center Solomons, on behalf of the Navy's Engineering Field Activity, Chesapeake; the RI for a fire training area at Niagara Falls Air Force Base, for the United States Air Force Reserve; the Resource Conservation and Recovery Act facility assessment at the Hawthorne Army Ammunition Plant in Nevada for the Sacramento District of the United States Army Corps of Engineers (USACE); investigations at the United States Department of Energy's Pantex Plant in Texas for the USACE Tulsa District; the comprehensive RI/FS for the Schilling Farm site in Michigan, for a private-sector client; and investigations of polychlorinated biphenyl contamination at natural gas pipeline compressor stations, on behalf of a major gas industry client. In addition, at the ASC, Ms. Hess was responsible for the interpretation and application of the protocol used in generating the data packages. The work required her use of the Finnegan FORMASTER computer program to produce data packages and diskette deliverables.

Ms. Hess managed E & E's provision of analyses to support an investigation of the feasibility of using drill cuttings as roadbed material in Anchorage, Alaska. The work involved analysis of drill cuttings by use of the modified monofilled water extraction procedure, as well as testing for metals and anions on a quick-turnaround basis. Ms. Hess also led the development of an analytical method to analyze polyanionic cellulose, the drilling additive found in the cuttings.

From 1985 to 1988, she was a gas chromatograph/mass spectrometer (GC/MS) analyst, responsible for the analysis of both volatile and semivolatile compounds and performance of air monitoring for volatile compounds following United States Environmental Protection Agency (EPA) CLP protocol. She also participated in E & E's analytical programs to support asbestos investigation and abatement. From 1985 to 1988, she held certification from both EPA and the National Institute of Occupational Safety and Health for the identification and counting of asbestos fibers.

GARY E. HAHN **Director, Analytical Services Center**

EDUCATION:

B.S., Chemistry, State University of New York at Buffalo
A.A.S., Chemistry, Erie County Technical Institute

EXPERIENCE:

Mr. Hahn manages the daily operation of E & E's Analytical Services Center (ASC). The laboratory uses procedures approved by the United States Environmental Protection Agency (EPA) and New York State Department of Health and is approved by EPA and the New York State Department of Environmental Conservation for the analysis of hazardous waste associated with Superfund sites, as well as by the New York State Department of Health and numerous other states for the analysis of drinking water, wastewater, and waste.

Mr. Hahn's primary responsibility is to maintain the firm's state-of-the-art analytical capability. He directs all testing and analyses performed by the laboratory, including those involving air and water quality, solid waste classification and treatability, and biological impacts. He directs analyses of environmental samples for routine indicators of pollution as well as for specific pollutants such as pesticides, polychlorinated biphenyls (PCBs) and other toxic organics, and heavy metals. He has directed the evaluation of indoor air in municipal buildings and private homes. He designed and equipped a complete environmental laboratory at Yanbu, Saudi Arabia. He also had a key role in the design of E & E's ASC.

For E & E's extensive, quick-reaction environmental sampling/characterization program for Unocal at the Swanson River Field oil and gas development site in Alaska, Mr. Hahn closely coordinated the analyses of all water samples, as well as confirmation analyses for about 10% of the soil samples, at E & E's ASC. Similarly, he managed E & E's provision of contract laboratory support for the Western New York Nuclear Services Center at West Valley. The work included approximately 4,000 various analyses for samples of groundwater and other media.

Mr. Hahn has extensive experience in analytical method development and process troubleshooting, including gas and liquid chromatography; X-ray and mass spectrometry; infrared and atomic absorption and emission spectroscopy; and classical wet chemical methods of analysis. He is thoroughly familiar with methods approved by the National Institute of Safety and Health for personnel monitoring and analysis, including procedures for testing for metals, solvents, gases, vapors, dusts, asbestos, pesticides, and other substances.

Mr. Hahn worked for 16 years in the chemical industry. His special assignments included the design of analytical laboratories for new chlor-alkali plants and the training of associated personnel, participation in a chemical inventory task force concerned with the Toxic Substances Control Act, and service as the chemical transportation coordinator for an emergency response team.

MARCIA M. GALLOWAY **Quality Assurance Manager**

EDUCATION:

M.S., Analytical Chemistry, Indiana University
B.A., Chemistry, summa cum laude, Bowdoin College

EXPERIENCE:

Ms. Galloway, the leader of E & E's chemical group, provides independent quality assurance (QA) reviews of both field and analytical operations. She coordinates with project and laboratory management to establish data quality objectives for investigations being conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA). She ensures that project goals are met; develops/reviews hazardous waste site QA project plans (QAPjPs) and ensures that all QA documents are consistent with federal and state guidelines; reviews data validation reports and resolves discrepancies; reviews QA corrective actions; and identifies final action items.

For the New York State Department of Environmental Conservation, Ms. Galloway is E & E's QA officer, providing data validation for projects conducted under the standby contract, the separate multisite Phase II investigation contract, and a third contract for the CERCLA remedial investigation/feasibility study (RI/FS) regarding contamination by halogenated volatile organic compounds (VOCs) at the Mead Property septage disposal site in Ulster County. For the Mead site, the validated data were used to identify and characterize the nature, source, and extent of contamination; define exposure routes; and assess the need for long-term remedial actions.

In addition, Ms. Galloway is the QA officer/chief chemist for E & E activities for the New York State Energy Research and Development Authority at West Valley, New York. Projects include a RCRA facility investigation (RFI), a groundwater monitoring program, and a leachate characterization. Ms. Galloway performs field audits; develops QAPjPs; procures, audits, and oversees subcontract laboratories for mixed-waste and radiological material analysis; and oversees data validation. For the mixed-waste treatability study for Trench 14 at the inactive low-level radioactive waste disposal area, she managed the development of the QAPjP and the analytical methodology, assisted in the setup/ implementation of the on-site laboratory, audited on-site analytical operations, and performed VOC analyses during the bench-scale treatability studies.

At the Niagara Falls, New York, Air Force Base, Ms. Galloway was QA officer for a basewide groundwater monitoring program and several RFI/corrective measure studies.

In addition, she provided QA for E & E's RFIs for the United States Department of Energy at Sandia National Laboratories. She assisted in the development of the data quality, collection, and analysis plan; reviewed data for radionuclides and organic and inorganic compounds, including volatile solvents and polychlorinated biphenyls; and performed audits of laboratories and approved the facilities for radiological and mixed waste analysis.

C-B

Ecology and Environment, Inc., Analytical Services Center Master Quality Assurance Plan (MQAP)

MASTER QUALITY ASSURANCE PLAN
(MQAP)

June 1995

Prepared for:

MASTER QUALITY ASSURANCE PLAN
(MQAP)

June 1995

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Table of Contents

Section Page

1 Project Management 1-1
1.1 Project Organization 1-2
1.1.1 QA Responsibilities 1-2
1.1.2 Laboratory Responsibilities 1-4
1.1.3 Project Responsibilities 1-9

1.2 Problem Definition/Background 1-10

1.3 Project Description 1-11

1.4 Data Quality Objectives for Measurement Data 1-11
1.4.1 Data Assessment Definitions 1-12
1.4.2 EPA Superfund Data Categories 1-14

1.5 Special Training Requirements/Certification 1-16
1.5.1 Training Modules/Core Programs 1-17
1.5.2 Laboratory Personnel Training 1-18

1.6 Documentation and Records 1-18
1.6.1 Sample Identification 1-19
1.6.2 Daily Logs 1-19
1.6.3 Corrections to Documentation 1-20
1.6.4 Photographs 1-20
1.6.5 Laboratory Data 1-20

2 Measurement/Data Acquisition 2-1
2.1 Sampling Process Design 2-1

2.2 Sampling Method Requirements 2-2
2.2.1 Equipment Decontamination 2-2
2.2.2 Investigation-Derived Waste 2-5
2.2.3 Sample Containers 2-7

Section Page

2.2.4 Sample Preservation and Holding Times 2-7

2.3 Sample Handling and Custody Requirements 2-8
2.3.1 Sample Custody 2-11

2.4 Analytical Method Requirements 2-15
2.4.1 Standard Laboratory Analytical Procedures 2-16
2.4.2 Nonstandard Laboratory Analytical Screening Procedures 2-17
2.4.3 Field-Screening Methods 2-19
2.4.4 Laboratory Glassware Cleaning and Storage Procedures 2-21

2.5 Internal Quality Control Requirements 2-22
2.5.1 Field Quality Control Samples 2-23
2.5.2 Laboratory Quality Control Analyses 2-25
2.5.3 Procedures Used to Assess Laboratory Data Accuracy, Precision, and Completeness 2-29

2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements 2-32
2.6.1 Field Equipment Maintenance 2-32
2.6.2 Laboratory Equipment Maintenance 2-33

2.7 Instrument Calibration and Frequency 2-33
2.7.1 Field Instrumentation 2-33
2.7.2 Laboratory Instrumentation 2-38

2.8 Inspection/Acceptance Requirements for Supplies and Consumables 2-41
2.8.1 Standard Receipt and Traceability 2-41
2.8.2 Laboratory Equipment and Supplies 2-42
2.8.3 Laboratory Waste Disposal 2-42

2.9 Data Acquisition Requirements 2-44

2.10 Data Management 2-44
2.10.1 Laboratory Data Management 2-45
2.10.2 Laboratory Data Reduction 2-47

3 Assessment/Oversight 3-1
3.1 Assessment and Response Actions 3-1
3.1.1 Peer Review 3-1
3.1.2 Management Systems Review 3-2
3.1.3 Technical Systems Audits and Performance Evaluation 3-2
3.1.4 Corrective Action 3-4

Table of Contents (Cont.)

Section Page

3.2 Reports to Management 3-6

4 Data Validation and Usability 4-1
4.1 Data Review, Validation, and Verification Requirements 4-1

4.2 Validation and Verification Methods 4-3
4.2.1 Data Validation Personnel 4-4
4.2.2 Standard Operating Procedure 4-5

List of Tables

Table Page

1-1 Key ASC Personnel 1-23

2-1 Sample Containers and Volumes for Soil Samples 2-50

2-2 Sample Containers and Volumes for Water Samples 2-51

2-3 Sample Preservation and Holding Times for Soil and Water Samples 2-53

2-4 Additional Sample Preservation and Holding Time Information 2-54

2-5 Field Reagent and Standard Storage 2-56

2-6 Laboratory Reagent and Standard Storage 2-57

2-7 Sample Preparation Methods 2-58

2-8 Inorganic Analytical Methods and Quality Control Criteria 2-59

2-9 Organic Analytical Methods and Quality Control Criteria 2-69

2-10 Field Measurement Analytical Methods 2-96

2-11 Base Neutral Quality Objectives, EPA Contract Laboratory Program 2-97

2-12 Acid Phenols, EPA Contract Laboratory Program 2-100

2-13 Volatile Organics, EPA Contract Laboratory Program 2-101

2-14 Pesticides/PCBs, EPA Contract Laboratory Program 2-103

2-15 EPA Contract Laboratory Program, System Monitoring and Surrogate Recovery Limits 2-105

List of Tables (Cont.)

Table **Page**

2-16 Volatile Screening Procedure, Laboratory Efficiency Information for Soils 2-106

2-17 Pesticide/PCB Screening Procedure, Laboratory Efficiency Information for Soils 2-107

2-18 Metals Screening Procedure, Laboratory Efficiency Information for Soils 2-108

2-19 PAH and Phenol Screening Procedure, Laboratory Efficiency Information for Soils 2-109

2-20 Field Quality Control Guidelines 2-110

2-21 Laboratory Quality Control Guidelines 2-111

2-22 Routine Field Equipment Maintenance 2-112

2-23 Routine Laboratory Instrument Maintenance 2-113

2-24 List of Typical Field Monitoring Equipment 2-115

2-25 ASC Instrumentation List 2-116

2-26 Summary of Calibration Procedures 2-119

2-27 BFB Key Ion Abundance Criteria 2-121

2-28 DFTPP Key Ion Abundance Criteria 2-122

2-29 GC/MS Acceptance Criteria 2-123

2-30 Reporting of Measurement Data Calculations 2-124

3-1 ASC Certifications and Qualifications 3-9

3-2 Field Corrective Actions 3-11

3-3 Laboratory Corrective Actions 3-12

List of Illustrations

Figure Page

1-1 Quality Assurance Program Organization 1-24

1-2 Analytical Services Center Management Organization 1-25

2-1 Selected E & E Standard Operating Procedures for Field Procedures 2-125

2-2 E & E Package Receipt Log 2-126

2-3 E & E Cooler Receipt Form 2-127

2-4 Destruction Authorization Form 2-128

2-5 Sample Custody Seal/Label 2-129

2-6 Sample Chain-of-Custody Form 2-130

3-1 Field Logbook Audit Form 3-13

3-2 Field Audit Checklist 3-16

3-3 ASC Internal Audit Checklist 3-21

3-4 QA/QC Discrepancy Form 3-26

3-5 Continuing QA Form 3-27

3-6 QA/QC Item Action Report 3-28

4-1 Data Flow/Reporting Scheme 4-9

4-2 Quality Assurance Protocol Review 4-10

List of Acronyms

%R	percent recovery
AAS	atomic absorption spectroscopy
ASAP	as soon as possible
ASC	E & E Analytical Services Center
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
BFB	bromofluorobenzene
BHC	benzenehexachloride
BOD	biochemical oxygen demand
BOD_5	five-day biochemical oxygen demand
Btu/lb	British thermal units per pound
$CaCO_3$	calcium carbonate
CAD	computer-aided design
CCC	calibration check compounds
CF	calibration factor
CHMM	certified hazardous materials manager
CLP	Contract Laboratory Program
COC	chain-of-custody
COD	chemical oxygen demand
CPR	cardiopulmonary resuscitation
D	detectable
DDD	dichlorodiphenyldichloroethane
DDT	dichlorodiphenyltrichloroethane

DFTPP	decafluorotriphenylphosphine
DO	dissolved oxygen
DOT	United States Department of Transportation
DQO	data quality objective
E & E	Ecology and Environment, Inc.
EPA	United States Environmental Protection Agency
EPTOX	extraction procedure toxicity
GC	gas chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
GIS	geographic information system
H_2SO_4	sulfuric acid
HCL	hydrochloric acid
HNO_3	nitric acid
HPLC	High-Performance Liquid Chromatography
IARs	Item Action Reports
ICP	inductively coupled argon plasma
IDW	investigation-derived waste
LABMIS	Laboratory Management Information System
MDL	method detection limit
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
ml	milliliter
ml/L/hour	milliliters per liter per hour
MQAP	Master Quality Assurance Plan
MSA	Mine Safety Apparatus
NA	not applicable
NaOH	sodium hydroxide
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OVA	organic vapor analyzer

PAHs	polynuclear aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PCs	personal computers
PE	performance evaluation
PPE	personal protection equipment
ppm	parts per million
PQL	practical quantitation limit
QA	quality assurance
QA/QC	quality assurance/quality control
QAPjPs	Quality Assurance Project Plans
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
S	soil (soil, sediment, and sludges)
SM	"Standard Methods for the Evaluation of Water and Waste Water," 7th Ed., 1989
SOGs	standard operating guidelines
SOPs	standard operating procedures
SOW	scope of work
SPCC	system performance check compounds
SW	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Ed., 1986, including update I, 1993
TCL	Target Compound List
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TOX	total organic halogen
TQ	Total Quality

TRPH	total recoverable petroleum hydrocarbons
TSS	total suspended solids
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
UPS	United Parcel Service
VAX	Virtual Address Extension
VOA	volatile organic analysis
VOCs	volatile organic compounds
W	water (groundwater and surface water)

1 Project Management

This Master Quality Assurance Plan (MQAP) has been prepared by Ecology and Environment, Inc., (E & E) as an overview of the capabilities and quality assurance (QA) objectives of the E & E Analytical Services Center (ASC). The MQAP also serves as the most current source of information required for preparing site-specific Quality Assurance Project Plans (QAPjPs) for specific projects for which the ASC is providing laboratory analyses.

This MQAP has been prepared in accordance with "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," Draft Final EPA QA/R-5 (July 1993) and other United States Environmental Protection Agency (EPA) guidance documents. This MQAP presents the policies, organization, objectives, functional activities, and specific quality assurance/quality control (QA/QC) procedures that will be employed by E & E to ensure that all technical data generated are accurate, representative, and ultimately capable of withstanding judicial scrutiny.

E & E is committed to providing clients with a high degree of quality in delivered services. To preserve this degree of quality, E & E maintains a comprehensive QA program that covers all company project and program implementation. This QA program establishes a solid foundation for sample management and analysis; data generation and interpretation; and report preparation, review, and approval; and ensures that all services are accurate, representative, and meet the objectives of the assigned tasks.

As outlined in this MQAP, all QA/QC procedures are in accordance with applicable professional technical standards; EPA requirements; and specific project goals and objectives. Detection limits are set in accordance with EPA-approved methods, where available, for analysis of organics and inorganics. QC requirements will be determined in advance by the ASC project manager, unless otherwise specified in the site-specific QAPjP.

In addition, E & E's ASC has developed standard operating procedures (SOPs) for individual analytical methods and internal QC procedures. These documents are an important aspect of the ASC QA program and are available for review during on-site evaluations.

1.1 Project Organization

E & E is a full-service consulting firm with services that include investigation, design, interpretation, and analytical capabilities. E & E's management structure provides for direct and continuous oversight responsibility, clear lines of authority, and the integration of activities. The primary contact at E & E with respect to all analytical testing is:

- Mr. Gary E. Hahn
  Laboratory Director
  Ecology and Environment, Inc.
  Analytical Services Center
  4493 Walden Avenue
  Lancaster, New York 14086
  (716) 685-8080

E & E's corporate QA program is the responsibility of the QA director and QA officer for the ASC. They receive direction from the QA advisory board, which is chaired by the executive vice president and select key executive staff. The QA director and QA officer are assisted by a QA coordinator in each region and at the ASC. Figure 1-1 presents the basic organizational structure of E & E's QA program, and Figure 1-2 shows the basic management structure of the ASC with key personnel listed on Table 1-1. Key personnel and their QA responsibilities are identified below.

1.1.1 QA Responsibilities

The overall responsibilities for the QA staff are defined below. Additional responsibilities to meet project-specific requirements will be included in site-specific QAPjPs.

Corporate QA Director

The corporate QA director, Russell A. Short, is responsible for ensuring compliance with E & E's Corporate QA Program. He remains independent of day-to-day, direct project but has the responsibility for ensuring that all program-, project-, site-, and task-specific QA/QC requirements are met. He has direct access to corporate executive staff, as necessary, to resolve any QA/QC problems, disputes, or deficiencies. His specific functions and duties include:

- Reviewing and approving all QA policies and procedures;
- Conducting QA program indoctrination sessions for senior project staff;
- Providing guidelines and information to assist in the development of program-, site-, and task-specific QA/QC policies and procedures;
- Reviewing QA/QC requirements, and subcontracting and other procurement documents;
- Reporting regularly to the corporate executive staff on the adequacy, status, and effectiveness of the E & E QA/QC program;
- Maintaining corporate files of all project-related QA/QC documents (e.g., memoranda and communication records);
- Maintaining a file of individuals who are qualified as QA personnel; and
- Conducting random office and field audits to ensure that all required QA/QC procedures are being properly implemented.

QA Officer

The QA officer, Marcia Meredith Galloway, is responsible for the direct oversight of all laboratory QA/QC activities for all projects. Her specific duties include:

- Reviewing and approving this MQAP and site-specific QAPjPs;
- Providing external review of analytical activities;
- Coordinating with the client manager and/or QA officer, the regional QA coordinator, E & E's technical staff, ASC management, and

ASC staff to ensure that QA objectives appropriate to the project are set and that ASC personnel are aware of these objectives;

- Coordinating with ASC management and staff to ensure that QC procedures appropriate to demonstrating data validity sufficient to meet QA objectives for a project are developed and in place;
- Conducting inspections in conjunction with the corporate QA office and keeping written records of the inspections;
- Coordinating with ASC QA staff to ensure that all routine QC procedures in the laboratory are followed and documented;
- Recommending and/or reviewing actions taken in the event of QA/QC failures in the laboratory; and
- Reporting nonconformance with either QC criteria or QA objectives (including an assessment of the impact on data quality or work assignment objectives) to the appropriate managers.

1.1.2 Laboratory Responsibilities

The overall responsibilities and specific QA duties for laboratory staff are defined below. Additional responsibilities to meet project-specific requirements will be included in site-specific QAPjPs.

ASC Director

The ASC director is Gary E. Hahn. The ASC director is responsible to the E & E executive vice president for technical services for overall analytical activities. He coordinates with the ASC QA staff and corporate QA office regarding analytical QA/QC requirements. His specific functions and duties include:

- Maintaining copies of E & E's methods and safety manual;
- Assisting in developing program-, project-, site-, and task-specific protocol in conjunction with the ASC project manager;
- Requiring that ASC staff clearly understand their required tasks and are properly trained to carry them out;

- Requiring that analyses are carried out in accordance with the specified protocol and that all data generated during the analyses are accurately recorded and verified; and

- Requiring that the study protocol, final report, and all supporting raw data are transferred to suitable archives upon completion of the study.

Specific QA duties of the director are:

- Overseeing QA of daily laboratory operations;

- Reviewing and approving laboratory reports before submission to client;

- Reviewing laboratory responses and corrective actions to ensure concurrence with internal and external audits;

- Reviewing and approving SOPs;

- Reviewing proficiency testing results;

- Reviewing and approving corrective actions to rectify unacceptable results; and

- Overseeing the development, approval, and implementation of corrective actions.

ASC QA Coordinator

The ASC QA coordinators are Dr. Ray Piccione and Marlene Davis. As ASC QA coordinators, they are responsible for the direct oversight of the QA program within the ASC, including the maintenance of all QA/QC documentation. They report directly to the QA officer and the corporate QA office. Their specific functions and duties include:

- Reporting QA/QC information and/or problems to the ASC director and QA officer;

- Maintaining the E & E ASC SOP and the MQAP;

- Maintaining proficiency testing, auditing, and certification records;

- Reviewing final reports on selected projects before submittal to client;
- Reviewing from 10% to 20% of remaining final reports;
- Reviewing and approving SOPs;
- Reviewing and approving corrective actions;
- Reviewing this MQAP and site-specific QAPjPs for correctness and advising project managers of necessary changes;
- Advising laboratory personnel on QA issues;
- Coordinating necessary responses to results of proficiency testing and external audits; and
- Investigating to ensure that corrective actions have been implemented.

ASC Project Manager

An ASC project manager is assigned for each client. The ASC project manager is responsible for the oversight of all laboratory work conducted for the assigned project and serves as a liaison between the ASC director and field personnel. The specific functions and duties of the ASC project manager include:

- Informing ASC personnel of all contract-specific QA/QC requirements (e.g., detection limits and QC samples);
- Tracking client sample shipping dates;
- Verifying the receipt of all required client samples;
- Project tracking and control of client samples within the ASC;
- Maintaining written status reports on the project, including any problems, recommendations, and corrective actions taken when required by the project;
- Preparing QA reports to meet client-specific requirements; and
- Overseeing data report preparation.

ASC Group Managers

The Organics Group manager, C. Wojtowicz, oversees the Organic Preparation, Gas Chromatography (GC), High-Performance Liquid Chromatography (HPLC), and Gas Chromatography/Mass Spectrometry (GC/MS) sections. The Inorganic Group manager, R. Von Smith, oversees the General Chemistry and Metals sections.

The group managers report directly to the ASC director. The following are specific functions and duties of the group managers:

- Providing oversight for daily operation of laboratory sections;
- Ensuring that analyses are carried out in accordance with protocol, including client-specific QC requirements;
- Ensuring supervisors and analysts understand their required tasks; and
- Reviewing each laboratory report and writing narratives when required.

Specific QA duties of the group managers are:

- Reporting QA difficulties to the ASC director and QA coordinator;
- Reviewing not immediately resolvable discrepancy reports, and providing direction to supervisors on appropriate corrective actions;
- Reviewing and approval of laboratory reports before submission to client;
- Reviewing proficiency test results; and
- Reviewing and approving new or revised SOPs.

ASC Section Supervisors

As shown in Figure 1-2, each laboratory section has a supervisor assigned to it. The supervisors report directly to their respective group manager. The following are specific functions and duties of the section supervisors:

- Ensuring that any project-specific information is brought to the attention of the analysts and that analyses are carried out accordingly;

- Ensuring that analysts understand their required tasks and operate under the correct SOP; and

- Reviewing analytical data before reporting, and writing narratives when required.

Specific QA duties of the section supervisors are:

- Reporting QA difficulties to the group manager;

- Reviewing proficiency test results and providing written corrective action to the QA coordinator, and ensuring such actions are implemented;

- Reviewing audit reports, providing corrective actions to the QA coordinator and ensuring such actions are implemented;

- Reviewing control charts and investigating any out-of-control events;

- Writing and/or reviewing SOPs; and

- Providing training to section personnel and documenting that training.

ASC Analysts

Analysts report directly to their section supervisor. The following are specific functions and duties of analysts:

- Performing analyses according to SOPs;

- Maintaining awareness of project-specific QC requirements and carrying out the analysis accordingly; and

- Reviewing analytical data before submittal to supervisor and taking immediate corrective actions when possible.

Specific QA duties of the analysts are:

- Reporting QA difficulties to supervisor or group manager via issuance of a discrepancy report;
- Enacting any appropriate corrective actions; and
- Writing SOPs.

1.1.3 Project Responsibilities

For each project conducted by E & E, qualified, experienced personnel are assigned to key project roles by the executive vice-president for technical services. The project management team is responsible for coordinating with field and laboratory staff to ensure the overall quality of the data and reports meet all client-specific requirements. 'Individuals assigned to key positions and any project-specific responsibilities will be included in the site-specific QAPjPs. General roles and responsibilities are identified below.

Project Director

The project director has overall responsibility for ensuring that the project meets client objectives and E & E quality standards. In addition, the project director is responsible for technical quality control and project oversight and provides the project manager with access to corporate management.

Project Manager

The project manager is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. The project manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The project manager provides the major point of contact and control for matters concerning the project. The following are specific duties of the project manager:

- Define project objectives and develop a detailed work plan and schedule;
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;

- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- Orient all staff concerning the project's special considerations;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Approve all external reports (deliverables) before their submission to the client;
- Ultimately be responsible for the preparation and quality of interim and final reports; and
- Represent the project team at meetings.

Technical Staff

The technical staff (team members) for a project are drawn from E & E's pool of corporate resources. The technical team staff is used to gather and analyze data and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

1.2 Problem Definition/Background

E & E has defined an approach for conducting project work in its *Project Management Policies and Procedures Manual*. The approach follows a matrix management system. It also uses planning and operations tools based on Total Quality (TQ) principles, including EPA's defined data quality objective (DQO) process.

At the outset of the project, E & E's designated project manager organizes a project team in keeping with any preliminary agreements or understanding with the client. The team consists of those personnel whose technical capabilities and background best meet the needs of the project, and members of the laboratory.

The project manager then conducts a scoping meeting with the project team. This meeting, at which appropriate background and other data, information, and needs are discussed, can be conducted with a client representative present or immediately after separate meetings with the client.

During this meeting, the specific problems to be solved or issues to be addressed are discussed in depth. These discussions will focus on identifying the decisions that will need to be made during the project and the measurements, data, information, and knowledge that need to be developed to support those decisions. The outcome of this process will be a problem definition and background section included in the site-specific QAPjP.

1.3 Project Description

This MQAP establishes the QA/QC framework and, in combination with E & E's Quality Management Plan, presents the foundation for controlling the quality of E & E services and deliverables. The MQAP presents guidelines for the implementation of the QA program for the ASC. E & E will ensure all analytical data are generated in accordance with guidelines presented in the MQAP. For projects with specific QA objectives, the ASC will follow guidelines presented in the site-specific QAPjP or client contractual specifications. The site-specific QAPjP will contain an overall description of the individual project or tasks including the following:

- Problems to be resolved;
- Direct and indirect measurements required;
- Applicable technical or regulatory QA/QC standards or criteria;
- Any special resources (e.g., personnel or equipment) needed for the project;
- A scope and schedule of the work to be performed, including sampling and analytical requirements and project deliverables; and
- Any specific assessment of oversight procedures required to ensure the project DQOs are met.

1.4 Data Quality Objectives for Measurement Data

DQOs are qualitative or quantitative statements developed by the data user to specify the quality of data needed from a particular data collection activity to support specific decisions. DQOs represent the starting point in the design of a given study. The process of developing DQOs helps ensure the accountability of all project staff to produce data of adequate quality for the intended use. The DQO development process will help identify critical data points and eliminate data points with limited applications, thereby promoting overall fiscal accountability. In addition, the DQO development process will match sampling and analytical capabilities to data targeted for specific uses to ensure the quality of the data does not over- or underestimate project requirements. For EPA Superfund-related projects, the DQO development process is outlined in the EPA guidance publication "Data Quality Objectives Process for Superfund," EPA/540/R-93-071, Interim Final, September 1993. E & E will complete the DQO process for all sites as part of the project planning described in Sections 1.3 and 2.1. If other agencies provide specific DQO definitions, they will be incorporated into site-specific QAPjPs.

DQOs are developed for individual sites to ensure that data collected during the investigation will be of sufficient quality to support decision-making. As defined in Section 1.4.1, QA objectives for measurement of analytical data and DQOs are typically expressed through quantitative or qualitative statements on precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters.

For a specific project, the QAPjP will focus on the objectives of the investigation. Overall, the site-specific QAPjP will provide a rationale and justification for each data-collection activity as well as alternative approaches to meeting project objectives. Site-specific QAPjPs will address basic questions such as why data are collected, how data will be used, and how much data are required. In addition, the required data quality will be addressed, indicating the magnitude of error that can be tolerated by the data user.

1.4.1 Data Assessment Definitions

Data assessment procedures involve the application of PARCC parameters to determine whether QA objectives for measurement of analytical data or DQOs for the project have been achieved. PARCC parameters are often interrelated and applicable to a variety of analytical data collection activities. Numerical acceptance criteria cannot be assigned to all PARCC objectives, but general performance goals are established for most analytical procedures. These numerical goals are presented in Section 2.4. Data assessment procedures throughout the MQAP clearly outline the steps to be taken, responsible individuals, and implications if QA objectives are not met. PARCC parameters are briefly defined below.

Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value, usually stated in terms of standard deviation or coefficient of variation. It also may be measured as the relative percent difference between two values. Precision includes the interrelated concepts of instrument or method detection limits and multiple field sample variance. Sources of this variance are sample heterogeneity, sampling error, and analytical error.

Accuracy

Accuracy measures the bias of the measurement system. Sources of this error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis. Data interpretation and reporting may also be significant sources of error. Typically, analytical accuracy is assessed through the analysis of spiked samples and may be stated in terms of percent recovery or the average (arithmetic mean) of the percent recovery. Blank samples are also analyzed to assess sampling and analytical bias (i.e., sample contamination). Background measurements similarly assess measurement bias.

Representativeness

Representativeness expresses the degree to which data represent a characteristic of a population, a parameter variation at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with proper design of the measurement program. Sample/measurement locations may be biased (judgmental) or unbiased (random or systematic). For unbiased schemes, the sampling must be designed not only to collect samples which represent conditions at a sample location, but also to select sample locations which represent the total area to be sampled.

Completeness

Completeness is defined as the percentage of measurements performed which are judged to be valid. Although a quantitative goal must be specified, the completeness goal is the same for all data uses: that a sufficient amount of *valid* data be generated. It is important that critical samples are identified, and plans be made to ensure that valid data are collected for them.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set may be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through the use of standard techniques to collect and analyze samples.

1.4.2 EPA Superfund Data Categories

The two Superfund data categories are referred to as Screening Plus 10% Definitive and Definitive. These categories divide environmentally related measurements into distinct quality levels based primarily on the increasing levels of confidence in the precision and accuracy of the analytical results. Screening data without definitive confirmation are considered to be data of unknown quality and are preliminary in nature. The Screening Plus 10% Definitive data comprise data of known quality that are quantitatively "verified" and for which the analyte identification is "definitively" confirmed. The Definitive data include any extremely "critical" measurements that are derived only through analyte-specific EPA methodology and that both definitively identify and quantify the analytes of interest. Detailed definitions of the characteristics of each category, along with examples of appropriate applications for data from each level, follow below. The site-specific QAPjPs must delineate which DQOs are associated with the various measurements to be conducted and what the specific goals for precision, accuracy, and completeness are for each measurement. Data from all categories must be representative and comparable.

Screening Plus 10% Definitive Category

The Screening Plus 10% Definitive category is a broad classification that includes measurements that can be nonquantitative to semiquantitative or involve only probable identification of compound class. This category is available for data-collection activities that involve rapid, nonrigorous measurement or analysis procedures and limited QA/QC requirements. These methods are used to make quick assessments of the types and levels of pollutants. Screening is often required during a time-critical phase of a removal action, or during an emergency, and is generally applied to assessment and characterization activities in which the types of contamination are either unknown or suspected, or additional information is needed to broaden the scope of existing information. This category is appropriate when sampling objectives require measurements to have the following characteristics:

- Definitive identification of analytes; and
- Verified quantitation of the parameter of interest.

Definitive identification refers to the sampling and analysis of a field sample by a technique that can unequivocally detect the specific analyte in question and that can produce verifiable documentation that identification has been successful. Quantitation of a parameter of interest may be considered to be "verified" so long as the precision and accuracy of the method has been determined by the reanalysis of 10% of the samples using the Definitive data category.

The Screening Plus 10% Definitive category is generally applied to assessment and characterization activities in which the types of contamination are suspected or known or the time frame of the activities allows EPA the benefit of requiring a higher level of confidence for these data. The precision and accuracy goals (defined on a method-specific basis) and completeness goals for the measurements shall be established in the site-specific QAPjP. The Definitive objective shall be routinely used to confirm results generated as part of the Screening Plus 10% Definitive. Typically, 10% of the screening measurements performed under a Screening Plus 10% Definitive category will be confirmed with data that meet Definitive requirements. The results of the substantiated screening data give an associated higher level of confidence to the remaining 90% of the screening data. The site-specific

QAPjP should discuss how the Screening Plus 10% Definitive and Definitive data sets are to be compared and what level of correlation is adequate.

The Screening Plus 10% Definitive category may be applied to, but is not limited to, the following activities:

- Obtaining data in an emergency;
- Health and safety monitoring;
- Preliminary identification or quantification of pollutants;
- Physical or chemical property determination;
- Site characterization and delineation of extent of contamination;
- Preliminary risk assessment; and
- Assessment of contaminant cleanup.

Definitive Category

The most exhaustive category is Definitive data, which is appropriate when the statistical precision of a sample analysis measurement must be determined for a specific sample location. These "critical" measurements would typically be used to establish confidence levels for a larger, comparable set of screening data. Rigorous, EPA-approved methods of analysis and comprehensive QA/QC must be followed to achieve Definitive data. This category would usually be applied to removal or assessment activities when a specific action or decision level is of concern and when highly significant cost or risk is associated with an incorrect decision. The precision and accuracy goals shall be defined on a method-specific basis in the site-specific QAPjP. A completeness goal of 100% should be set for all critical Definitive measurements and completeness goals for other definitive measurements set in the site-specific QAPjP. The following activities might be appropriate applications for Definitive data:

- Removals in which extremely cost-sensitive decisions must be made relative to action or decision levels;
- Enforcement and litigation purposes;
- Critical treatment/remediation system design; and

- Situations in which high risk to the public health or welfare or to the environment exists.

1.5 Special Training Requirements/Certification

E & E is committed to providing vigorous training in emergency response and health and safety procedures, the proper use of protective equipment, and overall policy objectives. Toward these ends, the firm has established an approach to training that emphasizes a core curriculum, augmented by modules to address specific needs and concerns.

E & E maintains up-to-date training records listing courses successfully completed by each employee and has designed/implemented sophisticated employee training tracking systems as an integral component of full-scale training programs to monitor regulatory compliance.

1.5.1 Training Modules/Core Programs

E & E has an established Health and Safety Program for Toxic and Hazardous Substances. All employees working in the presence of, or having potential exposure to, toxic or hazardous substances must comply with the provisions of this plan. The basic components that relate to training are completion of the firm's 40-hour health and safety program; annual cardiopulmonary resuscitation (CPR) and first aid certification; three days of initial field experience under the direct supervision of a trained and experienced supervisor; and periodic specialized and refresher training modules dealing with field investigation techniques and safety procedures.

In addition, United States Department of Transportation (DOT) hazardous materials transportation training is provided to all personnel who ship samples. Resource Conservation and Recovery Act (RCRA) hazardous waste generator training is reviewed as part of E & E's certified hazardous materials manager (CHMM) training. E & E's laboratory staff responsible for sample management and supervision completes the training as describe above.

E & E employees may participate in activities at potentially hazardous waste sites upon completion of the 40-hour health and safety training program and the cardiopulmonary resuscitation (CPR)/first aid certification course. To continue such participation, each employee must successfully complete a minimum of eight hours of refresher training, semiannually.

E & E has developed specialized and refresher training programs in health and safety/ toxicology; waste management; industrial hygiene; health physics; environmental sampling and analysis; environmental/regulatory compliance; emergency response; air pollution management; contingency planning; Spill Prevention, Control, and Countermeasure inspection; chemical safety audits; wastewater discharge practices; use of field instrumentation; and special field operation techniques. For each training program, E & E developed course objectives and all course materials, including student/instructor manuals, and presented the training. These courses are presented in modular form and can be tailored to meet specific activity/site/client needs. Additional modules are constantly being developed at the corporate training center in response to evolving environmental and hazardous substance/mixed waste-related issues and concerns.

1.5.2 Laboratory Personnel Training

Laboratory personnel undergo training by various techniques such as reading assignments, group instruction, analytical method instruction, and external seminars.

Initially, personnel are instructed in proper safety procedures. Presence at the safety session is recorded in a bound logbook. The laboratory safety officer is responsible for the safety sessions.

New personnel are assigned sections in the MQAP to read. A follow-up survey is then administered to test comprehension. The training is the responsibility of the QA coordinator.

Analytical training is accomplished by assigning an experienced analyst as instructor. A checklist has been devised to record various aspects of the training. The section supervisors are responsible for this training.

Continuous training is accomplished by group instruction (e.g., review of revised SOPs, assigned reading, review of past QA notices, or by attendance at external training seminars or equipment manufacturer seminars).

1.6 Documentation and Records

For most data collection activities, the primary documentation involves field records and analytical data packages. Requirements for field records are documented in E & E SOPs and described briefly below. Specific requirements for analytical data packages by method are included as part of E & E's SOP for analytical services delivery. The general requirements for definitive and screening data are described briefly below. The site-specific QAPjP will provide requirements for field and analytical documentation for each project. The remainder of the MQAP describes additional project documentation and record requirements for QA/QC assessments, data validation, data management, and other areas.

1.6.1 Sample Identification

The samples will be identified using the format described below. Each sample will be labeled, chemically preserved (if required), and sealed immediately after collection. To minimize handling of sample containers, labels will be completed prior to sample collection. The sample label will give the following information: date and time of collection, unique sample number, analysis required, and preservation. Each sample also will be referenced by sample number in the logbook and on the chain-of-custody (COC) record.

1.6.2 Daily Logs

Daily logs and data forms are necessary to provide sufficient data to enable participants to reconstruct events that occurred during the project and to refresh the memory of the field personnel should they be called upon to give testimony during legal proceedings. Procedures for recording information are specified in the E & E field activities logbook SOP, GENTECH 4.1.

For monitoring well and borehole installations, a specific preprinted geotechnical logbook is used. Included in this logbook are daily activity logs, borehole records, well completion diagrams, and well development records. Procedures for completion of this log are given in EEDTTECH 10.4.

In the event that there are several field activities occurring simultaneously, there may be a need to use a separate logbook for each activity. Under these circumstances, a site summary logbook should be used in addition to each task or activity logbook. The summary logbook should describe the ongoing operations and the general field activities (including personnel on site) and should provide an inventory of the activity logbooks and the field activity leaders.

1.6.3 Corrections to Documentation

All sample identification tags, COC records, field logbooks, and other forms must be written in waterproof ink. None of these documents is to be destroyed or thrown away, even if it is illegible or contains inaccuracies that require a replacement document. As with any data logbooks, no pages are to be removed from field logbooks for any reason. If an error is made on a document, the individual responsible for preparation of the document may make corrections by drawing a single line through the error and entering the correct information. All corrections must be initialed and dated.

1.6.4 Photographs

If required for a project, photographs will be taken as directed by the team leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. Pertinent information will be noted in the logbook concerning photographs as noted in the GENTECH 4.1 SOP. After the photographs have been developed, the information recorded in the field notebook should be transferred to the back of the photographs.

1.6.5 Laboratory Data

Analytical reports for definitive data may be in one of the following formats: a Contract Laboratory Program (CLP) data package, a Laboratory Management Information System (LABMIS) report, or a LABMIS report with supporting raw data, commonly termed a CLP-equivalent data package.

The CLP or CLP-equivalent data package should consist of a case narrative; sample tracking information; summary of analytical results, QC results, and calibration; detection limit studies; and copies of raw data. The package must contain a complete set of information to confirm identification and quantitation of 100% of the analytes. The information to be included in the LABMIS reports consists of a tabulation of analytical results and supporting

QC information. Raw data will be available for later inspection, if required, and will be maintained in the central job file.

All records related to the analytical effort are maintained at the ASC in a lockable filing room for at least one year, except those stored in the Virtual Address Extension (VAX) computer (e.g., cost information, scheduling, custody transfers, and management records). All files are transferred to boxes labeled by sequential numbers and stored in a secure warehouse. A list of laboratory job numbers corresponding to the sequential box number is maintained in the computer system. All records are maintained for a period of five years after the final report is issued.

The following types of records are maintained:

- COC records, including information regarding the sampler's name, date of sampling, type of sampling, location of sampling station, and number and type of containers used. COC records also include the signature of the E & E employee relinquishing samples to a non-E & E person (e.g., Federal Express agent), with the date and time of transfer noted, or the signature of the E & E sample custodian receiving the samples, with the date and time noted;

- Any discrepancy/deficiency report forms completed regarding the samples because of problems encountered during sampling, transportation, or analysis;

- Sample destruction authorization forms containing information on the manner of final disposal of samples upon completion of analysis and on an additional 30-day holding time, or longer, for possible reanalysis at the client's request;

- Computer records on disk with magnetic tape backup of cost information, scheduling, laboratory COC transfers, and laboratory management records in E & E's central VAX system;

- Computer tape backup of GC/MS data and cassette tape backup of HPLC data;

- All laboratory notebooks, including raw data such as readings, calibration details, and QC results;

- Hard copies of data system printouts (e.g., chromatograms, mass spectra, and inductively coupled argon plasma (ICP) data files);

- Tabulation of analytical results with supporting QC information;

- Field records, such as copies of the COC, logbooks, and other field notes, will be kept in the project file, along with copies of all work plans, QAPjPs, reports, cost information, correspondence, and other pertinent project information.

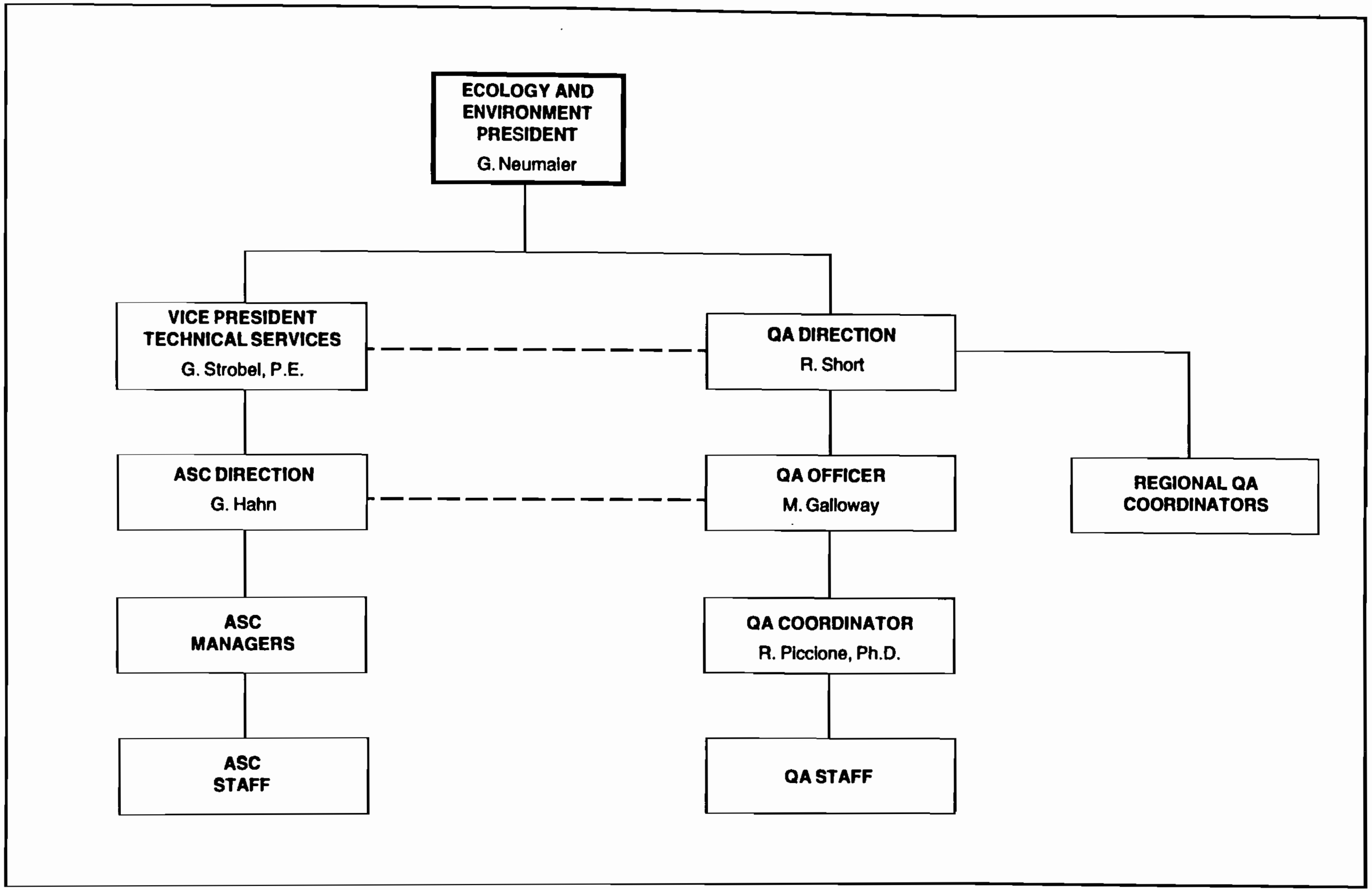
Table 1-1

KEY ASC PERSONNEL

Name	Position	Education
Anthony Bogolin	Support Services Manager	B.S., Environmental Science/Biology
I. Michael Cohen	HPLC Specialist	B.S., Chemistry/Biology
Marlene Davis	QA Coordinator	A.A.S. Chemistry B.S. Chemistry
Marcia Meredith Galloway	QA Officer	M.S., Analytical Chemistry B.A., Chemistry
Gary Hahn	Director	B.S., Chemistry
William Howard	Chief Sample Custodian and Computer Systems Manager	B.S., Management
Timothy Kannalley	Organics Sample Preparation Laboratory Supervisor	A.S., Science
Barbara Krajewski	CLP Datapack Coordinator/ Project Manager	B.A., Biology/Environmental Science
Gayle Kroetsch	Reports Coordinator	M.S., Education, General Science B.S., Education, General Science
Richard Nagler	Metals Section Supervisor	B.A., Biology
Raymond Piccione	QA Coordinator	Ph.D., Inorganic Chemistry B.S., Chemistry
Richard Samson	GC Section Supervisor	A.S., Natural Sciences
Michael Scanlon	GC/MS Specialist	Ph.D., Physical Chemistry M.A., Chemistry; B.S., Chemistry
Randy V. Smith	Computer Specialist/ Inorganics Section Manager	Ph.D. Analytical Chemistry B.S., Chemistry
Cynthia Stempniak	GC/MS Section Supervisor	B.A., Chemistry
Kathleen Willy	Project Manager	B.S., Chemistry
Caryn Wojtowicz	Organics Section Manager	B.A., Biology

Key:

GC/MS = Gas chromatograph/mass spectrometry.
HPLC = High-performance liquid chromatography.
QA = Quality assurance.
CLP = Contract Laboratory Program



SOURCE: Ecology and Environment, Inc., 1995.

Figure 1-1 QUALITY ASSURANCE PROGRAM ORGANIZATION

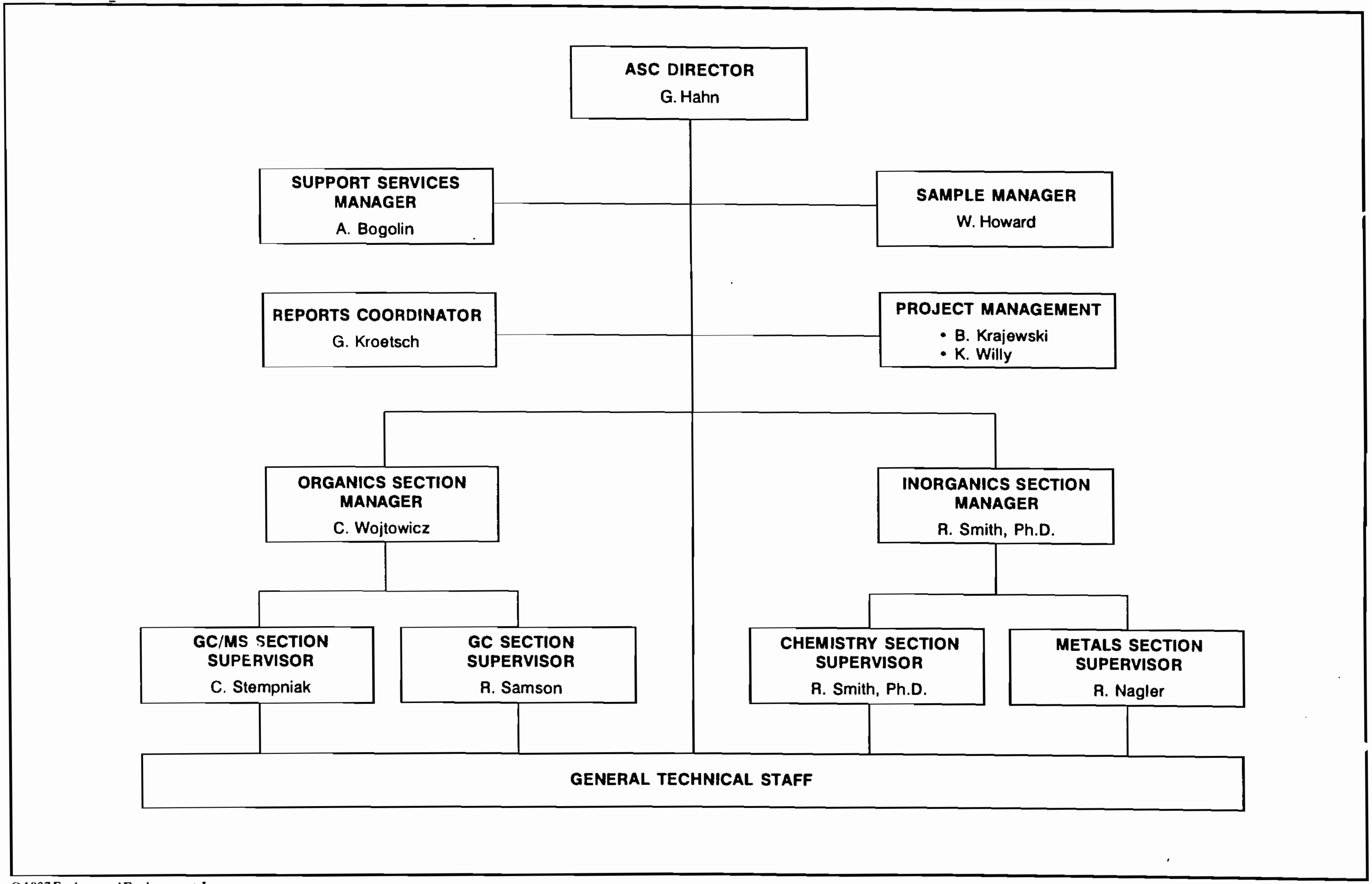


Figure 1-2 ANALYTICAL SERVICES CENTER MANAGEMENT ORGANIZATION

2 Measurement/Data Acquisition

This section of the MQAP contains descriptions of all aspects of the implementation of field laboratory and data-handling procedures. The MQAP provides the basis for ensuring that the appropriate methods are used and thoroughly documented. These procedures will be adapted, as appropriate, to meet the objectives of each project.

2.1 Sampling Process Design

E & E's procedures for sampling process design are part of an overall DQO process completed during project planning (see Sections 1.3 and 1.4). The project manager will assign a sampling design team that includes all final data users. The data users are responsible for evaluating available data, developing a conceptual scenario for the site, and specifying decisions to be made regarding the investigation. The factors to be considered in the scenario include possible sources, migration pathways, potential receptors, contaminants of concern, and the environmental or sociological consequences associated with the use of false negative or false positive data points.

Data users need to evaluate the overall project, including all different data types and their intended use, and prioritize data collection to focus on the most critical samples and analytes. Data collection strategies are developed by identifying data quantity and quality needs and evaluating sampling and analytical options. The laboratory should be contacted during initial project scoping meetings to evaluate the required DQOs against current analytical capabilities.

The final design will be documented in the field sampling plan and/or site-specific QAPjP. The documentation should clearly identify assumptions on which the statistical model is based, how those assumptions relate to the sampling and analytical activities, and what are the critical samples for testing the design hypothesis. E & E's field sampling plan will include a summary table listing the type of samples collected, the sampling location, the rationale for selecting the location, sample handling procedures, analytical methods, and the number and type of QA/QC samples. The site-specific QAPjP also will detail the type of sampling approach used for each set of samples.

2.2 Sampling Method Requirements

For each destructive and nondestructive sampling task, E & E specialists will review the DQOs with the client and determine the best technology to obtain the samples required for achieving the stated goals. E & E has an extensive series of SOPs that serve as the basis for all types of investigations. SOPs may be modified for individual tasks to accommodate specific nuances. Site-specific investigation methodologies; sample types, numbers, and locations; and chemical constituents will be identified in the work plan and site-specific QAPjP. A list of selected SOPs is presented in Figure 2-1. Additional SOPs are developed as needed.

In general, sampling at a site will progress from clean areas to contaminated areas. This minimizes the potential for cross-contamination of samples and, subsequently, eliminates data anomalies or misinterpretation of the extent of contamination. The order of sample collection at a specific location normally proceeds as follows: volatile organic compounds (VOCs); extractable organics (including total recoverable petroleum hydrocarbons [TRPHs] and oil and grease); total metals; dissolved metals; microbiological samples; other inorganics; and radionuclides. This sequence helps maintain the representativeness of the samples and the analytical results.

The remainder of this section describes typical procedures for equipment decontamination for the handling of investigation-derived waste (IDW) and for sample containers, preservatives, holding times, packing, and shipping.

2.2.1 Equipment Decontamination

Sampling methods and equipment are chosen to minimize decontamination requirements and the possibility of cross-contamination. Glass, Teflon, stainless steel, or other suitable inert containers will be used for the application of rinse solvents. Equipment or supplies that cannot be effectively decontaminated (e.g., sample tubing or rope) will be disposed of after sampling. Investigation/sampling equipment will be cleaned at the site prior to use, between sampling locations, or as specified in the work plan and the site-specific QAPjP, and prior to transport back to the E & E warehouse. Decontamination of field equipment will be noted in the project logbook. If it is necessary to make decontamination procedure changes in the field, the changes will be noted in the logbook. Otherwise, a notation will be made each day that decontamination was conducted as specified in the project documents (work plan, site-specific QAPjP, and site-specific health and safety plan). The site-specific QAPjP and work plan will describe applicable techniques. Typical procedures for decontaminating investigation/sampling equipment are as follows:

- Steam clean (drilling equipment only) or clean water rinse immediately after use;
- Detergent scrub with brushes (Alconox, Liquinox, or equivalent detergent will be used);
- Clean water rinse (with a steam cleaner for drilling equipment);
- Deionized water rinse;
- Solvent rinse (if applicable);
- Air drying;
- Deionized water rinse; and
- Wrap in aluminum foil (if not to be used immediately).

Heavily contaminated equipment will be rinsed with methanol prior to the detergent wash. Equipment that cannot be adequately cleaned will be discarded. Teflon implements used in the collection of samples for metals analysis also will require a 10% nitric acid solution rinse prior to a deionized water rinse.

Neoprene gloves used during sampling will be replaced between sampling locations or decontaminated using the following procedures:

- Clean water rinse immediately after use;

- Detergent scrub;
- Clean water rinse; and
- Air drying.

Water level indicators, tape measures, and other down-hole instruments (as well as field instruments such as pH and conductivity meters) will be decontaminated using the following procedures:

- Clean water rinse immediately after use;
- Detergent wipe or scrub;
- Clean water wipe or rinse;
- Deionized water wipe or rinse; and
- Air drying.

Submersible pumps and interior and exterior surfaces of pump hoses for all pumps used to purge groundwater wells will be decontaminated using the following procedures:

- Clean water rinse immediately after use;
- Detergent and tap water wash and flush;
- Clean water rinse and flush;
- Deionized water rinse and flush; and
- Air drying.

Note: Submersible and centrifugal pumps should be used for purging only. Peristaltic pumps must be used for sampling.

Tygon and teflon tubing, to be used for sample collection using the peristaltic pump and filtering samples, will be replaced between sampling locations with new, previously unused tubing. Nylon lanyards for bailers will be replaced between sampling locations. New tubing will be decontaminated prior to transport to the field site using the following procedures:

- Clean the outside of the tubing using the following procedure:
    - Detergent and tap water scrub;
    - Tap water rinse;
    - 10% nitric acid solution rinse;
    - Tap water rinse;
    - Solvent rinse; and
    - Deionized water rinse.
- Assemble tubing and pump over clean aluminum foil;
- Detergent and hot tap water flush;
- 10% nitric acid solution flush, turn off pump, and allow solution to sit for 15 minutes;
- Tap water flush;
- Solvent flush (if appropriate), turn off pump, and allow solution to sit for 15 minutes;
- Deionized water flush;
- Deionized water rinse of tubing exterior; and
- Store and transport clean tubing wrapped in aluminum foil.

Other procedures will be developed on an as-needed basis and incorporated into the site-specific QAPjP. Field blanks will be collected to verify the effectiveness of the decontamination procedures.

2.2.2 Investigation-Derived Waste

All IDW will be handled in a manner consistent with applicable federal and state regulations. The waste disposal methods to be used for IDW will depend upon the classification of the waste as either RCRA hazardous or RCRA nonhazardous. Classification of IDW will be based on historical site information, including analytical data when available. Disposal practices for a specific project will be addressed in the work plan.

IDW includes disposable equipment and personal protection equipment (PPE), purge and development waters, drilling fluids, soil cuttings, and decontamination fluids.

In general, the following procedures will be used to dispose of IDW:

RCRA Investigation-Derived Hazardous Waste

- RCRA hazardous waste may be placed in an active facility waste treatment system, or it may be disposed of in the source area if such an action does not pose a threat to human health or the environment; and

- If on-site disposal is not feasible, the waste will be containerized, labeled, and stored on site for subsequent disposal by the client.

RCRA Investigation-Derived Nonhazardous Waste

- RCRA nonhazardous waste (except disposable equipment and PPE) will be disposed of on site when possible. Liquid waste, such as monitoring well development and purge waters, will be poured onto the ground and allowed to infiltrate near the source area or downgradient from the well. Decontamination waters will be poured onto the ground in the decontamination area. Soil cuttings will be returned to the borehole or spread on the surface near the borehole. When on-site disposal is not possible, the waste will be containerized as described above; and

- RCRA nonhazardous waste and decontaminated disposable equipment and PPE will be double-bagged and placed inside a dumpster for disposal at a sanitary landfill.

All Cases for IDW

- Decontamination solvents will be collected in a container and allowed to evaporate during the course of the day. If it becomes necessary to dispose of a large quantity of solvent, the waste solvent will be containerized, properly labeled, and stored on site for subsequent disposal by the client;

- Waste acids and bases will be diluted or neutralized and flushed into a sanitary sewer; and

- Waste calibration standards will be flushed into a sanitary sewer.

2.2.3 Sample Containers

The volumes and containers required for the sampling activities are indicated in Tables 2-1 and 2-2. Prewashed sample containers will be provided by an approved specialty container supplier, which will prepare the containers in accordance with EPA bottle-washing procedures. Sample containers are stocked at the E & E warehouse. A record of sample bottle lot numbers will be maintained by the equipment manager. The log will include the lot number, the site name or project number, and the number of bottles used.

Sample containers for a specific job will be assembled by the equipment manager. When possible, sample containers will be transported to the site in the containers in which they were received from the supplier. When this is not possible, sample containers will be shipped or transported to the site in coolers. Unused volatile organic analysis (VOA) vials will always be shipped in a box (constructed to prevent breakage) and inside a cooler. Trip blanks will be transported inside the same box as the VOA vials. In general, most sample containers are transported to the project site in a project vehicle, such as a van. However, it is sometimes necessary to ship sample containers via common carrier; E & E uses Federal Express or United Parcel Service (UPS).

2.2.4 Sample Preservation and Holding Times

All samples requiring preservation will be preserved in the field immediately after collection and transportation to the hotline. A clean, disposable pipette or a premeasured, single-use, glass ampule will be used to transfer liquid preservatives to the sample container. Care will be taken to avoid contact between the pipette or ampule and the sample or sample container. Solid preservatives will be transferred to the sample container using a clean, stainless steel spoon. After preservation, the sample will be gently shaken to mix the preservative, and a small amount of the sample will be poured into a clean cup and tested with pH paper to determine if a sufficient amount of preservative has been used. Samples for VOA will not be tested with pH paper. Instead, a few drops of concentrated preservative will be added to an empty (dummy) VOA vial, which will then be filled with sample water and tested for pH. The amount of preservative necessary to adjust the sample pH will be recorded. This preservative amount will then be added to each VOA vial prior to sample collection. Use of additional preservative also will be recorded in the logbook. Field blanks that require preservation will be preserved with a volume of reagent equal to the volume of reagent used in the samples that the blanks represent. Preservatives and holding times for each type of priority pollutant analysis are indicated in Table 2-3. Additional preservation requirements and holding times for nonpriority pollutant analyses are listed in Table 2-4.

Reagents used for preservation are reagent-grade and are obtained from a chemical supply house such as American Scientific Products, Cole Parmer Instrument Company, or Baxter Diagnostics, Inc. Preservation supplies are stored with like chemicals in chemical storage cabinets at the E & E warehouse, as described in Table 2-5. Each bottle is clearly numbered, and the number, date of purchase, type of chemical, dates of each field project during which the bottle was used, and site name and project number are recorded in a logbook maintained by the equipment manager. Furthermore, the bottle number and chemical type of each preservative used at a site are recorded in the site logbook. As an alternative, preservatives may be purchased from Eagle Pitcher in premeasured, single-use glass ampules. The ampules will be stored at the E & E warehouse in the appropriate chemical storage cabinet. Each shipment of ampules will be assigned a unique number, and a logbook tracking the usage of the shipment will be kept by the equipment manager. The logbook will contain the same information as described above for bulk reagents. Fresh sample preservatives will be obtained from warehouse stocks prior to mobilization for each sampling event.

With the exception of volatiles, sample preservation with acids or bases will be verified at the ASC upon receipt, and the pH will be recorded in the sample management logbook. For volatiles, the pH will be verified after analysis when using the EPA CLP scope of work (SOW) and the pH recorded in the injection logbook. All sample coolers will be checked to verify that samples have been cooled properly, with documentation on the cooler receipt form (see Section 2.3.2). If the samples are improperly preserved, a QA/QC discrepancy form (see Section 3) will be submitted to the ASC director and QA coordinator for follow-up action. The project manager or field team leader will be notified by the ASC to implement corrective action in the field.

2.3 Sample Handling and Custody Requirements

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample but also prevents any detrimental effects due to the possible hazardous nature of the samples. Regulations for the packaging, marking, labeling, and shipping of hazardous materials are promulgated by DOT in 49 CFR 171 through 177. E & E has developed an SOP to address these requirements, PCBTECH 7.12.

All COC requirements must comply with SOPs in the EPA sample handling protocol. All sample control and COC procedures applicable to the E & E ASC are presented in internal SOPs and are discussed above.

Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids must never be mixed. All sample lids must stay with the original containers.
- The sample volume level can be marked by placing the top of the label at the appropriate sample height or by using a grease pencil. This procedure will help the laboratory to determine whether any leakage occurred during shipment. The label should not cover any bottle preparation QA/QC lot numbers.
- All sample bottles must be placed in a separate plastic bag to minimize the potential for contamination.
- Shipping coolers must be partially filled with packing materials and ice (when required) to prevent the bottles from moving during shipping.
- The sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.
- The environmental samples are to be cooled. Wet ice packaged in sealable, plastic bags will be used to cool samples during shipping. Ice is not to be used as a substitute for packing materials.
- Any remaining space in the cooler should be filled with inert packing material (e.g., vermiculite, bubble wrap, foam inserts). Under no circumstances should material such as sawdust or sand be used.
- A duplicate custody record must be placed in a plastic bag and taped to the inside of the cooler lid. Custody seals are affixed to the sample cooler.

- All sample containers will generally be segregated according to sample matrix and expected contaminant concentration. Soil samples will not be shipped with water samples, and low-concentration samples will not be shipped with medium- and high-concentration samples, unless otherwise directed by the client. In addition, all containers for a given sample will be shipped in the same cooler when possible. In cases where samples for volatile analysis would be shipped in several coolers on a single day, VOA vials will be consolidated into a single cooler to minimize the number of required trip blanks.

Note: The ASC does not knowingly accept samples with high levels of radioactivity or dioxins or any samples for which ASC handling procedures may be insufficient to protect laboratory employees. Project staff and field staff must take all feasible precautions, including discussions with site officials and company representatives and site observations, to ensure that neither they nor ASC personnel are exposed to unduly hazardous materials. Note that field staff are (in many cases) equipped with PPE and breathing apparatus not available to ASC personnel.

Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched to the Ecology and Environment, Inc., Analytical Services Center, located at 4493 Walden Avenue, Lancaster, New York 14086. A separate COC record must be prepared for each shipping container. The following requirements for shipping containers will be followed.

Sample shipping containers will generally be commercially purchased coolers (e.g., Coleman coolers). Each container will be custody-sealed for shipment as appropriate. The container custody seal will consist of filament tape wrapped around the package at least twice and custody seals affixed in such a way that access to the container can be gained only by cutting the filament tape and breaking a seal.

Field personnel will make arrangements for transportation of samples to the ASC. In most cases, samples will be shipped using an overnight express carrier (e.g., Federal Express). When custody is relinquished to a shipper, field personnel will telephone the ASC custodian (716/685-8080) to inform the laboratory of the expected time of arrival of the sample shipment and any time constraints on sample analysis. The ASC must be notified as early in the week as possible and, in the case of samples intended for Saturday delivery, no later than 3 p.m. (Eastern Standard Time) on Thursdays. Samples will be retained by the ASC for 30 days after the final report is submitted.

Marking and Labeling

The following procedure will be used to mark and label sample shipments:

- Use abbreviations only where specified.
- The words "This End Up" or "This Side Up" must be clearly printed on the top of the outer package. Upward pointing arrows should be placed on the sides of the package. The words "Laboratory Samples" also should be printed on the top of the package.
- After a sample container has been sealed, two COC seals are placed on the container, one on the front and one on the back. The seals are protected from accidental damage by placing strapping tape over them.
- If samples are designated as medium or high hazard, they must be sealed in metal paint cans, placed in the cooler with inert packing material, labeled, and placarded in accordance with DOT regulations.
- In addition, the coolers must also be labeled and placarded, in accordance with DOT regulations, when shipping medium- and high-hazard samples.

2.3.1 Sample Custody

This section describes SOPs for sample identification and COC. The purpose of these procedures is to ensure that the quality of the samples is maintained during collection, transportation, storage, and analysis. All COC requirements comply with SOPs indicated in EPA sample-handling protocol. Formal sample custody procedures begin when the precleaned sample containers leave the ASC or upon receipt from the container vendor. The ASC follows written and approved SOPs for shipping, receiving, logging, and internally transferring samples. These procedures are discussed in this section.

Sample identification documents must be carefully prepared so that sample identification and COC can be maintained and sample disposition controlled. Sample identification documents include field notebooks, sample labels, custody seals, and COC records.

The primary objective of the COC procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from receipt of precleaned sample bottles through completion of all required analyses. A sample is in custody if it is in a team member's physical possession, in a team member's view, locked up, or kept in a secured area that is restricted to authorized personnel.

Laboratory Custody Procedures

All laboratory custody procedures are maintained through E & E's LABMIS. The system provides for sample log in, signing samples out to and back from individual analysts, data storage and reporting, and sample disposal. These procedures ensure continuous documentation of sample custody from receipt to disposal. They are described below.

Sample Receipt and Log-In. A sample custodian accepts custody of the shipped samples from the carrier and enters preliminary information into the package receipt log under the appropriate column heading (see Figure 2-2). When the cooler is unpacked, the package receipt log is completed and a cooler receipt form is filled out (see Figure 2-3). The ASC SOPs SM.1, SM.2, and SM.8 describe the procedures for sample receipt in greater detail.

Sample log-in procedures are discussed in SM.2, also. The custodian logs the samples into LABMIS after verifying COC information. The custodian enters job and sample information, as well as analyses requested for each sample. Sample bar code labels are produced and applied to appropriate containers, and a computer sample log-in sheet is produced.

To ensure that holding times are met, all samples appear on a daily log provided to section supervisors. The samples are prioritized on the basis of holding times and allow supervisors to generate work assignments such that the "oldest" samples are analyzed first.

Intralab Custody. The bar code label allows easy tracking of samples within the ASC by simply scanning the bar code every time the sample is taken from or returned to the sample custodian. The ASC SOP SM.4 describes the procedure for custody transfer. A computer audit of the sample container will list all these transactions and indicate the analyst or custodian handling the sample. Custody of samples within the laboratory sections is documented in extraction, analysis, or injection logbooks.

After sample analysis is complete, custody of the sample and any digestates or extracts are returned to the sample custodian for storage for a period of 30 days (or longer if requested). The laboratory director determines the required method of disposal and provides a completed destruction authorization form (see Figure 2-4) to the sample custodian, who disposes of the sample/digestate/extract. The ultimate fate of the sample/digestate/extract is documented both on the form and in LABMIS. The ASC SOP SM.7 describes the procedure for sample destruction.

Security and Storage. All samples and subsamples (i.e., digestates or extracts) are stored under custody in the designated ASC area, including walk-in coolers at 4°C; refrigerators for extracts, solvents, and volatile samples; a freezer for storage at 0°C; and metal cabinets for samples and metals digestates not requiring refrigeration. Storage facilities for laboratory reagents and standards are presented in Table 2-6.

The designated ASC area for sample custody is a restricted area, and access is limited. Keys are distributed to custodial or supervisory staff only. A sample custodian is on duty at all times when the laboratory is open.

Sample custodians will maintain a copy of the package receipt log, sample receipt computer log, E & E computer log, and the sample destruction/disposal form. Sample custodians also will maintain a temperature log of all storage areas and take immediate corrective action if the areas are outside 4°C, ±2°C.

Field Custody Procedures

The following field custody procedures will be used:

- As few persons as possible should handle samples.
- All QC samples are subject to exactly the same COC and documentation as "real" samples.
- Precleaned sample bottles must be obtained from an approved retail source such as I-Chem. Coolers or boxes containing cleaned bottles

should be sealed with a custody tape seal during transport to the field or while in storage prior to use.

- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under COC rules.
- The sample collector will record sample data in the field logbook.
- The field team leader will determine whether proper custody procedures were followed during the fieldwork and decide whether additional samples are required.

Sample Container Custody. Precleaned sample containers will be relinquished by the equipment manager to the field team leader. The equipment manager will log the date, time, and person to whom the sample containers were released. The field team leader will record receipt of the sample containers in the project logbook.

If sample containers are received directly from the commercial supplier, the field team leader will record receipt of the containers in the project logbook.

Sample Labels. Sample labels (see Figure 2-5) or tags attached to or affixed around the sample container must be used to properly identify all samples collected in the field. The sample labels are to be placed on the bottles so as not to obscure any QA/QC lot numbers on the bottles. Sample information must be printed in a legible manner using waterproof ink, and the label covered with Mylar tape.

Chain-of-Custody Record. The COC form must be fully completed in duplicate by the field technician designated by the project manager to be responsible for sample shipment to the appropriate laboratory for analysis (see Figure 2-6). In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction or analysis holding times), the person completing the COC record should note these constraints in the "Remarks" section of the custody record in addition to providing prior notification to the laboratory. The custody record also should indicate any special preservation techniques necessary or whether the samples need to be filtered. Copies of the COC records are maintained with the project file.

Custody Seals. Custody seals (see Figure 2-5) are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. Sample shipping containers approved by DOT are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Strapping tape should be placed over the seals to ensure they are not accidentally broken during shipping.

Transfer of Custody and Shipping. The following procedures will be used for transfer of custody and shipping:

- The containers in which the samples are packed must be accompanied by a COC record. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the COC record for documentation purposes.

- Samples must be dispatched to the ASC for analysis with a separate COC record accompanying each shipment. Shipping containers must be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the COC record.

- All shipments must be accompanied by the original COC record identifying their contents. The other copies are distributed to the appropriate field team leader and project manager.

- If sent by U.S. mail, the package is registered with return receipt requested. If sent by common carrier, a bill of lading is used. Freight bills, postal service receipts, and bills of lading are retained as part of the permanent documentation.

2.4 Analytical Method Requirements

Analytical method requirements will be documented in the site-specific QAPjP and documented as part of the procurement process described in E & E's SOP for analytical services delivery. The laboratory QA program provided as a supplement to the QAPjP indicates laboratory-derived QA/QC criteria for required methods. QA/QC criteria specified by the method or developed internally by E & E's laboratory are provided in this section.

2.4.1 Standard Laboratory Analytical Procedures

Analytical methods in support of EPA rules and programs are referenced in 1) 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act"; 2) "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, Revised March 1983; 3) "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," 3rd edition, SW-846, 1986; 4) Inorganic (Document ILM02.0) and Organic (Document OLM01.[illegible]) Statements of Work for EPA Contract Laboratory Program, revised March 1990; 5) "Methods for the Determination of Organic Compounds in Drinking Water," EPA -600/4-88/039; 6) NYSDEC Analytical Services Protocol, Revised December 1991; 7) American Society for Testing and Materials, Revised 1984; and 8) "Standard Methods for the Evaluation of Water and Waste Water," 17th Edition, 1989. Other analytical references may be used to comply with specific client requirements. These references will be given in the site-specific QAPjP.

Table 2-7 presents the sample preparation methods that may be used in combination with applicable analytical methods. Table 2-8 lists all inorganic analyses typically performed by E & E's ASC. Any other methods required by specific clients will be added to the site-specific QAPjP. For each analyte, the table includes:

- Method number;
- Matrix;
- Analyte/component;
- Precision (relative percent difference [RPD] and concentration range);
- Accuracy (percent recovery [%R] and concentration range); and
- Method detection limit (MDL).

Table 2-9 lists all organic analyses typically performed by E & E's ASC. Any other methods required by specific clients will be added to the site-specific QAPjP. For each analyte, the table includes:

- Method number;

- Matrix;
- Analyte/component;
- MDL;
- Practical quantitation limit (PQL);
- Method accuracy %R for all compounds;
- Method precision RPD for all compounds; and
- %R and RPD limits for compounds routinely spiked.

Tables 2-8 and 2-9 present detection limits and data for QC criteria generated internally by E & E's ASC; other laboratory criteria will be specified in the site-specific QAPjPs. Analytical methods for routine field instrumentation are presented in Table 2-10.

Methodology references contain specific QC criteria associated with the particular methods. These requirements include calibration, tuning, and QC samples and are described in detail within the methods. Daily performance tests and demonstration of precision and accuracy are required. Hazardous waste characteristic parameters, which include ignitability, corrosivity, reactivity, and toxicity characteristic leaching procedure (TCLP), are subject to the same QA/QC requirements as specified for the other methods. QA criteria for CLP procedures for organic analyses are presented in Tables 2-11 through 2-15.

The QA objectives for the measurement of analytical data for methods typically performed by the ASC are listed in Tables 2-8 to 2-15. These objectives represent the ASC's capabilities applied to the analysis of standard sample matrices in lieu of any project-specific requirements. However, instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the detection limits or associated QC target criteria. In such instances, data will not be rejected *a priori* but will be examined on a case-by-case basis. The laboratory will report the reason for deviations from these detection limits or noncompliance with QC criteria in the report narrative.

2.4.2 Nonstandard Laboratory Analytical Screening Procedures

E & E's ASC has developed, validated, and used nonstandard analytical screening techniques for specific purposes. Generally, these methods are proposed where it can be shown that substantial cost or time savings can be achieved in comparison to standard procedures.

These methods are modifications of existing EPA methods. In order to make the methods faster and/or less expensive, some calibration and QC procedures are eliminated. The implementation of an analytical-screening program on site or at the ASC can accelerate decision-making assessments, significantly decrease analytical costs, and enable rapid turnaround times. In effect, analytical screening can:

- Minimize analytical costs;
- Provide more timely turnaround of sample data;
- Enable the use of analytical cost savings to enhance the number of sampling locations during the investigation;
- Aid in the selection of optimal groundwater well screen depths;
- Expedite the process of determining horizontal and vertical contaminant extents;
- Provide identification of appropriate samples for more-detailed analysis; and
- Provide immediate analytical feedback to field personnel and remedial contractors.

Laboratory screening will be used with definitive confirmation of at least 10 percent. The analytical screening parameters and detection limits will be specified in the QAPjP or the work plan and will depend on the parameter groups selected to function as indicator contaminants. Some examples of analytical screening methods that have been previously used by the laboratory are discussed below. QC targets, rather than specific QC criteria, are presented in Tables 2-16 and 2-19 because these methods are qualitative, not quantitative.

Volatiles Screen by Gas Chromatography. This screening procedure is based on EPA Methods 8010 and 8020. Compound identification is not supported by second-column confirmation. Gases are not analyzed. Coeluting compounds are not distinguished.

Calibration is abbreviated. This method is designed to produce false positives rather than false negatives.

Extractables Screen by HPLC. This procedure uses solid-phase extraction cartridges or discs. Quantitation is based on the response of a single compound. Calibration and QC are abbreviated. The analytical run is shortened. Phenols or polynuclear aromatic hydrocarbons (PAHs) are identified and reported as totals.

Polychlorinated Biphenyl (PCB) Screen by GC. This procedure is based on EPA Method 8080. Calibration and QC are abbreviated. Detection limits are higher and based on total PCBs. Individual Aroclors are not identified.

Pesticides/PCB Screen by GC. This procedure is based on EPA Method 8080. Calibration and QC are abbreviated. There are seven target pesticides, and PCB is reported as a total. Detection limits are higher than those of Method 8080. No surrogates are added.

Metals Screen by ICP. Matrix effects are documented. Calibration and QC are limited.

2.4.3 Field-Screening Methods

E & E's capabilities for field analytical support services evolved from the Field Analytical Support Project, which was developed, implemented, and refined primarily by E & E chemists in support of a program for EPA. The purpose of field analysis is to provide EPA with a wide range of quick, on-site analytical support capabilities that allow field teams to inexpensively (compared to the cost of full laboratory analyses) field-screen samples to determine the presence or absence of known hazardous materials.

Field analysis emphasizes the screening of target analytes known or suspected to be on site, based on the results of previous sample analyses or review of owner/operator documentation of previous site activities. Field analysis allows for the analysis of a greater number of samples in the field for the same cost as a lesser number of samples analyzed in a full-service laboratory. Added benefits include real-time feedback concerning the achievement of cleanup goals; waste source, site, and migration pathway conditions; and a quicker determination of the areal extent of contamination. In addition, field-screening techniques can be used to facilitate removal actions or field sampling/site characterization efforts by providing quick-turnaround, near real-time analyses or selecting the most appropriate samples requiring definitive analyses (thus using CLP analyses more judiciously and cost-effectively). All field-screening data will be confirmed using definitive data for at lease 10% of the samples.

E & E can provide a number of discrete or complementary services, including the development/implementation of specialized field analytical-screening methods, design and construction of on-site mobile laboratories, training of personnel in the calibration and use of field-screening equipment, and data analyses/preparation of reports. Field analytical-screening techniques can be used during removal and response actions, as well as during all phases of site investigation/remediation—from site assessment through remedial investigation/feasibility study (RI/FS), through implementation of the selected remedial design, to closure.

More than 30 field analytical-screening methods, in the form of standard operating guidelines (SOGs), have been derived by E & E chemists from EPA-approved analytical laboratory procedures (modified for field use). Modifications have been incorporated to reduce the sample size and the amount of extraction solvents used. Prior to mobilization, the proposed field analytical-screening methods selected for a particular site are specifically reviewed and optimized for the target compounds known to be on site (i.e., based on previous analytical results or owner/operator data). The methods can be verified using matrix spike samples, duplicate samples, and method detection limit studies.

To meet project DQOs, the analytical data can be produced with the same degree of QA/QC that is required for definitive data for fixed laboratories—with the added advantage of being available on site—or the analytical data can be screening data subject to definitive data confirmation.

To ensure acceptable data of a known level of quality, E & E's QA/QC methods for field analytical screening include:

- Peer-reviewed analytical methods that have been accepted by EPA headquarters and regional offices;
- Analyte-specific QA/QC protocols applied in a consistent manner;

- Personnel trained in the use of equipment and proper sampling protocol;
- Appropriate analytical instrumentation calibration;
- Definition of DQOs to define appropriate data uses;
- Use of blanks, matrix spikes, duplicates, EPA QC samples (if required), and blind performance evaluation samples; and
- Interlaboratory comparisons.

2.4.4 Laboratory Glassware Cleaning and Storage Procedures

Organic Extraction Glassware

The following procedure will be used when cleaning and storing glassware used in organic extractions:

- Tap water or solvent rinse, as appropriate, immediately after use;
- Hot detergent water (Alconox solution) wash;
- Tap water rinse to remove detergent;
- NOCHROMIX solution soak, as needed (e.g., for scratched or chipped glassware, extreme contamination);
- Thorough analyte-free water rinse;
- Oven or air drying (Class A volumetric glassware must be air dried);
- Store in designated, clean, contamination-free cabinet in a clean area of the laboratory; and
- Extraction solvent rinse prior to use.

For volatile organics glassware, cleaning is performed by a tap water rinse and oven drying. If there is excessive soiling, purge and trap units may require soaking in a hot detergent (Alconox) solution prior to the water rinse.

Metals Glassware

The following procedure will be used when cleaning and storing glassware used in metals analysis:

- Alconox and tap water solution wash;
- Tap water rinse, followed by deionized water rinse;
- 5% (volume/volume) nitric acid/deionized water solution rinse;
- Deionized water rinse;
- Air drying;
- Store in a designated contamination-free cabinet in a clean area of the laboratory; and
- Analyte-free solvent rinse prior to use.

For general analytical chemistry, the above cleaning procedures are used (with the exception of the nitric acid rinse).

2.5 Internal Quality Control Requirements

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. Field QC will include duplicates, trip blanks, field blanks, field equipment blanks, and miscellaneous field QC samples. Field QC samples will be preserved, documented, and transported in the same manner as the samples they represent. Laboratory-based QC will consist of standards, replicates, spikes, and blanks. Unless otherwise directed, the QC samples listed below will be collected and analyzed at the frequency listed as definitive analyses in Tables 2-20 and 2-21. Types and frequencies for screening analyses will be used when samples are collected for screening in the field or laboratory. Any changes to this protocol will be detailed in the site-specific work plan or QAPjP. Calibration frequencies are specified in Section 2.7.

2.5.1 Field Quality Control Samples

Duplicate Samples

The duplicate sampling requirements for each site will be described in detail in the site-specific QAPjP. Duplicate samples provide insight as to the homogeneity of the sample matrix and enable consideration of variations in contaminant concentrations present in the matrix. Duplicate sample data establish a degree of confidence that the sample represents site conditions.

Duplicate samples will be collected at the rate provided in Table 2-20. Duplicate soil samples will be prepared by collecting equal aliquots from the same sample source and placing them in separate sample bottles. Duplicate water samples will be prepared by collecting successive volumes of water and placing them in separate bottles. Duplicate samples will be shipped with the samples they represent and will be analyzed in the same manner.

Trip Blanks

Trip blanks are collected to establish that the transport of sample bottles to and from the field does not result in the contamination of the sample from external sources. Trip blanks will be collected for, and in conjunction with, only VOA sample tasks. If the 40-ml VOA vials are shipped to the field team by the ASC sample custodian, a representative number of vials filled with analyte-free water (preserved, capped, and labeled) will accompany the shipment to and from the laboratory. In the event that VOA vials are shipped directly to the field from a specialty container source such as I-Chem, trip blanks will be prepared upon receipt. A representative number of 40-ml vials will be filled with analyte-free water, sealed, and labeled in a clean area. A representative number of VOA vials will be two vials (trip blanks) for every shipping container containing samples for VOA. The above protocol for trip blanks applies to both aqueous and nonaqueous samples. Trip blanks will be treated in the same manner as the VOA samples they represent. Trip blanks will be sent with each sample shipping container that contains VOA samples.

Field Equipment Blanks

Field equipment blanks are blank samples (sometimes called transfer blanks or rinsate blanks) designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use and that cleaning procedures between samples are sufficient to minimize cross-contamination. Field equipment blanks will be prepared in the field using an approved water source. The field equipment blank will be preserved, documented, shipped, and analyzed in the same manner as the samples it represents. Equipment blanks will be collected as follows:

- If nine or fewer samples of a similar matrix are to be collected during an investigation, then one equipment blank must be collected from the field-cleaned equipment set.
- If 10 or more samples of a similar matrix are to be collected, a minimum of two equipment blanks will be collected. One will be collected from a field-cleaned equipment set prior to the start of sampling, and the second will be collected from a field-cleaned equipment set during the course of sampling.
- For sampling events that involve more than 20 samples, a minimum of two equipment blanks will be required. Additional equipment blanks will be collected at the rate of 5% of the required number of field cleanings per equipment set.

If an equipment set is cleaned more than 20 times in one sampling event, equipment blanks must be submitted at the rate of 5% of the total required cleanings for all equipment sets being used to collect a specific type of sample. An equipment set will be defined as all sampling equipment required to collect one sample. For example, one soil sample equipment set may include a stainless steel bowl, a stainless steel trowel, and a bucket auger.

Split Samples

Split samples will be collected when they are requested by the client. A split soil sample will be collected in the same manner as a duplicate. Split water samples will be collected from consecutive sample volumes from the sampling device. For large volume samples, half the volume of the sampling device will be emptied into one container, and the remainder will be placed in the corresponding split container. This procedure will be repeated until both containers are full. The two separate sample containers will be shipped to different laboratories for analysis, or one sample may be archived. The same analyses will be performed on each of the aliquots.

Miscellaneous Field QC Samples

This type of QC sampling involves the analysis of investigation water sources and monitoring well-drilling fluids (if used). Because the water supply source is used in decontamination and well-drilling activities, it may be necessary to determine the possibility for the introduction of outside contaminants. Drilling fluids (muds) that are used during well installation may also be analyzed to assess the possibility of mud constituents affecting groundwater samples. Miscellaneous field QC samples will be defined and discussed in the work plan and the site-specific QAPjP.

Field Measurements

Instruments for field parameters (e.g., pH and conductivity) will be checked with a standard every 4 hours and at the end of the sampling day. If pH response is greater than 0.2 unit more or less than the standard, complete recalibration will be conducted. Provided that the meter was in calibration 4 hours previously, reanalysis of samples collected since then will not be required. Discrepancies for conductivity will be noted in the logbook. QC check standards will be analyzed prior to shipment of the equipment for a field job. Calibration information will be recorded in the logbook associated with that piece of equipment.

Documentation

The collection of field QC samples and duplicate field measurements, as well as the conditions under which the samples were collected, will be documented in the field logbook.

2.5.2 Laboratory Quality Control Analyses

Laboratory-based QC will consist of blanks, replicates, spikes, and QC check standards. Depending upon the particular method used, QC may be more rigorous, but at a minimum, QC samples will be analyzed at a frequency specified in Table 2-21. Field duplicates and field blanks will be analyzed by the laboratory as samples and will not necessarily be identified to the laboratory as duplicates or blanks. Additional samples will be split by the laboratory and used for the laboratory duplicate, matrix spike, or matrix spike duplicate. QC records will be retained and results reported with sample data. All QC requirements are specified in Section 2.4. Requirements other than those specified in Section 2.4 will be followed if they are necessary to meet specific client requirements.

Laboratory Blanks

Three types of blanks routinely analyzed in the laboratory are field blanks, method blanks, and reagent blanks. The usual field blanks (i.e., trip blanks, equipment blanks, and field blanks) and miscellaneous QC samples are described above. They are analyzed in the laboratory as samples, and their purpose is to assess the sampling and transport procedures as possible sources of sample contamination. Method blanks and reagent/solvent blanks are used to assess laboratory procedures as possible sources of sample contamination:

- **Method blanks** for all samples consist of deionized water that is subjected to the entire sample procedure, including extraction, distillation, and digestion (whatever is appropriate for the analytical method being used).
- **Reagent/solvent blanks** consist of analyte-free water or solvents that are not processed. They are used to indicate instrument drift or contamination apart from that which may arise in sample processing.

Laboratory Replicate

These samples are aliquots of a single sample that is split on arrival at the laboratory or upon analysis. Additional sample volume provided by the field sampling team may be required. Significant differences between laboratory replicate samples are generally due to analytical technique or sample inhomogeneity, whereas significant differences in field duplicate samples may be due to a variety of reasons. Replicate samples are used to determine laboratory precision, especially with metals analysis and general analytical methods. Organic analysis precision is generally determined with a matrix spike duplicate pair.

QC Reference Standards

A reference standard is prepared in house or may be obtained from EPA. A reference standard is obtained from a lot different from that of the calibration standard where dictated by the method. The concentration of the known quantity is the "true" value of the standard. The reference standard is not carried through the same process used for the environmental samples but is analyzed without digestion or extraction. A reference standard result is used to validate an existing concentration calibration standard file or calibration curve.

Laboratory Control Sample

A laboratory control sample, commonly called a blank spike, is prepared by adding a known amount of analyte of the same type that is to be analyzed to analyte-free water before processing. The laboratory control sample is used to determine whether sample preparation and analysis are in control.

Accuracy is expressed as a %R and is calculated using the formula:

$$\%R \quad \frac{observed\ concentration}{expected\ concentration\ of\ known} \times 100$$

Sample Matrix Spike

A matrix spike is prepared by adding a known amount of analyte of the same type that is to be analyzed for to the environmental sample before processing. These analytes may be present as indigenous levels found in the actual samples. The calculated %R of the spike is taken as a measure of the bias of the total analytical method in a sample. When there is a negligible change in volume due to the spike, it is calculated as follows:

$$\%R \quad \frac{SSR - SR}{SA} \times 100$$

where,

%R = Percent recovery;

SSR = Measured concentration of the analyte in the spiked sample (spiked sample result);

SR = Measured concentration of the analyte concentration in the sample before the spike was added (sample result); and

SA = Concentration of added spike.

Limits for acceptable percent recovery are presented in Section 2.4.

Internal Standard

An internal standard is prepared by adding a known amount of pure compound to the environmental sample; the compound selected is not one expected to be found in the sample but is instead similar chemically to the compound of interest. Internal standards are added to the environmental sample just prior to GC/MS analysis. The internal standard is used for quantification purposes using the relative response factor (RRF).

Surrogate Spikes

Surrogate compounds are added to all samples in GC/MS analyses and to GC samples as indicated in Table 2-9. They are compounds similar to but different from target analytes. They may give both an indication of method efficiency and method bias. EPA CLP QC criteria will be used for Target Compound List (TCL) organics, and laboratory-derived criteria will be used for other methods and surrogate compounds.

Matrix Spike Duplicate and Duplicate

Aliquots are split in the laboratory from the same sample, and each aliquot is treated exactly the same throughout the analytical method. The RPD between the values of the matrix spike and matrix spike duplicate or between the sample and duplicate, as calculated below, is taken as a measure of the precision of the analytical method:

$$RPD \quad \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \; x \; 100$$

where,

RPD = Relative percent difference;

D_1 = First sample value; and
D_2 = Second sample value (duplicate).

Criteria for acceptable RPD are presented in Section 2.4. Acceptable RPDs may vary depending on actual concentration levels found in samples.

Blind QC Check Samples

Types of blind QC check samples include external performance evaluation (PE) samples provided by an outside certifying agency and internal QC samples submitted for routine analysis by the laboratory QA coordinator. The frequency of external PE samples varies with the agency, but generally E & E performs quarterly proficiency evaluations for the New York State Department of Health (NYSDOH) and semiannual evaluations for the EPA water pollution proficiency program. Internal QC samples are used as a supplement to the external QC samples.

2.5.3 Procedures Used to Assess Laboratory Data Accuracy, Precision, and Completeness

Laboratory accuracy and precision are determined as described in Section 2.5.2. Accuracy is assessed using %R values calculated from reference standards, laboratory control samples, matrix spikes, and surrogate spikes. Precision is assessed in terms of RPD values calculated from laboratory duplicate and/or matrix spike/matrix spike duplicate analyses. Overall precision for a specific project can be assessed using RPDs calculated from field duplicate analyses. Method-specific targets for accuracy and precision are provided in Tables 2-8 and 2-9.

Representativeness

The characteristic of representativeness is not quantifiable. The following subjective factors must be taken into account:

- Degree of site homogeneity;
- Degree of homogeneity of a sample taken from one point on a site; and

- Available information on which a sampling plan is based.

To maximize representativeness of results, sampling techniques and locations are carefully chosen so that they provide laboratory samples that are representative of both the site and the specific area. Within the laboratory, precautions are taken to extract from the sample bottle an aliquot representative of the whole sample. Those precautions include premixing the sample in the sample container and discarding large pebbles from soil samples.

Method Detection Limits

MDLs have been determined according to CLP procedures or procedures outlined in 40 CFR Part 136, Appendix B. The MDLs have been determined for organics and metals. General analytical chemistry detection limits have generally been determined by the lowest point on the curve. MDLs are being developed for parameters where absent, using the procedures referenced above. The MDLs are to be determined at least annually.

Many clients request the lowest possible limits of detection. However, the limits of quantitation are sample matrix-dependent. Thus, for most purposes, the laboratory uses PQLs that are above the determined method detection limits. PQLs are chosen from literature values, such as EPA CLP, or are set as values above but close to the MDLs.

Quality Control Charts

QC limits are calculated using 30 data points. The charts are prepared by determining the mean of the determinations, setting warning limits of plus or minus two (±2) standard deviations from the mean, and setting control limits of plus or minus three (±3) standard deviations from the mean. The following equation is used to calculate the standard deviation(s):

$$SD = \sqrt{\sum_{i=1}^{N} \frac{(X_i - \overline{X})^2}{N - 1}}$$

where n is the number of determinations, x_i is the numerical value for the last in the series of determinations, and x is the mean.

C-B-74

Upper and lower warning and control limits are determined using the following equations:

Upper or Lower Control Limit = X ± 3S

Upper or Lower Warning Limit = X ± 2S

where X is the average %R or the average %RPD and S is the standard deviation.

Analysis is considered out of control whenever one of the following conditions occurs:

- One value is outside control limits;
- Two consecutive values fall outside warning limits;
- Seven consecutive values fall on the same side of the mean; or
- Seven consecutive values form a consistent upward or downward trend.

Laboratory supervisors prepare a weekly analysis of out-of-control charts, discussing possible causes and suggested corrective actions, if necessary. These analyses are presented to the ASC QA coordinator and the section manager for review and comment.

Control limits are updated at least annually for all analytical procedures. Control limits will also be updated if significant modifications to the SOPs are made.

The following QC samples are plotted on control charts for each type of laboratory analysis:

- GC/MS: Surrogates, spikes, and QC reference standards;
- GC and HPLC: Surrogates, spikes, and QC reference standards;
- Metals: Laboratory control samples, spikes, and duplicates; and
- General Analytical Chemistry: Spikes, duplicates, and laboratory control samples.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All laboratory and field instruments and equipment used for sample analysis will be serviced and maintained only by qualified personnel. Some major laboratory instruments (e.g., GC/MS, ICP, and atomic absorption spectroscopy [AAS]) are maintained under service agreements with the manufacturer and will be serviced by manufacturer-approved service agents. All other instruments are maintained by senior analysts and electronics technicians. The technicians are qualified service agents approved by several manufacturers for work on their instruments. All repairs, adjustments, and calibrations will be documented in an appropriate maintenance logbook or data sheet that will be kept on file. The instrument and field equipment maintenance logbooks will clearly document the date, description of the problems, corrective action taken, result, and person who performed the work. Calibration procedures described in Section 2.7 will be used to test or inspect the instrument's performance.

2.6.1 Field Equipment Maintenance

Routine preventive maintenance is performed twice on each piece of field equipment: once prior to shipping it to a field job and again upon its return. Separate logbooks are used for each piece of equipment to document all maintenance. Each logbook is stored and shipped with its corresponding unit so that any maintenance performed or problems that occur in the field also can be documented. Table 2-22 provides a summary of routine maintenance on field equipment.

In the event of major equipment failure in the field, in most instances a replacement unit can be at the field site within 24 hours.

2.6.2 Laboratory Equipment Maintenance

E & E maintains a stock of spare parts and consumables for all analytical equipment. Routine preventive maintenance procedures are summarized in Table 2-23. Maintenance performed on each piece of equipment is documented in a maintenance logbook. The frequency of routine procedures will vary depending on the production work load and the types of samples analyzed. Approximate frequencies of procedures are outlined in Table 2-23. Nonroutine maintenance is performed when an instrument fails to calibrate or shows other signs of nonperformance.

The ASC operates backup instrumentation for most of its analytical equipment in the event of major instrument failure. If backup equipment is unavailable, either work does not proceed or other acceptable methods are used for analysis.

2.7 Instrument Calibration and Frequency

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations, as well as criteria set forth in the applicable analytical methodology references. Operation, calibration, and maintenance will be performed by personnel properly trained in these procedures. Documentation of all routine and special maintenance and calibration information will be maintained in an appropriate logbook or reference file and will be available for inspection. Table 2-24 lists typical monitoring equipment used during fieldwork, and Table 2-25 lists instruments on line at the ASC. Brief descriptions of calibration procedures for major laboratory and field instruments follow.

2.7.1 Field Instrumentation

O_2/Explosimeter

Procedures for field calibration of the Mine Safety Apparatus (MSA) Model 260 O_2/Explosimeter are as follows:

- Inspect instrument to ensure entry and exit ports are clear;
- Turn the middle switch to ON position (at this point, the alarm will sound and the meter dials will jump);
- Allow the meters to stabilize and then press the red reset button;
- Turn horn switch to OFF position if alarm still sounds;
- Check the battery by depressing the black battery button and note the reading on the explosimeter display;

- Calibrate the oxygen meter to 20.8% by using the calibrate knob;
- Adjust the explosimeter to zero by using the zero knob;
- Return switch to ON position if horn was turned off; and
- Check alarm levels by adjusting the calibrate knob for oxygen levels and the zero knob for explosimeter levels and note the readings when the alarm sounds. Return the readings to normal and depress the reset button.

Calibration is performed according to the manufacturer's instructions prior to shipping the instrument to the field or every 6 months, whichever comes first.

HNu Photoionizer

Static or dynamic gas generation systems can be used for calibration of the instrument. Several systems for generating test atmospheres for various gases have been described by G.O. Nelson in "*Controlled Test Atmospheres,*" Ann Arbor Science Publishers, Ann Arbor, Michigan (1971).

The most convenient packages for calibration are the nontoxic analyzed gas mixtures available from HNu Systems in pressurized containers (Catalogue No. 101-350).

A rapid procedure for calibration involves bringing the probe and readout into proximity with the calibration gas, cracking the valve on the tank, and checking the instrument reading. This provides a useful spot check for the instrument.

The recommended and most accurate procedure for calibration of the instrument from a pressurized container is to connect one side of the "T" to the pressurized container of calibration gas, another side of the "T" to a rotometer, and the third side of the "T" directly to the 8-inch extension of the photoionization probe. The valve of the pressurized container is cracked until a slight flow is indicated on the rotometer. The instrument draws in the volume of sample required for detection, and the flow in the rotometer indicates an excess of sample. The span potential is adjusted so that the instrument is reading the exact value of the calibration gas. (If the instrument span setting is changed, the instrument should be turned back to the standby position and, if necessary, the electronic zero should be readjusted.)

Calibration with toxic gases should be performed in a hood because the No. 101 is a nondestructive analyzer. The calibration gas should be prepared in the same matrix (e.g., air, nitrogen, or hydrogen) in which it is to be measured; otherwise, an inaccurate reading may be obtained. The increased response that is seen in oxygen-free gases can be attributed to a reduction in the quenching of ions by oxygen (actually O_2-) and is typical of any ionization detector. The quenching effect of oxygen is constant from about 10% O_2 to very high levels.

If a gas standard prepared in nitrogen is to be used for measurements in air, a 0.5- or 1-liter bag will be filled with the standard. Then 50 or 100 cc, respectively, of pure oxygen will be added to bring the level to 10% to 12%. Any error between this value and 20% oxygen is quite small. If the sample to be measured is in nitrogen, standards should be prepared in nitrogen. Each HNu is calibrated internally prior to shipment from the warehouse or every 6 months, whichever is more frequent.

In the field, HNus will be calibrated at the start of each day. If a significant change in weather occurs during the day (e.g., significant change in humidity or temperature) or if the unit is turned off for an extended period, then it will be recalibrated at that time. In addition, each instrument will be calibrated when it is returned to the warehouse. All calibration information will be recorded in the logbook stored in the instrument case and in the site logbook. When an HNu is used to screen samples in the field, periodic ambient readings will also be recorded in the logbook.

pH Meter

pH meter calibration procedures are as follows:

- Plug the temperature sensor into the meter unit.
- Attach the pH electrode to the meter and then place it in pH 7.00 buffer solution. The automatic temperature compensation network will make corrections for the temperature of the solution.
- Turn the control switch to the "pH" position and adjust the standardized knob until the meter reads 7.00 pH.
- Rinse the electrode with tap water and then place it in pH 4.0 buffer solution (or pH 10.0 buffer solution, depending on the expected field measurements).
- Adjust the slope knob until the meter reads 4.0 or 10.0, (whichever is appropriate).

- When not is use, fill the electrode cap with a small amount of pH 4.0 buffer solution before it is placed on the electrode.

Calibration of the pH meters will be completed each day immediately prior to use. The instrument will be checked with a standard every 4 hours and at the end of the sampling day. If the response is greater than 0.2 unit more or less than the standard, complete calibration will be conducted.

Specific Conductance

Specific conductance instruments are factory-calibrated and automatically compensate for temperature. Conductance will be checked daily with a solution of known conductance. Discrepancies will be noted in the logbook.

All calibration solutions for pH and specific conductance meters are obtained from a chemical supply house such as American Scientific Products. Expiration dates will be clearly marked on all solutions, and the equipment manager will be responsible for maintaining a stock of up-to-date solutions.

OVA

The procedures for calibration of the organic vapor analyzer (OVA) 128 instrument are as follows:

- Remove instrument from case.
- Turn on electronics and zero instrument on X10 scale. Turn gas select dial to 300.
- Turn on pump and hydrogen. Ignite flame. Go to survey mode.
- Introduce a methane standard near 100 parts per million (ppm).
- Adjust R-32 trimpot on circuit board to make meter read to standard.
- Turn off hydrogen flame and adjust meter needle to read 4 ppm.
- Switch to X1 scale and adjust R-31 trimpot to make meter read 4 ppm.
- Return to X10 scale and adjust meter needle to 40 ppm.

- Switch to X100 scale and adjust R-33 trimpot to make meter read 40 ppm.

The methane gas that is used to internally calibrate OVAs is purchased from a local gas company and is 99.99% pure methane.

The OVA is calibrated prior to shipment of the instrument to the field or every 6 months, whichever comes first. This calibration is performed by a certified Foxborough technician. The OVA will be checked against a methane standard on a daily basis in the field.

During field use, a carbon filter will be used with the OVA to distinguish methane from other organics. When the OVA is used to screen samples (except samples for headspace analysis), periodic ambient air readings will also be recorded in the logbook.

Dissolved Oxygen Meter

The dissolved oxygen (DO) meter will be calibrated annually using the Winkler titration method described in "Standard Methods for the Examination of Water and Wastewater." The DO meter will be air calibrated prior to mobilization, at 4-hour intervals during the sampling day, and at the end of the day in the field using the following procedures:

- Check the membrane. It should be flat, with no air bubble trapped under it.

- Turn the meter on and place the probe in approximately 1 inch of water in a biochemical oxygen demand (BOD) bottle. Allow the unit to sit for 10 minutes to achieve temperature stabilization and air saturation.

- After stabilization, read the air temperature and refer to the instrument calibration table to determine the calibration value.

- Place the probe as close as possible to the water surface (saturated atmosphere) and adjust the calibration knob until the reading is equal to the calibration value determined above.

- Adjust the meter (if appropriate) for salinity.

The probe will be kept in a saturated atmosphere during storage and between sites. This can be done by wrapping the probe loosely in a damp cloth.

Temperature

Thermometers will be checked annually at two temperatures against a National Institute of Standards and Technology (NIST) precision thermometer. The temperatures must agree within plus or minus 0.1°C. Thermometers that do not meet this criterion will be disposed of properly. Calibration information, including the make, model, serial number, and date of calibration, will be recorded in the appropriate calibration logbook.

2.7.2 Laboratory Instrumentation

A list of ASC instrumentation is provided in Table 2-25. Calibration procedures for all instruments are summarized in Table 2-26 and described below. If more stringent, the method calibration procedures will be followed.

Gas Chromatograph/Mass Spectrometer

Each GC/MS system will be calibrated according to the EPA CLP SOW or using the procedure described below and outlined in EPA SW-846. Initial calibration is performed using five different concentration levels for the parameters of interest. Compounds selected as system performance check compounds (SPCC) must show a minimum average response factor for the initial calibration to be considered valid. Compounds selected as calibration check compounds (CCC) must show a relative standard deviation (RSD) for response factors less than a specified amount for the calibration to be considered valid. Average response factors are calculated for the initial calibration and verified against a daily response factor. This calibration is used as long as it can be demonstrated to be valid.

On a daily basis, the instrument is hardware-tuned using either bromofluorobenzene (BFB) for volatile compounds or decafluorotriphenylphosphine (DFTPP) for semivolatile compounds. Mass spectral peaks must conform both in mass numbers and relative intensity to EPA method criteria before analysis can proceed. If difficulty is experienced in meeting tuning criteria, manual mass calibration is performed with perfluorotributylamine.

Following a successful tune, the initial five-point calibration is verified by a single midrange standard. The SPCC and CCC are used to check response factors for adequacy and consistency against required limits before analysis can proceed. A successful calibration verification is followed by a method blank analysis for volatile analyses. All target analytes (with the exception of common laboratory solvents and phthalates) must be below the target detection limit before analysis can proceed.

Current tuning and calibration criteria are listed in Tables 2-27 through 2-29.

Gas Chromatography

Each GC system used for pesticide/PCB analysis will be calibrated according to the EPA CLP SOW or using the external standard technique for quantitation described below and outlined in EPA SW-846. Initial calibration is performed using five concentration levels for each parameter of interest. This calibration is done on each quantitation column and each instrument. The results are used to prepare a calibration curve for each analyte.

An evaluation standard is analyzed to check column breakdown at the beginning of each analytical run. Individual standard mixes are analyzed to establish calibration factors and absolute retention time. The calibration factors and retention times are verified throughout the analytical run and at the end of the analytical sequence. Each analyte must be within its retention time window, or corrective action is taken by the laboratory. The calibration factor must agree with the factor determined at the beginning of the run within plus or minus 15% for both quantitation and confirmation analyses.

Plasma Emission Spectrophotometry

The ICP is calibrated daily using one standard and one blank. The standard is within the demonstrated linear range of the instrument. The linear range is verified quarterly. The calibration is validated initially using an independent reference standard. The calibration is checked every 10 samples or every 2 hours, whichever is more frequent. The instrument is recalibrated if recovery is not within 90% to 110% (see Table 2-26).

Atomic Absorption Spectrophotometry

AAS units are calibrated daily using four standards and one blank. The calibration is validated initially using an independent reference standard. The calibration is checked every 10 samples or every 2 hours, whichever is more frequent. If acceptance criteria are not met (see Table 2-29), the instrument is recalibrated.

Autoanalyzer

The Lachat autoanalyzer system is set up daily using at least five calibration standards. Calibration is verified every 10 samples with a standard. Several analyses are performed with the system.

Ion Chromatograph

The ion chromatograph is initially calibrated using the external standard technique. An initial calibration at five concentration levels is prepared for each parameter of interest. This initial calibration is verified daily by analysis of a continuing standard that is prepared at the midlevel concentration. Calibration factors from the continuing calibration check must agree within plus or minus 15% of the initial calibration, or the initial calibration will be reanalyzed.

High-Performance Liquid Chromatograph

Each HPLC system is initially calibrated using the external standard technique as outlined in EPA SW-846. Initial calibration is prepared for five concentration levels for each parameter of interest. The results are used to prepare a calibration curve for each analyte, and an average calibration factor is generated.

The initial five-point calibration is verified daily by a single midrange standard. The calibration factor generated by this standard must agree within plus or minus 15% of the average calibration factor before analysis may begin. A single midrange standard is also analyzed at the conclusion of each analytical run. Calibration factors must agree within plus or minus 15% of the calibration factors generated by the standard analyzed at the beginning of each analytical run, or corrective action is taken by the laboratory.

Ancillary Equipment

Refrigerators are monitored daily to be within 2°C to 6°C. The incubator is continuously monitored to be within method specifications for BOD. Ovens are monitored before and after use.

Documentation

All calibration information is recorded in method logbooks, on appropriate forms, or on computer printouts. Any out-of-control analyses are described on a QA/QC discrepancy form (see Section 3) and submitted to the supervisor for corrective action. The calibration information is filed with the raw data in the reports area and/or in the section file. All standards are either EPA- or NIST-traceable or certified by the supplier.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables

2.8.1 Standard Receipt and Traceability

All standards are obtained directly from EPA or through a reliable commercial supplier. All commercially supplied standards are either traceable to EPA or NIST reference standards or are certified by the supplier with supporting documentation.

The certificates are kept on file in a central location. When standards are received, their chemical type, lot number, concentration, date opened, and expiration date are documented. When standards are prepared from these source materials, information is included in a logbook with date of preparation, lot source, amount used, final volumes, resulting concentration, date of expiration, and preparer's initials. On the standards themselves, the following information is recorded: preparation logbook reference, date prepared, expiration date, and preparer's initials.

2.8.2 Laboratory Equipment and Supplies

Procedures for the procurement, inspection, maintenance, and management of equipment and supplies are documented in laboratory SOP QA.11. These procedures will comply with all applicable EPA guidance for property management. All laboratory reagents and chemicals are the responsibility of the individual laboratory section supervisor. All reagents and chemicals are documented with the date received, date opened, expiration date (if appropriate), and the person receiving them.

2.8.3 Laboratory Waste Disposal

The laboratory director is responsible for ensuring that samples submitted to the laboratory for analysis and waste generated during analysis are disposed of in a safe, efficient manner acceptable to all local, state, and federal agencies and to corporate management. Disposal options include the following:

- Return to client or site;
- Dispose in a sanitary sewer;
- Send to a sanitary landfill (via dumpster); or
- Send to an approved treatment, storage, and disposal facility for treatment, incineration, or burial.

The following can be disposed into a sanitary sewer: all drinking water samples; routine industrial wastewater discharge samples; all surface water samples (except water treatment lagoons); and clean groundwater monitoring well samples that have total organic carbon less than 1,000 ppm, cyanide less than 250 ppm, sulfide less than 500 ppm, and all metals and organics less than TCLP limits. Highly toxic, malodorous, or tear-producing chemicals are not disposed of in a drain.

Waste solvents free of solid, corrosive, or reactive substances are collected in a 5-gallon safety solvent storage container located in each individual laboratory. When full, this container is emptied into a 30- or 50-gallon, steel storage drum in a secondary containment device to be picked up by a designated disposal service.

Extracts are accumulated in a 4-liter plastic jar and are segregated and treated as follows:

• GC/MS extracts	- Lab-packed "HP" (hazardous/ poisonous) drums to be disposed of as methylene chloride extracts (F002).
• GC extracts in hexane with PCBs greater than 50 ppm	- Lab-packed in "PCB" lab packs as hexane for incineration.
• GC extracts in hexane with PCBs less than 50 ppm	- Lab-packed in "HF" (hazardous/ flammable) lab packs as hexane for incineration.

• GC extracts containing mercury and sulfuric acid	- Separated in separatory funnels, then acid placed in drum, solvent in solvent drum, and mercury in a container to be recycled.
• HPLC extracts containing acetonitrile or methanol	- Lab-packed in "HF" drums for incineration as acetonitrile or methanol.
• Acid waste and sulfuric, nitric, and hydrochloric acids in concentrations greater than 10% or containing metals in excess of TCLP limits	- Placed in 30- or 50-gallon drums for disposal by neutralization and metals recovery.
• Soil, sediment, and water samples found or suspected to contain PCBs in excess of 50 ppm	- Placed in 55-gallon drums as PCB waste for incineration. Drums may contain empty containers, metal tubes, and PCB-contaminated articles, but no RCRA-listed waste.
• Soil, sediment, and water samples found or suspected to contain PCBs with less than 50 ppm.	- Accumulated as PCB-containing, but nonhazardous waste for incineration.
• Samples determined to be nonhazardous (mainly clothing and sampling articles)	- Placed in 55-gallon drums to be disposed of by burial in a hazardous waste landfill.

Other lab packs that are disposed of by incineration include the following:

- "HF": Oils, chemicals, or soils having a flash point of less than or equal to 140°F;
- "HTC": Samples having the characteristic of toxicity due to metals as identified by the TCLP tests;
- "HP": Samples containing compatible organic compounds in insufficient concentrations to cause them to be hazardous;
- "HR": Reactive wastes containing cyanide greater than 250 ppm or sulfide greater than 500 ppm; and
- "NH": Nonhazardous samples deemed by the laboratory director as not suitable for a landfill, such as oily soils or nonhazardous organic chemicals.

Wastes are picked up and disposed of by a licensed waste hauler and transported to a selected disposal facility for final disposal. Lab packs are packaged so that individual containers do not break during storage or transportation, and detailed records of waste disposal are kept. All lab packs are shipped to a licensed waste hauler in accordance with EPA requirements. Documentation of disposal is accomplished using the EPA Uniform Waste Management Form as required. All off-site disposal of E & E waste is approved in advance by the ASC director.

2.9 Data Acquisition Requirements

Data acquired from nondirect measurement sources include physical information such as descriptions of the sampling activities and geologic logs; technical software programs; state and local environmental agency files; soil surveys; reference computer databases and literature files; historical reports on a site; and subjective information gathered through interviews. Specific data acquisition requirements for a project or task will be addressed in the site-specific QAPjP.

2.10 Data Management

Central to E & E data management are internally developed programs for tracking of samples and results from work plan generation to the final report. This centralized sample tracking system generates work planning tables, labels, field sampling forms, electronic chain-of-custody, and final report tables. The program allows for data entry, electronic transfer for laboratory databases and EPA CLP databases, and entry of validation qualifiers. The central database can be electronically linked to E & E's geographic information system (GIS), computer-aided design (CAD) system, risk assessment programs, and other final data user models and statistical programs. E & E's system provides a mechanism to control paperwork errors and prevent loss in the accuracy of data reporting. It also has procedures for interfacing with EPA-developed tracking programs and databases for CLP and other programs.

Data management and reporting for laboratory data will vary depending on the type of laboratory used for the project. For EPA CLP and other laboratories, data management requirements are specified by EPA. E & E's internal procedures for the ASC are described briefly below. Subcontract laboratories will be expected to maintain equivalent programs. Any project requirements will be documented in the site-specific QAPjP.

2.10.1 Laboratory Data Management

Programs for data reporting fall into two areas: programs developed or modified at the laboratory and programs purchased from commercial sources. Data management for these types of programs requires the following procedures:

- **E & E-developed or E & E-modified programs.** All E & E-developed programs written in a language such as FOCUS, BASIC, or C will be fully documented with comment lines in the source code of the programs. Each program begins with a program header that will include a description of the function of the program, the name of the programmer, the date the program was written, the dates the program was modified, and comments on the program. A full listing, where appropriate, will be filed by computer management.

  All E & E-modified programs will be documented with a statement explaining why the modification was made, who made the change, and when the change was made. A copy of the original program and the updated program will be maintained by computer management.

  All original and modified programs will be tested on a backup using data sets with known results. After initial testing by the original programmer, the program will be submitted for testing oversight by the corporate QA office. The program then will be tested against a separate set of data with known results. The output of the program will be checked by the QA officer or designee. Copies of the test data set and the results of the program test will be kept with the program documentation by computer management.

  The laboratory computer systems manager maintains in-house programs. LABMIS is used to store all data for non-CLP reports and to produce LABMIS final reports.

- **Commercial Programs.** Commercial programs will be reviewed by an individual designated by computer management. After review of the documentation, a backup of the program will be tested with a set of known data. The program output will be checked by the computer management or its designee. After initial testing, the QA office will have oversight to testing with a separate set of known data. The results of all software tests will be maintained by computer management. Formaster and Ward are commercial programs that

E & E's laboratory uses to store all data for CLP reports and to produce all final CLP reports.

A maintenance contract with Formaster requires response within 24 hours to laboratory queries concerning the software. The laboratory also has a maintenance contract for the Ward program.

The laboratory uses three IBM personal computers (PCs) for generating CLP reports. Four others may be used for backup. A local service contract requires equipment to be repaired or replaced within one week.

All PC equipment is backed up on a weekly basis with a commercial archiving program. Two complete hard-disk backups are maintained and rotated. The disks are collected and noted in a bound notebook by the QA office. The original data for all CLP reports are maintained on tape archives and can be retrieved as necessary. Security for the PC-based programs is provided by limiting access to the equipment to trained and approved personnel.

All CLP reports are generated within the CLP data reports group using Formaster and Ward. E & E maintains a list of qualified personnel who have access to Formaster and Ward. All non-CLP reports are generated within the standard laboratory reports group using LABMIS. Only the reports group has access to the passwords necessary to enter LABMIS. There is a password for each laboratory section.

Any changes to results in the database stored in the computer for LABMIS are fully audited. When changes are made, they are logged into the audit file along with the date made and the person making them. Reports are generated directly from the electronic database by means of the appropriate computer program.

Laboratory copies of each report are filed by job number. The reports for the current year are kept in numbered shelves in the filing room. Reports from previous years are stored in labeled boxes in the laboratory warehouse. All job numbers currently in the warehouse are maintained on a list by the reports section. Access to these files is limited to selected laboratory personnel and laboratory auditors. Storage conditions are controlled to minimize the risk of damage to laboratory records.

2.10.2 Laboratory Data Reduction

Prior to the submission of the report to the client, all data will be evaluated for precision, accuracy, and completeness. Sections 2.4 and 2.5 of this document include some of the QC criteria to be used in the data validation process.

QA/QC requirements from both methodology and company protocol will be strictly adhered to during sampling and analytical work. All data generated will be reviewed by comparing and interpreting results from chromatograms (responses and stability of retention times), accuracy (percent recovery of spiked samples), and precision (reproducibility of results). All calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results.

Field measurements will be read directly from the instrument and recorded in the site logbook. The pH and specific conductance meters that E & E uses automatically compensate for temperature. Field measurements will be reported by the project manager in the project report.

Laboratory data reduction includes all processes that change the numerical value of the raw data. Raw data include information contained in laboratory notebooks, chromatograms, and strip-chart recordings. Laboratory notebook entries, chromatograms, and strip-chart recordings are identified by laboratory job numbers and sample numbers. A unique identifier is applied to each chromatogram and strip-chart recording within each laboratory section. Each GC/MS chromatogram is identified by a file name that consists of a letter followed by a four-digit number. The letter signifies the instrument used for analysis; the number is sequential. Chromatograms also may be identified by the date and time of analysis.

GC and HPLC chromatograms are labeled with the following information: date and time of analysis, instrument identification, and corresponding logbook page on which the injection has been recorded. A run number, sequential for the day, also is listed on the chromatogram and in the logbook. Strip charts/instrument printouts for metals and general chemistry analyses are identified by the date of analysis. Computer record files are identified by the laboratory job number. At present, data are not transferred directly from instrumentation to the computer system. The laboratory technician or analyst who operates the analytical instrument is responsible for initial data reduction. The reports group personnel can also enter raw data into the computer.

For analyses performed with linear regression, data reduction involves the comparison of sample raw data to a standard curve. Samples or sample extracts are diluted, if necessary, to remain within the linear range of the curve.

To check the linearity of the calibration curve, the linear regression coefficient (r) will be calculated as given below:

$$r - \frac{N\Sigma x_i y_i \quad \Sigma x_i \Sigma y_i}{N\Sigma x_i^2 - (\Sigma x_i)^2\Big]^{1/2} N\Sigma y_i^2 - (\Sigma y_i)^2\Big]^{1/2}}$$

where x_i is the sample concentration, y_i is the sample response measurement, and N is the number of data points. Sample results will be calculated using the formula $y = mx + b$, where y is the sample response measurement (peak area or height), x is the sample concentration, m is the slope of the line, and b is the y-intercept.

For analyses performed using internal standards, results will be calculated by the formula given below, which compares the peak area of a known concentration of an internal standard to the peak area of one particular analyte. The RRF of the analyte will be determined by analysis of a known amount of that analyte:

$$Concentration_x \quad \frac{Area_x \ x \ Concentration_{IS}}{Area_{IS} \ x \ RRF}$$

where x is the analyte and IS is the internal standard. Dilution of the extract and percent moisture in soils and sediments must also be taken into account by applying appropriate correction factors to this calculation.

For analyses performed using external standards, results will be calculated using the calibration factor of the midlevel calibration standard, providing all the acceptance criteria specified in Tables 2-26 through 2-29 are met. The calibration factor (CF) is calculated by dividing the nanogram of the standard by the area of peak in the standard. The concentration in the sample is calculated as shown below:

$$Concentration_x \quad \frac{Area_x \ x \ CF \ x \ V_f}{sample \ weight \ or \ volume}$$

Dilution of the extract and percent moisture in soils and sediments must also be taken into account by applying appropriate correction factors to this calculation. Applicable methods allow the use of a midlevel calibration standard if the initial five-point curve is linear. Results from all types of analyses will be calculated and reported using the correct number of significant figures. The digits that are considered significant are those that are known with certainty plus one digit whose value is in doubt. Results will be expressed so that they contain the same number of significant figures as that of the least accurately known value.

GC/MS and GC calculations are performed by the instrument's computer data system with the general exception of multipeak analyte calculations. Metals calculations for all water samples are performed by the instrument's computer data systems. For soil samples, final concentrations in micrograms per liter are manually converted to milligrams per kilogram using the sample weight and final digestion volume. For general analytical methods, Table 2-30 lists the calculations performed.

Table 2-1

SAMPLE CONTAINERS AND VOLUMES FOR SOIL SAMPLES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)
Purgeable (volatile) organics	40-ml glass vials with Teflon-backed septum	One (1); fill completely, minimal air space
Extractable organics	8-oz. glass jar with Teflon-lined cap	One (1); fill completely
Metals	8-oz. glass jar with Teflon-lined cap	One (1); fill completely
General analytical tests	8-oz. glass jar with Teflon-lined cap	One (1); fill completely

Notes: All sample bottles will be prepared in accordance with EPA bottle-washing procedures.

Several types of analyses may be performed on samples from the same container, depending on the sample size and preservation requirements.

When project-specific laboratory quality control samples are required, a double volume of sample will be collected and labeled as matrix spike/matrix spike duplicate.

Sample preservation requirements and holding times are presented in Tables 2-3 and 2-4.

Table 2-2

SAMPLE CONTAINERS AND VOLUMES FOR WATER SAMPLES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)
Purgeable (volatile) organics	40-ml glass vials with Teflon-backed septums	Two (2); fill completely; no air space
Extractable organics	0.5-gallon or 2-liter amber glass bottles with Teflon-lined caps	Two (2) per test; fill 7/8 full
Metals	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill 7/8 full
Cyanide	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill 7/8 full
TOC	125-ml polyethylene	One (1); fill completely
Sulfide	1-liter polyethylene bottle	One (1); fill completely, no air space
Acidity, alkalinity, pH, dissolved solids, suspended solids	1-liter polyethylene bottle with polyethylene-lined cap (multiple analyses) all from one bottle	One (1); fill completely
Hardness	1-liter polyethylene bottle with polyethylene-lined cap	Can take out of metals analysis bottles
Chloride	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely
Sulfate	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely
Nitrate	1-liter polyethylene bottle	One (1); fill completely
Nitrite	1-liter polyethylene bottle	One (1); fill completely
Total phenol	1-liter amber glass bottle	One (1); fill completely
Dissolved oxygen	BOD bottle	Two (2); fill completely
TOX	1-liter amber glass bottle	One (1); fill completely, no air space
Ammonia-nitrogen	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely
BOD_5	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely
COD	1 125-ml polyethylene bottle with polyethylene-lined cap	One (1); fill completely
Color	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely
Fluoride	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely

Table 2-2

SAMPLE CONTAINERS AND VOLUMES FOR WATER SAMPLES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)
TKN	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely
Hexavalent chromium	One 125-ml polyethylene bottle with polyethylene-lined cap	One (1); fill completely
Oil and Grease	1-liter amber glass bottle	One (1); fill completely
TRPH	1-liter amber glass bottle	One (1); fill completely
Orthophosphate	1-liter polyethylene bottle with polyethylene-lined cap	One (1); fill completely

Notes: All sample bottles will be prepared in accordance with EPA bottle-washing procedures.

Several types of analyses may be performed on samples from the same container depending on the sample size and preservation requirements.

When project-specific laboratory quality control samples are required, a triple volume of sample will be collected and labeled as a matrix spike/matrix spike duplicate.

Sample preservation requirements and holding times are presented in Tables 2-3 and 2-4.

Key:

BOD = Biochemical oxygen demand.
BOD_5 = Five-day biochemical oxygen demand.
COD = Chemical oxygen demand.
ml = Milliliter.
TKN = Total Kjeldahl nitrogen.
TOC = Total organic carbon.
TOX = Total organic halogen.
TRPH = Total recoverable petroleum hydrocarbons.

Table 2-3

SAMPLE PRESERVATION AND HOLDING TIMES FOR SOIL AND WATER SAMPLES

Parameter	Preservative	Holding Time	
		Soil	Water
Volatiles by gas chromatography/mass spectrometry and gas chromatography[a]	HCl to pH <2; Cool, 4°C Methods 602, 8020, and 8240	— 14 days	14 days 7 days
	Cool, 4°C Method 601 Method 602 Method 8010 Method 8020 Method 8240	— — 14 days 14 days 14 days	14 days 7 days 14 days 7 days 7 days
Extractable organics[c]	Cool, 4°C	Extract within 14 days, analyze within 40 days of extraction	Extract within 7 days, analyze within 40 days of extraction
Metals	HNO_3[d] to pH <2 Cool, 4°C	— 6 months	6 months —
Mercury	HNO_3[d] to pH <2 Cool, 4°C	— 28 days	28 days —
Cyanide[e]	NaOH to pH >12; Cool, 4°C	— 14 days	14 days —
Chromium VI	Cool, 4°C	24 hours	24 hours

Note: Samples to be analyzed for volatile aromatics are preserved to pH <2 per client requirements. However, in cases where high levels of cations interfere with the addition of hydrochloric acid (HCl), samples will be shipped unpreserved and analyzed within 7 days.

[a] Holding times are based on time of sample collection.

[b] If residual chlorine is present, sodium thiosulfate will be added to the sample; the vial will be almost filled with the sample; and then acid, if required, will be added. Finally, the vial will be filled and capped.

[c] If residual chlorine is present, sodium thiosulfate will be added to the sample until a negative litmus test is achieved.

[d] Acid should be added to excess water samples to avoid overheating or the splattering of acid.

[e] All water samples for cyanide analysis will be field tested for oxidizing agents and sulfide prior to pH adjustments. The test for the presence of oxidizing agents will be performed with KI-starch litmus paper. If the test is positive, a small amount of ascorbic acid will be added until a negative test is achieved. Then, an additional 0.6 gram of ascorbic acid will be added per liter of sample. The test for the presence of sulfide will be performed with lead acetate paper. If sulfide is present, the following procedures will be used. Samples with visible particulates will be filtered. Then, the sample will be treated with the addition of cadmium nitrate until a negative spot test is obtained. The sample then will be filtered and preserved with sodium hydroxide (NaOH). Alternatively, if sulfide is present or cannot be removed, the sample may be preserved with NaOH and analyzed within 24 hours.

Key:

HCl = Hydrochloric acid.
HNO_3 = Nitric acid.
NaOH = Sodium hydroxide.

Table 2-4

ADDITIONAL SAMPLE PRESERVATION AND HOLDING TIME INFORMATION

Type of Analysis	Preservation	Holding Time[a]
TOC	H_2SO_4 to pH <2 Cool, 4°C	28 days
Sulfide	0.04% zinc acetate Cool, 4°C	7 days
Acidity	Cool, 4°C	14 days
Alkalinity	Cool, 4°C, no headspace	14 days
pH	None	ASAP
Dissolved solids	None	7 days
Suspended solids	None	7 days
Hardness	HNO_3[a] to pH <2	6 months
Chloride	Cool, 4°C	28 days
Sulfate	Cool, 4°C	28 days
Nitrate	Cool, 4°C	48 hours
Nitrite	Cool, 4°C	48 hours
Nitrate-nitrite	H_2SO_4[b] to pH <2 Cool, 4°C	28 days
Total phenol	H_2SO_4[b] to pH <2 Cool, 4°C	28 days
Dissolved oxygen	Cool, 4°C	6 hrs.
TOX	H_2SO_4[b] to pH <2 Cool, 4°C	7 days
Ammonia-nitrogen	H_2SO_4[b] to pH <2 Cool, 4°C	28 days
BOD_5	Cool, 4°C	48 hours
COD	H_2SO_4[b] to pH <2 Cool, 4°C	28 days
Color	Cool, 4°C	48 hours
Fluoride	Cool, 4°C	28 days
TKN	H_2SO_4[b] to pH <2 Cool, 4°C	28 days
TRPH	H_2SO_4[b] to pH <2 Cool, 4°C	28 days
Oil and grease	H_2SO_4[b] to pH <2 Cool, 4°C	28 days
Orthophosphate	Filter immediately Cool, 4°C	48 hours
Total phosphorus	H_2SO_4[b] to pH <2	28 days
Specific conductance	Cool, 4°C	28 days

Table 2-4

ADDITIONAL SAMPLE PRESERVATION AND HOLDING TIME INFORMATION

Type of Analysis	Preservation	Holding Time[a]
Turbidity	Cool, 4°C	48 hours
Sulfite	Cool, 4°C	Analyze immediately
Surfactants	Cool	48 hours

[a] Holding times are based on time of sample collection.

[b] Acid should be added to excess water sample to avoid overheating or the splattering of acid.

Key:

ASAP = As soon as possible.
BOD_5 = Five-day biochemical oxygen demand.
COD = Chemical oxygen demand.
HNO_3 = Nitric acid.
H_2SO_4 = Sulfuric acid.
TKN = Total Kjeldahl nitrogen.
TOC = Total organic carbon.
TOX = Total organic halogen.
TRPH = Total recoverable petroleum hydrocarbon.

Table 2-5

FIELD REAGENT AND STANDARD STORAGE

Chemical	Method of Science	Transport
Nitric acid	Stored in original containers in cabinet designed for acid storage.	All necessary reagents will be transported to the project site in prepackaged glass ampules or in glass containers designed for transport of the respective reagents. In all cases, reagent containers will be packed securely in vermiculite inside a cooler. Separate coolers will be used for acids, bases, standards, and solvents.
Hydrochloric acid	See above	
Sulfuric acid	See above	
Sodium hydroxide	Stored in original containers in cabinet designed for caustic storage.	
standards	Stored on shelf in the air conditioned portion of the warehouse.	

Table 2-6

LABORATORY REAGENT AND STANDARD STORAGE

Item	Storage
Acids	Cabinet under hood in laboratory sections
Solvents	Cabinet under hood inorganic preparation section.
Dry chemicals	Cabinets in storage room.
Reagents	Cabinets in laboratory sections.
Standards (organic)	Refrigerator in laboratory sections.
Standards (inorganic)	Cabinet in laboratory sections.

Table 2-7

SAMPLE PREPARATION METHODS

Sample Preparation Method Number	Description	Matrix
1310	EPTOX extraction	S/W
1311	TCLP extraction	S/W
3005	ICP digestion	W
3020	Furnace digestion	W
3050	ICP digestion	S
3050	Furnace digestion	S
3510	Separatory funnel extraction	W
3550	Sonicator extraction	S
3580A	Waste dilution	S
CLP organics	Continuous liquid extraction	W
3610	Alumina cleanup	Extract
3620	Florisil cleanup	Extract
CLP organics	Gel permeation chromatography cleanup	Extract
3660	Cleanup of sulfur	Extract

Key:

CLP = Contract Laboratory Program.
EPTOX = Extraction procedure toxicity.
ICP = Inductively coupled argon plasma (spectrometry).
S = Soil.
TCLP = Toxicity characteristic leaching procedure.
W = Water.

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
General Chemistry[a]							
EPA 305.1	W	Acidity	1	mg/L as $CaCO_3$	NA	95-105	10
EPA 310.1	W	Alkalinity	1	mg/L as $CaCO_3$	NA	85-115	5.2
EPA 300.0[f]	W	Chloride	0.028	mg/L	90-110[b]	90-110	10[b]
		Nitrate	.008	mg/L	90-110[b]	90-110	10[b]
		Sulphate	0.17	mg/L	90-110[b]	90-110	10[b]
		Orthophosphate	0.028	mg/L	90-110[b]	90-110	10[b]
ASTM D-482	S	Ash	1	%	—	—	15[b]
SM 5210	W	BOD	2	mg/L	—	82-118	—
ASTM D-2015-77	S	Btu	10	Btu/lb.	—	85-115	20[b]
EPA 325.2	W	Chloride	0.6	mg/L	81-119	90-110	5
SW 9251	W	Chloride	0.6	mg/L	81-119	90-110	5
EPA 330.4	W	Chlorine (residual)	0.1	mg/L	—	—	15[b]
ASTM-D2015-77	S	Chlorine (percent)	0.4	%	—	85-115	—
EPA 300	W	Chlorine (percent)	0.05	%	—	85-115	20[b]
EPA 410.2	W	COD (low concentration)	5	mg/L	80-120[b]	90-110	17
EPA 410.1	W	COD (medium concentration)	50	mg/L	80-120[b]	90-110	15
EPA 110.2	W	Color	5	PCU	NA	NA	10
EPA 120.1	W	Conductance	1	umhos/cm	NA	96-104	12
EPA 335.1	W	Cyanide (amenable)	10	mg/L	75-125	85-115	20
EPA 335.3	W	Cyanide (total)	0.01	mg/L	61-134	85-115	20
EPA CLP	S	Cyanide (total)	1	mg/kg	57-141	85-115	35
SW 9012	W	Cyanide (total)	0.01	mg/kg	75-125	85-115	20

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
SW 1010	S/W	Flashpoint	NA	°C or °F	NA	81° ±1.5°C	20
EPA 340.2	W	Fluoride	0.016	mg/L	90-110	90-110	11
EPA 130.2	W	Hardness	1	mg/L as $CaCO_3$	NA	85-115	6.2
ASTM D2216-80	S	Moisture Content	1	%	—	—	20
EPA 350.2	W	Nitrogen (ammonia)	0.3	mg/L	83-116	85-115	30
EPA 351.3	W	Nitrogen (Kjeldahl)	0.3	mg/L	71-127	80-120	9.4
EPA 353.2	W	Nitrogen (nitrate)	0.003	mg/L	81-121	80-120	13
EPA 353.2	W	Nitrogen (nitrite)	0.003	mg/L	78-121	80-120	20^b
EPA 353.2	W	Nitrogen (nitrate/nitrite)	0.003	mg/L	NA	NA	NA
EPA 413.1	W	Oil and Grease	1	mg/L	—	80-120	25
SW 9070	W	Oil and Grease	1	mg/L	—	80-120	25
SW 9071	S	Oil and Grease	1	mg/kg	$50\text{-}150^b$	85-115	35^b
EPA 150.1	W	pH	0.1	+ su	—	—	5
SW 9073	W	Petroleum Hydrocarbons	1	mg/L	—	85-115	25^b
SW 9073	S	Petroleum Hydrocarbons	5	mg/kg	88-138	85-115	35^b
EPA 420.1	W	Phenol	0.005	mg/L	$80\text{-}120^b$	80-120	20^b
SW 9065-M	S	Phenol	0.5	mg/kg	$80\text{-}120^b$	80-120	25^b
EPA 365.2^g	W	Phosphate (all forms)	0.01	mg/L	40-128	80-120	14
EPA 160.1	W	TDS	10	mg/L	NA	80-120	7.4
EPA 160.2	W	TSS	4	mg/L	NA	85-115	33
EPA 160.3	W	Residue (total)	10	mg/L	—	—	20^b
EPA 160.4	W	Residue (volatile)	1	mg/L	NA	NA	20^b
EPA 160.5	W	Residue (settleable)	0.1	ml/L/hour	NA	NA	—

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
EPA 375.4	W	Sulfate	3	mg/L	80-120^b	80-120	10^b
SW 9036	W	Sulfate	3	mg/L	73-124	80-120	12
EPA 377.1	W	Sulfite	0.5	mg/L	—	80-120	20^b
ASTM D129-64	S	Sulfur (percent)	0.025	%	—	85-115	20^b
EPA 425.1	W	Surfactants (anionic)	0.2	mg/L	80-120^b	80-120	20^b
EPA 376.1	W	Sulfide	1	mg/L	—	—	10^b
SW 9030	W	Sulfide	1	mg/L	—	—	10^b
EPA 170.1	W	Temperature	NA	NA	—	—	—
SM 5310-B	W	TOC	1	mg/L	61-124	80-120	26
SW 9060	W	TOC	1	mg/L	61-124	80-120	26
SW 9020	W	TOX	5	µg/L	74-125	95-105	20^b
EPA 180.1	W	Turbidity	0.02	NTU	NA	90-110	10
Hazardous Waste Characteristics							
SW 1010	S/W	Ignitability	NA	°C or °F	NA	81° ± 1.5°C	4
SW 9040	W	Corrosivity	(Work is subcontracted)^h				
SW 9045	S	Corrosivity	(Work is subcontracted)^h				
SW Chapter 7, 9010	S/W	Reactivity (cyanide)	0.5	mg/kg	> 50^b	> 50	50^b
SW Chapter 7, 9030	S/W	Reactivity (sulfide)	50	mg/kg	> 50^b	> 10	50^b
SW 1311	S/W	TCLP	NA	NA	NA	NA	NA
Metals^d							
EPA 200.7	W	Aluminum	3	µg/L	72-136	80-120	87

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
SW 6010	W	Aluminum	3	µg/L	72-136	80-120	20
SW 6010	S	Aluminum	0.3	mg/kg	75-125^{e}	—	50
CLP 200.7-M	W	Aluminum	5	µg/L	75-125	80-120	20
CLP 200.7-M	S	Aluminum	1	mg/kg	75-125	—	20
EPA 200.7	W	Antimony	19	µg/L	38-145	—	20
SW 6010	W	Antimony	19	µg/L	38-145	—	20
SW 6010	S	Antimony	1.9	mg/kg	D-139	—	35
CLP 200.7-M	W	Antimony	24	µg/L	75-125	—	20
CLP 200.7-M	S	Antimony	4.8	mg/kg	75-125	—	20
EPA 206.2	W	Arsenic	2	µg/L	74-116	80-120	26
SW 7060	W	Arsenic	2	µg/L	74-116	80-120	20
SW 7060	S	Arsenic	0.2	mg/kg	34-144	—	28
SW 6010	W	Arsenic	45	µg/L	74-116	80-120	20
SW 6010	S	Arsenic	4.5	mg/kg	34-144	—	35
CLP 206.2-M	W	Arsenic	1	µg/L	75-125	80-120	20
CLP 206.2-M	S	Arsenic	0.2	mg/kg	75-125	—	20
EPA 200.7	W	Barium	3	µg/L	70-127	80-120	59
SW 6010	W	Barium	3	µg/L	70-127	80-120	59
SW 6010	S	Barium	0.3	mg/kg	59-138	—	28
CLP 200.7-M	W	Barium	7	µg/L	75-125	80-120	20
CLP 200.7-M	S	Barium	1.4	mg/kg	75-125	—	20
EPA 200.7	W	Beryllium	2	µg/L	86-121	80-120	20
SW 6010	W	Beryllium	2	µg/L	86-121	80-120	20

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
SW 6010	S	Beryllium	0.2	mg/kg	83-118	—	35
CLP 200.7-M	W	Beryllium	1	µg/L	75-125	80-120	20
CLP 200.7-M	S	Beryllium	0.2	mg/kg	75-125	—	20
EPA 200.7	W	Boron[c]	10	µg/L	75-125[b]	80-120	20[b]
SW 6010	S	Boron[c]	1	mg/kg	75-125[b]	—	35[b]
SW 6010	W	Boron[c]	10	µg/L	75-125[b]	80-120	20[b]
EPA 200.7	W	Cadmium	2	µg/L	86-112	80-120	20
SW 6010	W	Cadmium	2	µg/L	86-112	80-120	20
SW 6010	S	Cadmium	0.2	mg/kg	74-114	—	35
CLP 200.7-M	W	Cadmium	2	µg/L	75-125	80-120	20
CLP 200.7-M	S	Cadmium	0.4	mg/kg	75-125	—	20
EPA 200.7	W	Calcium	134	µg/L	75-125[e]	80-120	11
SW 6010	W	Calcium	134	µg/L	75-125[e]	80-120	20
SW 6010	S	Calcium	13.4	mg/kg	75-125[e]	—	95
CLP 200.7-M	W	Calcium	195	µg/L	75-125[e]	80-120	20
CLP 200.7-M	S	Calcium	39	mg/kg	75-125[e]	—	20
EPA 200.7	W	Chromium	4	µg/L	87-115	80-120	105
SW 6010	W	Chromium	4	µg/L	87-115	80-120	105
SW 6010	S	Chromium	0.4	mg/kg	59-175	—	94
CLP 200.7-M	W	Chromium	4	µg/L	75-125	80-120	20
CLP 200.7-M	S	Chromium	0.8	mg/kg	75-125	—	20
SW 7195	W	Chromium (hexavalent)	10	µg/L	75-125[b]	80-120	20[b]
EPA 200.7	W	Cobalt	3	µg/L	77-117	80-120	20

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
SW 6010	W	Cobalt	3	µg/L	77-117	80-120	20
SW 6010	S	Cobalt	0.3	mg/kg	72-120	—	100
CLP 200.7-M	W	Cobalt	4	µg/L	75-125	80-120	20
CLP 200.7-M	S	Cobalt	0.8	mg/kg	75-125	—	20
EPA 200.7	W	Copper	3	µg/L	80-119	80-120	72
SW 6010	W	Copper	3	µg/L	80-119	80-120	72
SW 6010	S	Copper	0.3	mg/kg	72-132	—	94
CLP 200.7-M	W	Copper	1	µg/L	75-125	80-120	20
CLP 200.7-M	S	Copper	0.2	mg/kg	75-125	—	20
EPA 200.7	W	Iron	64	µg/L	82-125	80-120	113
SW 6010	W	Iron	64	µg/L	82-125	80-120	113
SW 6010	S	Iron	6.4	mg/kg	75-125[e]	—	55
CLP 200.7-M	W	Iron	5	µg/L	75-125	80-120	20
CLP 200.7-M	S	Iron	1	mg/kg	75-125[e]	—	20
EPA 239.2	W	Lead	3	µg/L	92-132	80-120	24
EPA 200.7	W	Lead	25	µg/L	92-132	80-120	24
SW 7421	W	Lead	3	µg/L	92-132	80-120	24
SW 7421	S	Lead	0.3	mg/kg	25-154	—	44
SW 6010	W	Lead	25	µg/L	92-132	80-120	24
SW 6010	S	Lead	2.5	mg/kg	25-154	—	44
CLP 239.2-M	W	Lead	1	µg/L	75-125	80-120	20
CLP 239.2-M	S	Lead	0.2	mg/kg	75-125	—	20
CLP 200.7-M	W	Lead	23	µg/L	75-125	80-120	20

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
CLP 200.7-M	S	Lead	4.6	mg/kg	75-125	—	20
EPA 200.7	W	Magnesium	173	µg/L	75-125^{e}	80-120	17
SW 6010	W	Magnesium	173	µg/L	75-125^{e}	80-120	17
SW 6010	S	Magnesium	17.3	mg/kg	75-125^{e}	—	135
CLP 200.7-M	W	Magnesium	86	µg/L	75-125^{e}	80-120	20
CLP 200.7-M	S	Magnesium	17.2	mg/kg	75-125^{e}	—	20
EPA 200.7	W	Manganese	2	µg/L	86-120	80-120	70
SW 6010	W	Manganese	2	µg/L	86-120	80-120	70
SW 6010	S	Manganese	0.2	mg/kg	28-207	—	55
CLP 200.7-M	W	Manganese	1	µg/L	75-125	80-120	20
CLP 200.7-M	S	Manganese	0.2	mg/kg	75-125	—	20
EPA 245.1	W	Mercury	0.2	µg/L	24-147	—	23
SW 7470	W	Mercury	0.2	µg/L	24-147	—	23
SW 7471	S	Mercury	0.1	mg/kg	D-167	—	61
CLP 245.1-M	W	Mercury	0.2	µg/L	75-125	—	20
CLP 245.1-M	S	Mercury	0.1	mg/kg	75-125	—	20
EPA 200.7	W	Molybdenum^{c}	20	µg/L	75-125^{b}	—	20^{b}
SW 6010	W	Molybdenum^{c}	20	µg/L	75-125^{b}	—	20^{b}
SW 6010	S	Molybdenum^{c}	2	mg/kg	75-125^{b}	—	35^{b}
EPA 200.7	W	Nickel	7	µg/L	82-113	80-120	70
SW 6010	W	Nickel	7	µg/L	82-113	80-120	70
SW 6010	S	Nickel	0.7	mg/kg	54-129	—	40
CLP 200.7-M	W	Nickel	4	µg/L	75-125	80-120	20

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
CLP 200.7-M	S	Nickel	0.8	mg/kg	75-125	—	20
EPA 200.7	W	Potassium	340	µg/L	75-125^e	80-120	89
SW 6010	W	Potassium	340	µg/L	75-125^e	80-120	89
SW 6010	S	Potassium	34	mg/kg	75-125^e	–	28
CLP 200.7-M	W	Potassium	189	µg/L	75-125^e	80-120	20
CLP 200.7-M	S	Potassium	37.8	mg/kg	75-125^e	--	20
EPA 270.2	W	Selenium	2	µg/L	71-117	80-120	25
SW 7740	W	Selenium	2	µg/L	71-117	80-120	25
SW 7740	S	Selenium	0.2	mg/kg	13-140	—	25
SW 6010	W	Selenium	69	µg/L	71-117	80-120	25
SW 6010	S	Selenium	6.9	mg/kg	13-140	—	25
CLP 270.2-M	W	Selenium	2	µg/L	75-125	80-120	20
CLP 270.2-M	S	Selenium	0.4	mg/kg	75-125	—	20
EPA 200.7	W	Silicon^c	100	µg/L	75-125^b	—	20^b
SW 6010	W	Silicon^c	100	µg/L	75-125^b	—	20^b
SW 6010	S	Silicon^c	10	mg/kg	75-125^b	—	35^b
EPA 200.7	W	Silver	2	µg/L	56-145	—	20
SW 6010	W	Silver	2	µg/L	56-145	—	20
SW 6010	S	Silver	0.2	mg/kg	41-147	—	35
CLP 200.7-M	W	Silver	1	µg/L	75-125	—	20
CLP 200.7-M	S	Silver	0.2	mg/kg	75-125	—	20
EPA 200.7	W	Sodium	724	µg/L	75-125^e	80-120	15
SW 6010	W	Sodium	724	µg/L	75-125^e	80-120	15

Table 2-8

INORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	Accuracy % Spike Recovery	Accuracy % Known Recovery	Precision % RPD
SW 6010	S	Sodium	72.4	mg/kg	75-125^{e}	—	75
CLP 200.7-M	W	Sodium	254	µg/L	75-125^{e}	80-120	20
CLP 200.7-M	S	Sodium	50.8	mg/kg	75-125^{e}	—	20
EPA 279.2	W	Thallium	2	µg/L	41-147	80-120	25
SW 7841	W	Thallium	2	µg/L	41-147	80-120	25
SW 7841	S	Thallium	0.2	mg/kg	75-117	—	25
CLP 279.2-M	W	Thallium	1	µg/L	75-125	80-120	20
CLP 279.2-M	S	Thallium	0.2	mg/kg	75-125	—	20
EPA 200.7	W	Vanadium	5	µg/L	55-125	80-120	20
SW 6010	W	Vanadium	5	µg/L	55-125	80-120	20
SW 6010	S	Vanadium	0.5	mg/kg	69-125	—	46
CLP 200.7-M	W	Vanadium	3	µg/L	75-125	80-120	20
CLP 200.7-M	S	Vanadium	0.6	mg/kg	75-125	—	20
EPA 200.7	W	Zinc	35	µg/L	87-114	80-120	157
SW 6010	W	Zinc	35	µg/L	87-114	80-120	157
SW 6010	S	Zinc	3.5	mg/kg	45-142	—	43
CLP 200.7-M	W	Zinc	2	µg/L	75-125	80-120	20
CLP 200.7-M	S	Zinc	0.4	mg/kg	75-125	—	20

Table 2-8 (Cont.)

[a] Method detection limits (MDLs) are listed for fluoride, chloride, sulfate, and nitrate/nitrite. The remaining general chemistry parameters are listed as reporting limits and are set using the lowest curve point. Where applicable, the MDLs for the remaining parameters will be determined.

[b] Insufficient data points. Targets set is based on method targets or expected accuracy and precision.

[c] MDL study not completed.

[d] The MDL values listed for Contract Laboratory Program (CLP) metals methods are instrument detection limits.

[e] Not spiked because of commonly found levels in the indigenous matrix.

[f] Nitrite is also detected by this method when requested. Nitrite, nitrate, and orthophosphate have 48-hour holding times.

[g] Methods under United States Environmental Protection Agency (EPA) Method 365.2 are based on specific reactions for the orthophosphate ion; thus, depending on the prescribed pretreatment of the sample, the various forms of phosphate can be determined. Refer to EPA Method 300 for orthophosphate ion analyses.

[h] Subcontractors will be named in the site-specific quality assurance project plans (QAPjPs).

Key:

MDL = Method detection limit (most current).
RPD = Relative percent difference.
W = Groundwater and surface water.
S = Soil, sediment, and sludges.
EPA = United States Environmental Protection Agency Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.
ASTM = American Society for Testing and Materials.
NA = Not applicable.
SM = Standard Methods for the Evaluation of Water and Waste Water, 17th Ed., 1989.
SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1986, including update I, 1993.
BOD = Biochemical oxygen demand.
mg/L = Milligrams per liter.
$CaCO_3$ = Calcium carbonate.
Btu/lb. = British thermal units per pound.
COD = Chemical oxygen demand.
mg/kg = Milligrams per kilogram.
ml/L/hour = Milliliters per liter per hour.
TDS = Total dissolved solids.
TSS = Total suspended solids.
μg/L = Micrograms per liter.
TOC = Total organic carbon.
TOX = Total organic halides.
NTU = Nephelometric turbidity units.
TCLP = Toxicity characteristic leaching procedure.

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
Organics										
SW 8270 and or EPA 625	W	Base/Neutral/Acid Extractables								
		bis(2-Chloroethyl) ether	7.13	µg/L	10	µg/L	58-82	16	—	—
		1,3-Dichlorobenzene	5.05	µg/L	10	µg/L	48-81	30	—	—
		1,4-Dichlorobenzene	6.17	µg/L	10	µg/L	20-124	30	26-82	28
		Benzyl Alcohol[b]	10	µg/L	10	µg/L	41-89	23	—	—
		1,2-Dichlorobenzene	6.77	µg/L	10	µg/L	63-95	26	—	—
		bis(2-Chloroisopropyl) ether	5.94	µg/L	10	µg/L	58-82	16	—	—
		N-Nitroso-Dipropylamine	5.37	µg/L	10	µg/L	48-121	15	26-100	28
		Hexachloroethane	4.88	µg/L	10	µg/L	49-79	30	—	—
		Nitrobenzene	6.21	µg/L	10	µg/L	59-102	16	—	—
		Isophorone	6.20	µg/L	10	µg/L	71-100	16	—	—
		Benzoic Acid[b]	50	µg/L	50	µg/L	1-16	196	—	—
		bis(2-Chloroethoxy) methane	5.97	µg/L	10	µg/L	68-103	14	—	—
		1,2,4-Trichlorobenzene	5.60	µg/L	10	µg/L	44-142	20	44-142	32
		Naphthalene	6.11	µg/L	10	µg/L	51-96	13	—	—
		4-Chloroaniline	14.3	µg/L	10	µg/L	89-212	19	—	—
		Hexachlorobutadiene	5.23	µg/L	10	µg/L	60-89	18	—	—
		2-Methylnaphthalene	9.11	µg/L	10	µg/L	63-95	13	—	—
		Hexachlorocyclopentadiene	6.69	µg/L	10	µg/L	43-117	45	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		2-Chloronaphthalene	6.46	µg/L	10	µg/L	51-127	34	—	—
		2-Nitroaniline	11.4	µg/L	50	µg/L	68-132	36	—	—
		Dimethyl Phthalate	0.750	µg/L	10	µg/L	D-141	55	—	—
		Acenaphythylene	6.59	µg/L	10	µg/L	44-116	40	—	—
		3-Nitroaniline	18.8	µg/L	50	µg/L	37-416	28	—	—
		Acenaphthene	6.52	µg/L	10	µg/L	47-145	42	47-145	21
		Dibenzofuran	11.8	µg/L	10	µg/L	52-135	39	—	—
		2,4-Dinitrotoluene	5.06	µg/L	10	µg/L	39-139	24	39-139	37
		2,6-Dinitrotoluene	6.42	µg/L	10	µg/L	55-121	37	—	—
		Diethylphthalate	4.73	µg/L	10	µg/L	16-149	32	—	—
		4-Chlorophenyl phenyl ether	5.30	µg/L	10	µg/L	55-132	38	—	—
		Fluorene	6.21	µg/L	10	µg/L	42-126	40	—	—
		4-Nitroaniline	22.2	µg/L	50	µg/L	90-205	46	—	—
		N-Nitrosodiphenylamine	4.71	µg/L	10	µg/L	69-97	12	—	—
		4-Bromophenyl phenyl ether	5.89	µg/L	10	µg/L	78-101	12	—	—
		Hexachlorobenzene	5.78	µg/L	10	µg/L	73-94	15	—	—
		Phenanthrene	6.43	µg/L	10	µg/L	69-103	15	—	—
		Anthracene	5.29	µg/L	10	µg/L	55-84	16	—	—
		Di-n-butylphthalate	6.32	µg/L	10	µg/L	72-113	18	—	—
		Fluoranthene	5.67	µg/L	10	µg/L	59-113	22	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Pyrene	7.47	µg/L	10	µg/L	52-115	21	52-115	22
		Butyl Benzyl Phthalate	7.26	µg/L	10	µg/L	77-110	16	—	—
		3,3'-Dichlorobenzidine	94.6	µg/L	20	µg/L	37-121	39	—	—
		Benzo(a)anthracene	5.56	µg/L	10	µg/L	49-150	17	—	—
		bis(2-ethylhexyl)phthalate	5.09	µg/L	10	µg/L	74-115	16	—	—
		Chrysene	6.49	µg/L	10	µg/L	55-87	19	—	—
		Di-n-octyl Phthalate	4.17	µg/L	10	µg/L	64-132	16	—	—
		Benzo(b)fluoranthene	3.36	µg/L	10	µg/L	46-114	41	—	—
		Benzo(k)fluoranthene	7.96	µg/L	10	µg/L	47-91	41	—	—
		Benzo(a)pyrene	4.42	µg/L	10	µg/L	61-77	14	—	—
		Indeno(1,2,3-cd)pyrene	1.99	µg/L	10	µg/L	62-92	15	—	—
		Dibenzo(a,h)anthracene	2.03	µg/L	10	µg/L	50-150	25	—	—
		Benzo(ghi)perylene	2.61	µg/L	10	µg/L	50-150	25	—	—
		Phenol	5.14	µg/L	10	µg/L	5-112	47	5-112	42
		2-Chlorophenol	8.17	µg/L	10	µg/L	29-83	56	29-83	29
		2-Methylphenol	10.5	µg/L	10	µg/L	47-86	57	—	—
		4-Methylphenol	8.36	µg/L	10	µg/L	44-76	57	—	—
		2-Nitrophenol	9.59	µg/L	50	µg/L	37-105	44	—	—
		2,4-Dimethylphenol	10.5	µg/L	10	µg/L	41-90	35	—	—
		2,4-Dichlorophenol	8.36	µg/L	10	µg/L	35-94	41	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		4-Chloro-3-methylphenol	8.46	µg/L	10	µg/L	22-147	29	23-100	49
		2,4,6-Trichlorophenol	11.3	µg/L	10	µg/L	26-119	47	—	—
		2,4,5-Trichlorophenol	12.2	µg/L	50	µg/L	40-133	51	—	—
		2,4-Dinitrophenol	14.0	µg/L	50	µg/L	D-116	35	—	—
		4,6-Dinitro-2-methylphenol	11.4	µg/L	50	µg/L	31-98	50	—	—
		4-Nitrophenol	7.17	µg/L	50	µg/L	D-132	44	10-109	50
		Pentachlorophenol	11.3	µg/L	50	µg/L	14-176	48	14-176	55
		Nitrobenzene-d5 (surrogate)	—	—	—	—	—	—	35-114	—
		2-Fluorobiphenyl (surrogate)	—	—	—	—	—	—	43-116	—
		Terphenyl-d14 (surrogate)	—	—	—	—	—	—	33-97	—
		2-Fluorophenol (surrogate)	—	—	—	—	—	—	21-100	—
		Phenol-d5 (surrogate)	—	—	—	—	—	—	10-94	—
		2,4,6-Tribromophenol (surrogate)	—	—	—	—	—	—	21-110	—
SW 8270	S	**Base/Neutral/Acid Extractables**								
		bis(2-Chloroethyl) ether	65.0	µg/kg	330	µg/kg	D-137	33	—	—
		1,3-Dichlorobenzene	71.0	µg/kg	330	µg/kg	D-117	42	—	—
		1,4-Dichlorobenzene	72.0	µg/kg	330	µg/kg	20-124	30	20-124	27
		Benzyl Alcohol	333	µg/kg	330	µg/kg	D-135	37	—	—
		1,2-Dichlorobenzene	70.0	µg/kg	330	µg/kg	D-152	41	—	—
		bis(2-Chloroisopropyl) ether	74.0	µg/kg	330	µg/kg	D-135	33	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		N-Nitroso-Dipropylamine	70.0	µg/kg	330	µg/kg	33-109	45	28-95	24
		Hexachloroethane	66.0	µg/kg	330	µg/kg	11-112	41	—	—
		Nitrobenzene	59.0	µg/kg	330	µg/kg	15-97	48	—	—
		Isophorone	49.0	µg/kg	330	µg/kg	15-118	31	—	—
		Benzoic Acid	1,665	µg/kg	1,600	µg/kg	20-111	92	—	—
		bis(2-Chloroethoxy) methane	59.0	µg/kg	330	µg/kg	7-132	35	—	—
		1,2,4-Trichlorobenzene	53.0	µg/kg	330	µg/kg	44-142	39	44-142	28
		Naphthalene	62.0	µg/kg	330	µg/kg	2-125	26	—	—
		4-Chloroaniline	107	µg/kg	330	µg/kg	D-80	36	—	—
		Hexachlorobutadiene	48.0	µg/kg	330	µg/kg	9-119	43	—	—
		2-Methylnaphthalene	129	µg/kg	330	µg/kg	D-145	33	—	—
		Hexachlorocyclopentadiene	59.0	µg/kg	330	µg/kg	18-93	51	—	—
		2-Chloronaphthalene	60.0	µg/kg	330	µg/kg	D-121	31	—	—
		2-Nitroaniline	118	µg/kg	1,600	µg/kg	D-125	35	—	—
		Dimethyl Phthalate	42.0	µg/kg	330	µg/kg	1-124	29	—	—
		Acenaphythylene	57.0	µg/kg	330	µg/kg	D-124	28	—	—
		3-Nitroaniline	122	µg/kg	1,600	µg/kg	D-125	35	—	—
		Acenaphthene	64.0	µg/kg	330	µg/kg	47-145	27	47-145	19
		Dibenzofuran	124	µg/kg	330	µg/kg	D-152	29	—	—
		2,4-Dinitrotoluene	48.0	µg/kg	330	µg/kg	39-139	56	39-139	18

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		2,6-Dinitrotoluene	39.0	µg/kg	330	µg/kg	8-115	35	—	—
		Diethylphthalate	49.0	µg/kg	330	µg/kg	D-128	27	—	—
		4-Chlorophenyl phenyl ether	50.0	µg/kg	330	µg/kg	D-130	27	—	—
		Fluorene	54.0	µg/kg	330	µg/kg	2-118	26	—	—
		4-Nitroaniline	135	µg/kg	1,600	µg/kg	D-190	37	—	—
		N-Nitrosodiphenylamine	57.0	µg/kg	330	µg/kg	D-146	26	—	—
		4-Bromophenyl phenyl ether	55.0	µg/kg	330	µg/kg	D-131	26	—	—
		Hexachlorobenzene	46.0	µg/kg	330	µg/kg	D-127	25	—	—
		Phenanthrene	50.0	µg/kg	330	µg/kg	26-74	53	—	—
		Anthracene	63.0	µg/kg	330	µg/kg	D-99	20	—	—
		Di-n-butylphthalate	61.0	µg/kg	330	µg/kg	D-132	28	—	—
		Fluoranthene	60.0	µg/kg	330	µg/kg	24-61	61	—	—
		Pyrene	86.0	µg/kg	330	µg/kg	52-115	69	52-115	28
		Butyl Benzyl Phthalate	116	µg/kg	330	µg/kg	D-144	29	—	—
		3,3'-Dichlorobenzidine	282	µg/kg	660	µg/kg	D-128	51	—	—
		Benzo(a)anthracene	55.0	µg/kg	330	µg/kg	13-102	32	—	—
		bis(2-ethylhexyl)phthalate	106	µg/kg	330	µg/kg	D-131	26	—	—
		Chrysene	63.0	µg/kg	330	µg/kg	12-74	45	—	—
		Di-n-octyl Phthalate	92.0	µg/kg	330	µg/kg	D-157	45	—	—
		Benzo(b)fluoranthene	57.0	µg/kg	330	µg/kg	4-110	54	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Benzo(k)fluoranthene	104	µg/kg	330	µg/kg	7-60	60	—	—
		Benzo(a)pyrene	73.0	µg/kg	330	µg/kg	13-81	33	—	—
		Indeno(1,2,3-cd)pyrene	78.0	µg/kg	330	µg/kg	17-83	34	—	—
		Dibenzo(a,h)anthracene	82.0	µg/kg	330	µg/kg	50-150	35	—	—
		Benzo(ghi)perylene	96.0	µg/kg	330	µg/kg	50-150	35	—	—
		Phenol	157	µg/kg	330	µg/kg	40-101	33	22-92	18
		2-Chlorophenol	116	µg/kg	330	µg/kg	23-134	33	23-134	18
		2-Methylphenol	118	µg/kg	330	µg/kg	22-140	37	—	—
		4-Methylphenol	135	µg/kg	330	µg/kg	20-136	45	—	—
		2-Nitrophenol	110	µg/kg	330	µg/kg	D-118	33	—	—
		2,4-Dimethylphenol	208	µg/kg	330	µg/kg	4-116	31	—	—
		2,4-Dichlorophenol	89.0	µg/kg	330	µg/kg	D-118	40	—	—
		4-Chloro-3-methylphenol	81.0	µg/kg	330	µg/kg	22-147	42	29-102	17
		2,4,6-Trichlorophenol	86.0	µg/kg	330	µg/kg	D-108	33	—	—
		2,4,5-Trichlorophenol	114	µg/kg	1,600	µg/kg	D-130	33	—	—
		2,4-Dinitrophenol	122	µg/kg	1,600	µg/kg	D-108	56	—	—
		4,6-Dinitro-2-methylphenol	436	µg/kg	1,600	µg/kg	D-99	39	—	—
		4-Nitrophenol	99.0	µg/kg	1,600	µg/kg	27-100	47	22-121	30
		Pentachlorophenol	115	µg/kg	1,600	µg/kg	14-176	165	14-176	54
		Nitrobenzene-d5 (surrogate)	—	—	—	—	—	—	35-90	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		2-Fluorobiphenyl (surrogate)	—	—	—	—	—	—	30-115	—
		Terphenyl-d14 (surrogate)	—	—	—	—	—	—	29-122	—
		2-Fluorophenol (surrogate)	—	—	—	—	—	—	32-92	—
		Phenol-d5 (surrogate)	—	—	—	—	—	—	33-93	—
		2,4,6-Tribromophenol (surrogate)	—	—	—	—	—	—	24-105	—
CLP	S/W	**Base/Neutral/Acid Extractables**	**See Tables 2-11 and 2-12**							
SW 8240 and/or EPA 624	W	**Volatile Organic Compounds**								
		Chloromethane	1.60	µg/L	10	µg/L	106-127	12	—	—
		Bromomethane	2.90	µg/L	10	µg/L	91-118	11	—	—
		Vinyl Chloride	2.05	µg/L	10	µg/L	93-110	13	—	—
		Chloroethane	3.70	µg/L	10	µg/L	94-112	10	—	—
		Methylene Chloride	2.93	µg/L	5	µg/L	66-116	21	—	—
		Acetone	2.77	µg/L	10	µg/L	49-111	35	—	—
		Carbon Disulfide	1.43	µg/L	5	µg/L	88-139	21	—	—
		1,1-Dichloroethene	2.17	µg/L	5	µg/L	63-115	21	28-175	13
		1,1-Dichloroethane	0.97	µg/L	5	µg/L	72-114	21	—	—
		1,2-Dichloroethene (total)	2.69	µg/L	5	µg/L	81-131	19	—	—
		Chloroform	1.56	µg/L	5	µg/L	76-112	17	—	—
		1,2-Dichloroethane	0.79	µg/L	5	µg/L	72-114	15	—	—
		2-Butanone	5.80	µg/L	10	µg/L	45-110	20	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		1,1,1-Trichloroethane	1.66	µg/L	5	µg/L	81-127	23	—	—
		Carbon Tetrachloride	0.88	µg/L	5	µg/L	84-129	22	—	—
		Vinyl Acetate	2.7	µg/L	10	µg/L	24-125	46	—	—
		Bromodichloromethane	1.34	µg/L	5	µg/L	68-115	18	—	—
		1,1,2,2-Tetrachloroethane	0.58	µg/L	5	µg/L	45-113	18	—	—
		1,2-Dichloropropane	1.31	µg/L	5	µg/L	72-113	21	—	—
		trans-1,3-Dichloropropene	1.35	µg/L	5	µg/L	39-108	18	—	—
		Trichloroethene	1.20	µg/L	5	µg/L	71-112	23	71-157	11
		Dibromochloromethane	1.70	µg/L	5	µg/L	65-115	18	—	—
		1,1,2-Trichloroethane	0.91	µg/L	5	µg/L	61-110	18	—	—
		Benzene	0.92	µg/L	5	µg/L	76-113	20	63-124	13
		cis-1,3-Dichloropropene	0.96	µg/L	5	µg/L	74-123	19	—	—
		Bromoform	0.54	µg/L	5	µg/L	64-109	17	—	—
		2-Hexanone	1.83	µg/L	10	µg/L	43-107	21	—	—
		4-Methyl-2-pentanone	1.35	µg/L	10	µg/L	49-108	17	—	—
		Tetrachloroethene	1.67	µg/L	5	µg/L	76-116	22	—	—
		Toluene	0.73	µg/L	5	µg/L	72-112	32	73-120	7
		Chlorobenzene	1.23	µg/L	5	µg/L	77-109	19	76-118	8
		Ethyl Benzene	1.63	µg/L	5	µg/L	67-117	19	—	—
		Styrene	0.65	µg/L	5	µg/L	61-116	37	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Total Xylenes	3.17	μg/L	5	μg/L	67-115	20	—	—
		1,2-Dichloroethane (surrogate)	—	—	—	—	—	—	83-113	—
		Toluene-d8 (surrogate)	—	—	—	—	—	—	88-110	—
		4-Bromofluorobenzene (surrogate)	—	—	—	—	—	—	86-115	—
SW 8240	S	**Volatile Organic Compounds**								
		Chloromethane	7.00	μg/kg	10	μg/kg	D-160	33	—	—
		Bromomethane	4.30	μg/kg	10	μg/kg	21-148	26	—	—
		Vinyl Chloride	5.50	μg/kg	10	μg/kg	32-149	26	—	—
		Chloroethane	3.40	μg/kg	10	μg/kg	53-134	33	—	—
		Methylene Chloride	7.20	μg/kg	5	μg/kg	59-122	17	—	—
		Acetone	94.4	μg/kg	10	μg/kg	32-169	77	—	—
		Carbon Disulfide	2.4	μg/kg	5	μg/kg	51-128	18	—	—
		1,1-Dichloroethene	3.0	μg/kg	5	μg/kg	61-109	18	67-122	11
		1,1-Dichloroethane	2.1	μg/kg	5	μg/kg	83-112	12	—	—
		1,2-Dichloroethene (total)	5.60	μg/kg	5	μg/kg	67-120	24	—	—
		Chloroform	2.60	μg/kg	5	μg/kg	83-107	18	—	—
		1,2-Dichloroethane	1.90	μg/kg	5	μg/kg	81-114	24	—	—
		2-Butanone	8.10	μg/kg	5	μg/kg	67-147	69	—	—
		1,1,1-Trichloroethane	1.90	μg/kg	5	μg/kg	69-118	34	—	—
		Carbon Tetrachloride	2.90	μg/kg	5	μg/kg	61-116	33	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Vinyl Acetate	2.7	µg/kg	10	µg/kg	D-96	137	—	—
		Bromodichloromethane	1.90	µg/kg	5	µg/kg	72-117	30	—	—
		1,1,2,2-Tetrachloroethane	2.50	µg/kg	5	µg/kg	73-121	29	—	—
		1,2-Dichloropropane	2.50	µg/kg	5	µg/kg	82-121	12	—	—
		trans-1,3-Dichloropropene	2.20	µg/kg	5	µg/kg	54-126	28	—	—
		Trichloroethene	1.50	µg/kg	5	µg/kg	71-157	23	64-120	11
		Dibromochloromethane	1.80	µg/kg	5	µg/kg	72-116	26	—	—
		1,1,2-Trichloroethane	1.90	µg/kg	5	µg/kg	84-119	16	—	—
		Benzene	2.30	µg/kg	5	µg/kg	75-101	23	65-122	12
		cis-1,3-Dichloropropene	2.20	µg/kg	5	µg/kg	48-130	19	—	—
		Bromoform	1.70	µg/kg	5	µg/kg	34-125	43	—	—
		2-Hexanone	4.50	µg/kg	10	µg/kg	47-164	55	—	—
		4-Methyl-2-pentanone	1.90	µg/kg	10	µg/kg	63-152	47	—	—
		Tetrachloroethene	2.60	µg/kg	5	µg/kg	71-113	20	—	—
		Toluene	2.30	µg/kg	5	µg/kg	76-102	11	66-121	12
		Chlorobenzene	2.30	µg/kg	5	µg/kg	75-101	14	70-123	13
		Ethyl Benzene	2.70	µg/kg	5	µg/kg	84-112	12	—	—
		Styrene	2.10	µg/kg	5	µg/kg	79-113	21	—	—
		Total Xylenes	5.70	µg/kg	5	µg/kg	84-111	18	—	—
		1,2-Dichloroethane (surrogate)	—	—	—	—	—	—	87-121	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Toluene-d8 (surrogate)	—	—	—	—	—	—	84-138	—
		4-Bromofluorobenzene (surrogate)	—	—	—	—	—	—	82-119	—
CLP	S/W	**Volatile Organic Compounds**	**See Table 2-13**							
SW 8080 and/or EPA 608	W	**Pesticides/PCBs**								
		alpha-BHC	0.00846	µg/L	0.025	µg/L	63-108	20	—	—
		beta-BHC	0.0196	µg/L	0.025	µg/L	57-124	8.9	—	—
		delta-BHC	0.00973	µg/L	0.025	µg/L	61-112	11	—	—
		gamma-BHC (lindane)	0.00937	µg/L	0.025	µg/L	53-157	20	53-157	20
		Heptachlor	0.0115	µg/L	0.025	µg/L	55-129	16	55-129	16
		Aldrin	0.00551	µg/L	0.025	µg/L	46-152	23	46-152	23
		Heptachlor Epoxide	0.00613	µg/L	0.050	µg/L	66-102	7	—	—
		Endosulfan I	0.00765	µg/L	0.050	µg/L	65-166	34	—	—
		Dieldrin	0.0172	µg/L	0.050	µg/L	69-136	20	69-136	20
		4,4'-DDE	0.0154	µg/L	0.050	µg/L	59-110	14	—	—
		Endrin	0.0194	µg/L	0.050	µg/L	49-177	21	—	—
		Endosulfan II	0.0145	µg/L	0.050	µg/L	61-117	8.3	—	—
		4,4'-DDD	0.0131	µg/L	0.050	µg/L	67-117	21	—	—
		Endosulfan Sulfate	0.0274	µg/L	0.10	µg/L	45-89	14	—	—
		4,4'-DDT	0.0182	µg/L	0.10	µg/L	52-149	27	52-149	27
		Endrin Aldehyde	0.0629	µg/L	0.10	µg/L	43-100	26	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Methoxychlor	0.129	μg/L	0.40	μg/L	64-115	26	—	—
		Chlordane	0.0158	μg/L	0.20	μg/L	63-100	12	—	—
		Toxaphene	0.281	μg/L	1.0	μg/L	41-126	20^a	—	—
		Aroclor 1016	0.388	μg/L	0.50	μg/L	50-114	20^a	—	—
		Aroclor 1221	0.288	μg/L	0.50	μg/L	15-178	20^a	—	—
		Aroclor 1232	0.250	μg/L	0.50	μg/L	10-215	20^a	—	—
		Aroclor 1242	0.294	μg/L	0.50	μg/L	39-150	20^a	54-139	20^a
		Aroclor 1248	0.232	μg/L	0.50	μg/L	38-158	20^a	—	—
		Aroclor 1254	0.137	μg/L	0.50	μg/L	29-131	20^a	—	—
		Aroclor 1260	0.318	μg/L	0.50	μg/L	8-127	20^a	—	—
		Dibutylchlorendate (surrogate)	—	—	—	—	—	—	52-124	—
SW 8080	S	**Pesticides/PCBs**								
		alpha-BHC	0.364	μg/kg	1.0	μg/kg	77-130	19	—	—
		beta-BHC	0.729	μg/kg	1.0	μg/kg	35-162	39	—	—
		delta-BHC	0.146	μg/kg	1.0	μg/kg	76-120	27	—	—
		gamma-BHC (lindane)	0.293	μg/kg	1.0	μg/kg	58-118	18	58-118	18
		Heptachlor	0.207	μg/kg	1.0	μg/kg	54-119	20	54-119	20
		Aldrin	0.454	μg/kg	1.0	μg/kg	51-121	35	51-121	35
		Heptachlor Epoxide	0.160	μg/kg	1.0	μg/kg	78-120	27	—	—
		Endosulfan I	0.794	μg/kg	2.0	μg/kg	53-147	25	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Dieldrin	0.783	μg/kg	2.0	μg/kg	65-118	24	65-118	24
		4,4'-DDE	1.16	μg/kg	2.0	μg/kg	83-126	6.9	—	—
		Endrin	0.783	μg/kg	2.0	μg/kg	43-155	12	43-155	12
		Endosulfan II	0.881	μg/kg	2.0	μg/kg	59-150	27	—	—
		4,4'-DDD	0.544	μg/kg	2.0	μg/kg	85-139	27	—	—
		Endosulfan Sulfate	0.548	μg/kg	5.0	μg/kg	57-89	17	—	—
		4,4'-DDT	0.912	μg/kg	5.0	μg/kg	22-155	34	22-155	34
		Endrin Aldehyde	0.658	μg/kg	5.0	μg/kg	46-110	38	—	—
		Methoxychlor	3.88	μg/kg	16	μg/kg	76-123	19	—	—
		alpha (chlordane)	2.46	μg/kg	8.0	μg/kg	74-119	42	—	—
		gamma (toxaphene)	11.9	μg/kg	50	μg/kg	41-126	35[a]	—	—
		Aroclor 1016	10.0	μg/kg	20	μg/kg	50-114	35[a]	—	—
		Aroclor 1221	19.0	μg/kg	20	μg/kg	15-178	35[a]	—	—
		Aroclor 1232	11.5	μg/kg	20	μg/kg	10-210	35[a]	—	—
		Aroclor 1242	5.98	μg/kg	20	μg/kg	39-150	35[a]	50-143	35[a]
		Aroclor 1248	5.65	μg/kg	20	μg/kg	38-158	35[a]	—	—
		Aroclor 1254	10.3	μg/kg	20	μg/kg	29-131	35[a]	—	—
		Aroclor 1260	7.40	μg/kg	20	μg/kg	8-127	35[a]	—	—
		Dibutylchlorendate (surrogate)	—	—	—	—	—	—	29-161	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
CLP	S/W	**Pesticides/PCBs**	See Table 2-14							
SW 8141	W	**Organophosphorus Pesticides**^{c}								
		Azinphos methyl	1	µg/L	1.0	µg/L	35-110	20[a]	—	—
		Chlorpyrifos	0.6	µg/L	1.0	µg/L	87-109	20[a]	—	—
		Dimethoate	0.9	µg/L	1.0	µg/L	10-150	20[a]	—	—
		Diazinon	0.4	µg/L	1.0	µg/L	55-79	20[a]	—	—
		Disulfoton	0.5	µg/L	1.0	µg/L	64-110	20[a]	—	—
		Mevinphos	0.3	µg/L	1.0	µg/L	41-72	20[a]	—	—
		Naled	0.4	µg/L	1.0	µg/L	62-94	20[a]	—	—
		Parathion methyl	0.2	µg/L	1.0	µg/L	34-163	20[a]	34-163	20[a]
		Phorate	0.5	µg/L	1.0	µg/L	45-80	20[a]	—	—
		Malathion	0.3	µg/L	1.0	µg/L	35-121	20[a]	—	—
		Parathion	1	µg/L	1.0	µg/L	34-163	20[a]	—	—
		Ethion	0.5	µg/L	1.0	µg/L	10-150	20[a]	—	—
		Sulprofos (surrogate)	—	—	—	—	—	—	19-136	—
SW 8141	S	**Organophosphorus Pesticides**								
		Azinphos methyl	330	µg/kg	1,000	µg/kg	35-110	35[a]	—	—
		Chlorpyrifos	330	µg/kg	1,000	µg/kg	87-109	35[a]	—	—
		Dimethoate	330	µg/kg	1,000	µg/kg	10-150	35[a]	—	—
		Diazinon	330	µg/kg	1,000	µg/kg	55-79	35[a]	—	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Disulfoton	330	µg/kg	1,000	µg/kg	64-110	35^a	—	—
		Mevinphos	330	µg/kg	1,000	µg/kg	41-72	35^a	—	—
		Naled	330	µg/kg	1,000	µg/kg	62-94	35^a	—	—
		Parathion methyl	330	µg/kg	1,000	µg/kg	50-138	35^a	50-138	35^a
		Phorate	330	µg/kg	1,000	µg/kg	45-80	35^a	—	—
		Malathion	330	µg/kg	1,000	µg/kg	18-162	35^a	18-162	35^a
		Parathion	330	µg/kg	1,000	µg/kg	50-138	35^a	—	—
		Ethion	330	µg/kg	1,000	µg/kg	10-150	35^a	—	—
		Sulprofos (surrogate)	—	—	—	—	—	—	21-131	—
SW 8310	W	PAHs								
		Naphthalene	0.8	µg/L	10	µg/L	29-95	20^a	29-95	20^a
		Acenaphthylene	0.7	µg/L	10	µg/L	25-112	20^a	25-112	20^a
		Acenaphthene	0.8	µg/L	10	µg/L	26-103	20^a	26-103	20^a
		Fluorene	0.1	µg/L	1.0	µg/L	35-104	20^a	35-104	20^a
		Phenanthrene	0.1	µg/L	1.0	µg/L	43-97	20^a	43-97	20^a
		Anthracene	0.2	µg/L	1.0	µg/L	27-105	20^a	27-105	20^a
		Fluoranthene	0.3	µg/L	2.5	µg/L	40-127	20^a	40-127	20^a
		Pyrene	0.4	µg/L	2.5	µg/L	31-140	20^a	31-140	20^a
		Benzo(a)anthracene	0.2	µg/L	1.0	µg/L	40-126	20^a	40-126	20^a
		Chrysene	0.1	µg/L	1.0	µg/L	39-122	20^a	39-122	20^a

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Benzo(b)fluoranthene	0.1	µg/L	1.0	µg/L	36-109	20^a	36-109	20^a
		Benzo(k)fluoranthene	0.1	µg/L	1.0	µg/L	26-112	20^a	26-112	20^a
		Benzo(a)pyrene	0.1	µg/L	1.0	µg/L	2-152	20^a	2-152	20^a
		Dibenzo(a,h)anthracene	0.2	µg/L	2.5	µg/L	23-121	20^a	23-121	20^a
		Benzo(ghi)perylene	0.1	µg/L	2.5	µg/L	14-130	20^a	14-130	20^a
		Indeno(1,2,3-cd)pyrene	0.1	µg/L	1.0	µg/L	19-119	20^a	19-119	20^a
		1-methylnaphthalene	5	µg/L	10	µg/L	—	20^a	—	20^a
		2-methylnaphthalene	5	µg/L	10	µg/L	—	20^a	—	20^a
		Terphenyl-d14 (surrogate)	—	—	—	—	—	—	52-124	—
SW 8310	S	**PAHs**								
		Naphthalene	500	µg/kg	200	µg/kg	D-195	35^a	D-195	35^a
		Acenaphthylene	500	µg/kg	200	µg/kg	41-122	35^a	41-122	35^a
		Acenaphthene	500	µg/kg	200	µg/kg	20-124	35^a	20-124	35^a
		Fluorene	50	µg/kg	20	µg/kg	35-122	35^a	35-122	35^a
		Phenanthrene	50	µg/kg	20	µg/kg	26-107	35^a	26-107	35^a
		Anthracene	50	µg/kg	20	µg/kg	14-98	35^a	14-98	35^a
		Fluoranthene	125	µg/kg	50	µg/kg	22-145	35^a	22-145	35^a
		Pyrene	125	µg/kg	50	µg/kg	31-143	35^a	31-143	35^a
		Benzo(a)anthracene	50	µg/kg	20	µg/kg	40-130	35^a	40-130	35^a
		Chrysene	50	µg/kg	20	µg/kg	45-113	35^a	45-113	35^a

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Benzo(b)fluoranthene	50	µg/kg	20	µg/kg	50-113	35[a]	35[a]	35[a]
		Benzo(k)fluoranthene	50	µg/kg	20	µg/kg	50-112	35[a]	35[a]	35[a]
		Benzo(a)pyrene	50	µg/kg	20	µg/kg	34-122	35[a]	35[a]	35[a]
		Dibenzo(a,h)anthracene	125	µg/kg	50	µg/kg	16-163	35[a]	35[a]	35[a]
		Benzo(ghi)perylene	125	µg/kg	50	µg/kg	23-136	35[a]	35[a]	35[a]
		Indeno(1,2,3-cd)pyrene	50	µg/kg	20	µg/kg	31-128	35[a]	35[a]	35[a]
		1-methylnaphthalene	500	µg/kg	200	µg/kg	—	35[a]	35[a]	35[a]
		2-methylnaphthalene	500	µg/kg	200	µg/kg	—	35[a]	35[a]	35[a]
		Terphenyl-d14 (surrogate)	—	—	—	—	—	—	60-120	—
SW 8150	W	**Herbicides**								
		2,4-dichlorophenoxyacetic acid	0.30	µg/L	0.50	µg/L	58-120	20[a]	30-130	35
		Silvex	0.026	µg/L	0.030	µg/L	60-149	20[a]	40-150	50
		4-(2,4-dichlorophenoxy)butanoic acid	0.63	µg/L	1.0	µg/L	87-99	20[a]	44-120	35
		2,4,5-trichlorophenoxyacetic acid	0.049	µg/L	0.80	µg/L	68-88	20[a]	35-122	50
		2,4'-Dichlorophenyl acetic acid	—	—	—	—	—	—	28-123	—
SW8150	S	**Herbicides**								
		2,4-dichlorophenoxyacetic acid	120	µg/kg	200	µg/kg	28-131	35[a]	30-140	50
		Silvex	12	µg/kg	20	µg/kg	16-154	35[a]	25-143	50
		4-(2,4-dichlorophenoxy)butanoic acid	310	µg/kg	500	µg/kg	87-99	35[a]	24-140	50
		2,4,5-trichlorophenoxyacetic acid	230	µg/kg	300	µg/kg	68-88	35[a]	26-142	50

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		2,4'-Dichlorophenyl acetic acid	—	—	—	—	—	—	39-153	—
SW 8330	W	**Nitroaromatics**								
		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]	0.420	μg/L	1.0	μg/L	60-130^b	25	—	—
		Hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]	0.235	μg/L	1.0	μg/L	60-110	25	60-110	25
		1,3,5-Trinitrobenzene [1,3,5-TNB]	0.147	μg/L	1.0	μg/L	45-85	25	—	—
		1,3-Dinitrobenzene [1,3-DNB]	0.198	μg/L	1.0	μg/L	60-130^a	25	60-130^a	25
		Tetryl	0.120	μg/L	1.0	μg/L	60-130^a	25	—	—
		Nitrobenzene [NB]	0.177	μg/L	1.0	μg/L	50-100	25	50-100	25
		2,4,6-Trinitrotoluene [2,4,6-TNT]	0.178	μg/L	1.0	μg/L	65-115	25	65-115	25
		2,6-Dinitrotoluene [2,6-DNT]	0.218	μg/L	1.0	μg/L	50-110	25	50-110	25
		2,4-Dinitrotoluene [2,4-DNT]	0.237	μg/L	1.0	μg/L	60-110	25	60-110	25
		2-Nitrotoluene [2-NT]	0.625	μg/L	1.0	μg/L	50-115	25	50-115	25
		4-Nitrotoluene [4-NT]	0.583	μg/L	1.0	μg/L	60-130^b	25	—	—
		3-Nitrotoluene [3-NT]	0.444	μg/L	1.0	μg/L	60-130^b	25	—	—
		2-Amino-4,6-dinitrotoluene (2A46DNT)	0.378	μg/L	1.0	μg/L	60-110	25	60-110	25
		4-Amino-2,6-dinitrotoluene (4A26DNT)	0.166	μg/L	1.0	μg/L	60-130^b	25	—	—
		3,4-Dinitrotoluene [3,4-DNT] (surrogate)	—	—	—	—	—	—	60-120	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
SW 8330	S	**Nitroaromatics**								
		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]	109	µg/kg	1,000	µg/kg	60-130^b	35^a	—	—
		Hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]	458	µg/kg	1,000	µg/kg	85-125	35^a	85-125	35^a
		1,3,5-Trinitrobenzene [1,3,5-TNB]	223	µg/kg	1,000	µg/kg	65-115	35^a	65-115	35^a
		1,3-Dinitrobenzene [1,3-DNB]	181	µg/kg	1,000	µg/kg	60-130^a	35^a	—	—
		Tetryl	235	µg/kg	1,000	µg/kg	60-130^a	35^a	—	—
		Nitrobenzene [NB]	141	µg/kg	1,000	µg/kg	85-110	35^a	85-110	35^a
		2,4,6-Trinitrotoluene [2,4,6-TNT]	83.4	µg/kg	1,000	µg/kg	90-125	35^a	90-125	35^a
		2,6-Dinitrotoluene [2,6-DNT]	183	µg/kg	1,000	µg/kg	80-110	35^a	80-100	35^a
		2,4-Dinitrotoluene [2,4-DNT]	285	µg/kg	1,000	µg/kg	80-110	35^a	80-110	35^a
		2-Nitrotoluene [2-NT]	429	µg/kg	1,000	µg/kg	75-120	35^a	75-120	35^a
		4-Nitrotoluene [4-NT]	803	µg/kg	1,000	µg/kg	60-130^b	35^a	—	—
		3-Nitrotoluene [3-NT]	759	µg/kg	1,000	µg/kg	60-130^b	35^a	—	—
		2-Amino-4,6-dinitrotoluene [2A46DNT]	122	µg/kg	1,000	µg/kg	75-110	35$_a$	75-110	35^a
		4-Amino-2,6-dinitrotoluene [4A26DNT]	158	µg/kg	1,000	µg/kg	60-130^b	35^a	—	—
		3,4-Dinitrotoluene [3,4-DNT] (surrogate)	—	—	—	—	—	—	60-120	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
SW 8010 and/or EPA 601	W	**Volatile Halogenated Hydrocarbons**								
		Carbon tetrachloride	0.4	µg/L	0.50	µg/L	73-107	20^a	73-107	20^a
		1,2-dichloroethane	0.4	µg/L	0.50	µg/L	56-130	20^a	56-130	20^a
		1,1,1-trichloroethane	0.5	µg/L	0.50	µg/L	75-105	20^a	75-105	20^a
		1,1-dichloroethane	0.3	µg/L	0.50	µg/L	66-117	20^a	66-117	20^a
		1,1,2-trichloroethane	0.3	µg/L	0.50	µg/L	38-149	20^a	38-149	20^a
		1,1,2,2-tetrachloroethane	0.3	µg/L	0.50	µg/L	51-140	20^a	51-140	20^a
		Chloroethane	0.3	µg/L	0.80	µg/L	59-113	20^a	59-113	20^a
		2-chloroethylvinylether	2.6	µg/L	2.0	µg/L	—	20^a	—	20^a
		Chloroform	1.7	µg/L	0.50	µg/L	68-107	20^a	68-107	20^a
		1,1-dichloroethene	0.2	µg/L	0.50	µg/L	71-101	20^a	71-101	20^a
		Trans-1,2-dichloroethene	0.5	µg/L	0.50	µg/L	69-110	20^a	69-110	20^a
		1,2-dichloropropane	0.3	µg/L	3.0	µg/L	54-132	20^a	54-132	20^a
		Trans-1,3-dichloropropene	0.4	µg/L	1.5	µg/L	36-145	20^a	36-145	20^a
		Cis-1,3-dichloropropene	0.5	µg/L	0.70	µg/L	47-131	20^a	47-131	20^a
		Methylene chloride	2.7	µg/L	2.5	µg/L	36-143	20^a	36-143	20^a
		Chloromethane	0.4	µg/L	5.0	µg/L	28-114	20^a	28-114	20^a
		Bromomethane	0.2	µg/L	0.50	µg/L	58-108	20^a	58-108	20^a
		Bromoform	0.3	µg/L	0.50	µg/L	50-139	20^a	50-139	20^a
		Bromodichloromethane	0.3	µg/L	2.0	µg/L	54-131	20^a	54-131	20^a

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Fluorotrichloromethane	0.4	µg/L	0.60	µg/L	51-116	20^a	51-116	20^a
		Dichlorodifluoromethane	0.3	µg/L	5.0	µg/L	15-105	20^a	15-105	20^a
		Chlorodibromomethane	0.3	µg/L	0.50	µg/L	50-139	20^a	50-139	20^a
		Tetrachloroethene	0.3	µg/L	0.50	µg/L	62-121	20^a	62-121	20^a
		Trichloroethene	0.4	µg/L	1.0	µg/L	57-124	20^a	57-124	20^a
		Vinyl chloride	0.5	µg/L	1.0	µg/L	46-111	20^a	46-111	20^a
		Bromochloromethane (surrogate)	—	—	—	—	—	—	48-154	—
		1,4-Dichlorobutane (surrogate)	—	—	—	—	—	—	41-170	—
		1-Chloro-2-bromopropane (surrogate)	—	—	—	—	—	—	46-168	—
SW 8010	S	**Volatile Halogenated Hydrocarbons**								
		Carbon tetrachloride	0.4	µg/kg	0.50	µg/kg	26-126	35^a	26-126	35^a
		1,2-dichloroethane	0.4	µg/kg	0.50	µg/kg	D-162	35^a	D-162	35^a
		1,1,1-trichloroethane	0.5	µg/kg	0.50	µg/kg	D-176	35^a	D-176	35^a
		1,1-dichloroethane	0.3	µg/kg	0.50	µg/kg	D-212	35^a	D-212	35^a
		1,1,2-trichloroethane	0.3	µg/kg	0.50	µg/kg	17-138	35^a	17-138	35^a
		1,1,2,2-tetrachloroethane	0.3	µg/kg	0.50	µg/kg	40-118	35^a	40-118	35^a
		Chloroethane	0.3	µg/kg	0.80	µg/kg	23-93	35^a	23-93	35^a
		2-chloroethylvinylether	2.6	µg/kg	2.0	µg/kg	—	35^a	—	35^a
		Chloroform	1.7	µg/kg	0.50	µg/kg	10-148	35^a	10-148	35^a
		1,1-dichloroethene	0.2	µg/kg	0.50	µg/kg	D-164	35^a	D-164	35^a

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Trans-1,2-dichloroethene	0.5	µg/kg	0.50	µg/kg	D-162	35^a	D-162	35^a
		1,2-dichloropropane	0.3	µg/kg	3.0	µg/kg	18-139	35^a	18-139	35^a
		Trans-1,3-dichloropropene	0.4	µg/kg	1.5	µg/kg	36-145	35^a	36-145	35^a
		Cis-1,3-dichloropropene	0.5	µg/kg	0.70	µg/kg	11-207	35^a	11-207	35^a
		Methylene chloride	2.7	µg/kg	2.5	µg/kg	D-357	35^a	D-357	35^a
		Chloromethane	0.4	µg/kg	5.0	µg/kg	2-33	35^a	2-33	35^a
		Bromomethane	0.2	µg/kg	0.50	µg/kg	9-73	35^a	9-73	35^a
		Bromoform	0.3	µg/kg	0.50	µg/kg	20-119	35^a	20-119	35^a
		Bromodichloromethane	0.3	µg/kg	2.0	µg/kg	34-122	35^a	34-122	35^a
		Fluorotrichloromethane	0.4	µg/kg	0.60	µg/kg	8-80	35^a	8-80	35^a
		Dichlorodifluoromethane	0.3	µg/kg	5.0	µg/kg	—	35^a	—	35^a
		Chlorodibromomethane	0.3	µg/kg	0.50	µg/kg	32-118	35^a	32-118	35^a
		Tetrachloroethene	0.3	µg/kg	0.50	µg/kg	D-155	35^a	D-155	35^a
		Trichloroethene	0.4	µg/kg	1.0	µg/kg	D-170	35^a	D-170	35^a
		Vinyl chloride	0.5	µg/kg	1.0	µg/kg	—	35^a	—	35^a
		Bromochloromethane (surrogate)	—	—	—	—	—	—	43-113	—
		1,4-Dichlorobutane (surrogate)	—	—	—	—	—	—	29-129	—
		1-Chloro-2-bromopropane (surrogate)	—	—	—	—	—	—	45-110	—
SW 8020 and/or EPA 602	W	**Volatile Aromatic Hydrocarbons**								
		1,2-dichlorobenzene	0.1	µg/L	1.2	µg/L	60-127	20^a	60-127	20^a

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Benzene	0.2	μg/L	0.60	μg/L	48-132	20^a	48-132	20^a
		Ethylbenzene	0.2	μg/L	0.70	μg/L	53-126	20^a	53-126	20^a
		Toluene	0.2	μg/L	0.90	μg/L	48-132	20^a	48-132	20^a
		Chlorobenzene	0.2	μg/L	1.4	μg/L	30-147	20^a	30-147	20^a
		1,3-dichlorobenzene	0.1	μg/L	1.4	μg/L	60-123	20^a	60-123	20^a
		1,4-dichlorobenzene	0.2	μg/L	1.2	μg/L	56-127	20^a	56-127	20^a
		Methyl tert butyl ether[d]	0.3	μg/L	1.5	μg/L	63-123	20^a	63-123	20^a
		Xylenes (Total)	0.4	μg/kg	2.0	μg/L	64-125	20^a	64-125	20^a
		Trifluorotoluene (surrogate)	—	—	—	—	—	—	76-115	—
EPA 8020	S	**Volatile Aromatic Hydrocarbons**								
		1,2-dichlorobenzene	0.1	μg/kg	1.2	μg/kg	24-139	35^a	24-139	35^a
		Benzene	0.2	μg/kg	0.60	μg/kg	69-99	35^a	69-99	35^a
		Ethylbenzene	0.2	μg/kg	0.70	μg/kg	44-129	35^a	44-129	35^a
		Toluene	0.2	μg/kg	0.90	μg/kg	49-123	35^a	49-123	35^a
		Chlorobenzene	0.2	μg/kg	1.4	μg/kg	9-149	35^a	9-149	35^a
		1,3-dichlorobenzene	0.1	μg/kg	1.4	μg/kg	34-130	35^a	34-130	35^a
		1,4-dichlorobenzene	0.2	μg/kg	1.2	μg/kg	29-134	35^a	29-134	35^a
		Methyl tert-butyl ether[d]	0.3	μg/kg	1.5	μg/kg	49-110	35^a	49-110	35^a
		Xylenes (total)	0.4	μg/kg	2.0	μg/kg	52-113	35^a	52-113	35^a
		Trifluorotoluene (surrogate)	—	—	—	—	—	—	32-123	—

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
EPA 601 (Modified)	W	1,2-Dibromomethane	0.01	µg/L		µg/L	60-140[a]	40a	60-140[a]	40a
SW 8011	W	1,2-Dibromoethane	0.0028	µg/L		µg/L	60-140[a]	20[a]	60-140[a]	20[a]
		1,2-Dibromo-3-chloropropane	0.0011	µg/L		µg/L	60-140[a]	20[b]	60-140[a]	20[a]
Ambient Air Monitoring Volatile Compounds										
T01 and T02	Air	Vinyl chloride			1.2[e]	µg/m^3			70-130	
		Methylene chloride			0.5[e]	µg/m^3			—	
		Acetone			1.2[e]	µg/m^3			—	
		Trichlorofluoromethane			0.5[e]	µg/m^3			—	
		Carbon disulfide			0.3[e]	µg/m^3			—	
		1,1-Dichloroethene			0.5[e]	µg/m^3			80-120	
		1,1-Dichloroethane			0.5[e]	µg/m^3			—	
		Trans-1,2-dichloroethene			0.5[e]	µg/m^3			—	
		Chloroform			0.5[e]	µg/m^3			—	
		1,2-Dichloroethane			0.2[e]	µg/m^3			—	
		2-Butanone			1.2[e]	µg/m^3			—	
		1,1,1-Trichloroethane			0.5[e]	µg/m^3			—	
		Carbon tetrachloride			0.4[e]	µg/m^3			—	
		Bromodichloromethane			0.4[e]	µg/m^3			—	
		Trichloroethene			0.3[e]	µg/m^3			80-120	
		Benzene			0.4[e]	µg/m^3			80-120	

Table 2-9

ORGANIC ANALYTICAL METHODS AND QUALITY CONTROL CRITERIA

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units	Method Accuracy % Recovery	Method Precision % RPD	% Spike Recovery	Duplicate % RPD
		Tetrachloroethene			0.2^e	$\mu g/m^3$			—	
		Toluene			0.5^e	$\mu g/m^3$			—	
		Chlorobenzene			0.5^e	$\mu g/m^3$			—	
		Ethylbenzene			0.5^e	$\mu g/m^3$			80-120	
		Styrene			0.5^e	$\mu g/m^3$			—	
		Total xylenes			0.5^e	$\mu g/m^3$			—	
Ambient Air Monitoring Polychlorinated Biphenyls										
T10	Air	Aroclor 1016			0.01	$\mu g/m^3$			—	
		Aroclor 1221			0.01	$\mu g/m^3$			—	
		Aroclor 1232			0.01	$\mu g/m^3$			—	
		Aroclor 1242			0.01	$\mu g/m^3$			75-125	
		Aroclor 1248			0.01	$\mu g/m^3$			—	
		Aroclor 1254			0.01	$\mu g/m^3$			—	
		Aroclor 1260			0.01	$\mu g/m^3$			—	

2-94

Table 2-9 (Cont.)

[a] Insufficient data points. Target sets are based on method targets or expected accuracy and precision.

[b] MDL to be developed. The United States Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Contract-Required Detection Limit is shown.

[c] MDL study not completed; instrument detection limit is shown.

[d] Not cited in method.

[e] Assumes 20 liters of air sampled and total retention.

Key:

D = Detectable. Result must be greater than 0.
EPA = United States Environmental Protection Agency Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.
MDL = Method detection limit, most current.
PQL = Practical quantitation limit.
RPD = Relative percent difference.
S = Soil, sediment, and sludges.
SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1986, including update I, 1993.
W = Groundwater and surface water.
µg/L = Micrograms per liter.
µg/kg = Micrograms per kilogram.
CLP = Contract Laboratory Program.
PCBs = Polychlorinated biphenyls.
BHC = Benzenehexachloride.
PAHs = Polynuclear aromatic hydrocarbons.
T = United States Environmental Protection Agency (EPA) "Compendium of Methods for the Determination for Toxic Organic Compounds in Ambient Air," EPA-600/4-87-006, revised June 1988.

Table 2-10

FIELD MEASUREMENT ANALYTICAL METHODS

Method Number	Matrix	Analyte/Component
EPA 120.1	W	Specific conductance
EPA 150.1	W	pH
EPA 170.1	W	Temperature
EPA 360.2	W	Dissolved oxygen

Key:

EPA = United States Environmental Protection Agency.
W = Water.

Table 2-11

BASE NEUTRAL QUALITY OBJECTIVES[a]
EPA CONTRACT LABORATORY PROGRAM OLM01.8
NYSDEC ASP METHOD 91-2
GC/MS

Compound	Contract Required Quantitation Limits		QC Criteria - Matrix Spike[a]			
			Water		Soil	
	Water (µg/L)	Soil/ Sediment (µg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
Bis(2-chloroethyl) ether	10	330	—	—	—	—
1,3-Dichlorobenzene	10	330	—	—	—	—
1,4-Dichlorobenzene	10	330	28	36 - 97	27	28 - 104
1,2-Dichlorobenzene	10	330	—	—	—	—
2,2'-Oxybis(1-chloropropane)	10	330	—	—	—	—
N-nitroso-dipropylamine	10	330	38	41 - 116	38	41 - 126
Hexachloroethane	10	330	—	—	—	—
Nitrobenzene	10	330	—	—	—	—
Isophorone	10	330	—	—	—	—
Bis(2-chloroethoxy) methane	10	330	—	—	—	—
1,2,4-Trichlorobenzene	10	330	28	39 - 98	23	38 - 107
Naphthalene	10	330	—	—	—	—
4-Chloroaniline	10	330	—	—	—	—
Hexachlorobutadiene	10	330	—	—	—	—
2-Methylnaphthalene	10	330	—	—	—	—
Hexachlorocyclopentadiene	10	330	—	—	—	—
2-Chloronaphthalene	10	330	—	—	—	—
2-Nitroaniline	25	800	—	—	—	—
Dimethyl phthalate	10	330	—	—	—	—
Acenaphthylene	10	330	—	—	—	—

Key at end of table.

Table 2-11

BASE NEUTRAL QUALITY OBJECTIVES[a]
EPA CONTRACT LABORATORY PROGRAM OLM01.8
NYSDEC ASP METHOD 91-2
GC/MS

Compound	Contract Required Quantitation Limits		QC Criteria - Matrix Spike[a]			
			Water		Soil	
	Water (µg/L)	Soil/ Sediment (µg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
3-Nitroaniline	25	800	—	—	—	—
Acenaphthene	10	330	31	46 - 118	19	31 - 137
Dibenzofuran	10	330	—	—	—	—
2,4-Dinitrotoluene	10	330	38	24 - 96	47	28 - 89
2,6-Dinitrotoluene	10	330	—	—	—	—
Diethyl phthalate	10	330	—	—	—	—
4-Chlorophenyl phenyl ether	10	330	—	—	—	—
Fluorene	10	330	—	—	—	—
4-Nitroaniline	25	800	—	—	—	—
N-nitrosodiphenylamine	10	330	—	—	—	—
4-Bromophenyl phenyl ether	10	330	—	—	—	—
Hexachlorobenzene	10	330	—	—	—	—
Phenanthrene	10	330	—	—	—	—
Anthracene	10	330	—	—	—	—
Carbazole	10	330	—	—	—	—
Di-n-butylphthalate	10	330	—	—	—	—
Fluoranthene	10	330	—	—	—	—
Pyrene	10	330	31	26 - 127	36	35 - 142
Butyl benzyl phthalate	10	330	—	—	—	—
3,3'-Dichlorobenzidine	20	660	—	—	—	—

Key at end of table.

Table 2-11

BASE NEUTRAL QUALITY OBJECTIVES[a]
EPA CONTRACT LABORATORY PROGRAM OLM01.8
NYSDEC ASP METHOD 91-2
GC/MS

	Contract Required Quantitation Limits		QC Criteria - Matrix Spike[a]			
			Water		Soil	
Compound	Water (µg/L)	Soil/ Sediment (µg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
Benzo(a)anthracene	10	330	—	—	—	—
Bis(2-ethylhexyl)phthalate	10	330	—	—	—	—
Chrysene	10	330	—	—	—	—
Di-n-octyl phthalate	10	330	—	—	—	—
Benzo(b)fluoranthene	10	330	—	—	—	—
Benzo(k)fluoranthene	10	330	—	—	—	—
Benzo(a)pyrene	10	330	—	—	—	—
Indeno(1,2,3-cd)pyrene	10	330	—	—	—	—
Dibenz(a,h)anthracene	10	330	—	—	—	—
Benzo(g,h,i)perylene	10	330	—	—	—	—

Note: Medium soil/sediment quantitation limits for semivolatile target compound list compounds are 30 times the individual low soil/sediment detection limits.

[a] Selected compounds.

Key:

ASP = Analytical Services Protocol.
CLP = Contract Laboratory Program
EPA = United States Environmental Protection Agency.
GC/MS = Gas chromatography/mass spectrometry.
NYSDEC = New York State Department of Environmental Conservation.
µg/kg = Micrograms per kilogram.
µg/L = Micrograms per liter.
QC = Quality control.
RPD = Relative percent difference.

Table 2-12

ACID PHENOLS
EPA CONTRACT LABORATORY PROGRAM OLM01.8[a]
NYSDEC ASP METHOD 91-2
GC/MS

Compound	Contract Required Quantitation Limits		QC Criteria - Matrix Spike[a]			
			Water		Soil	
	Water (µg/L)	Soil/ Sediment (µg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
Phenol	10	330	42	12 - 110	35	26 - 90
2-Chlorophenol	10	330	40	27 - 123	50	25 - 102
2-Methylphenol	10	330	—	—	—	—
4-Methylphenol	10	330	—	—	—	—
2-Nitrophenol	10	330	—	—	—	—
2,4-Dimethylphenol	10	330	—	—	—	—
2,4-Dichlorophenol	10	330	—	—	—	—
4-Chloro-3-methylphenol (para-chloro-meta-cresol)	10	330	42	23 - 97	33	26 - 103
2,4,6-Trichlorophenol	10	330	—	—	—	—
2,4,5-Trichlorophenol	25	800	—	—	—	—
2,4-Dinitrophenol	25	800	—	—	—	—
4,6-Dinitro-2-methylphenol	25	800	—	—	—	—
4-Nitrophenol	25	800	50	10 - 80	50	11 - 114
Pentachlorophenol	25	800	50	9 - 103	47	17 - 109

Note: Medium soil/sediment quantitation limits for semivolatile target compound list compounds are 30 times the individual low soil/sediment detection limits.

[a] Selected compounds.

Key:

ASP = Analytical Services Protocol.
CLP = Contract Laboratory Program.
EPA = United States Environmental Protection Agency.
GC/MS = Gas chromatography/mass spectrometry.
NYSDEC = New York State Department of Environmental Conservation.
µg/kg = Micrograms per kilogram.
µg/L = Micrograms per liter.
QC = Quality control.
RPD = Relative percent difference.

Table 2-13

VOLATILE ORGANICS
EPA CONTRACT LABORATORY PROGRAM OLM01.8
NYSDEC METHOD 91-1
GC/MS

Compound	Contract Required Quantitation Limits		QC Criteria - Matrix Spike[a]			
			Water		Soil	
	Water (μg/L)	Soil/ Sediment[b] (μg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
Chloromethane	10	10	—	—	—	—
Bromomethane	10	10	—	—	—	—
Vinyl chloride	10	10	—	—	—	—
Chloroethane	10	10	—	—	—	—
Methylene chloride	10	10	—	—	—	—
Acetone	10	10	—	—	—	—
Carbon disulfide	10	10	—	—	—	—
1,1-Dichloroethene	10	10	14	61 - 145	22	59 - 172
1,1-Dichloroethene	10	10	—	—	—	—
1,2-Dichloroethene (total)	10	10	—	—	—	—
Chloroform	10	10	—	—	—	—
1,2-Dichloroethene	10	10	—	—	—	—
2-Butanone	10	10	—	—	—	—
1,1,1,1-Tetrachloroethane	10	10	—	—	—	—
Carbon tetrachloride	10	10	—	—	—	—
Bromodichloromethane	10	10	—	—	—	—
1,1,2,2-Tetrachloroethane	10	10	—	—	—	—
1,2-Dichloropropane	10	10	—	—	—	—
Trans-1,3-dichloropropene	10	10	—	—	—	—
Trichloroethene	10	10	14	71 - 120	24	62 - 137
Dibromochloromethane	10	10	—	—	—	—
1,1,2-Trichloroethane	10	10	—	—	—	—

Key at end of table.

Table 2-13

VOLATILE ORGANICS
EPA CONTRACT LABORATORY PROGRAM OLM01.8
NYSDEC METHOD 91-1
GC/MS

			QC Criteria - Matrix Spike[a]			
	Contract Required Quantitation Limits		Water		Soil	
Compound	Water (µg/L)	Soil/ Sediment[b] (µg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
Benzene	10	10	11	76 - 127	21	66 - 142
Cis-1,3-dichloropropene	10	10	—	—	—	—
Bromoform	10	10	—	—	—	—
2-Hexanone	10	10	—	—	—	—
4-Methyl-2-pentanone	10	10	—	—	—	—
Tetrachloroethene	10	10	—	—	—	—
Toluene	10	10	13	76 - 125	21	59 - 139
Chlorobenzene	10	10	13	75 - 130	21	60 - 133
Ethylbenzene	10	10	—	—	—	—
Styrene	10	10	—	—	—	—
Total Xylenes	10	10	—	—	—	—

[a] Selected compounds.

[b] Medium soil/sediment detection limits for volatile compounds are 125 times the individual soil/sediment detection limits.

Key:

ASP = Analytical Services Protocol.
CLP = Contract Laboratory Program.
EPA = United States Environmental Protection Agency.
GC/MS = Gas chromatography/mass spectrometry.
NYSDEC = New York State Department of Environmental Conservation.
QC = Quality control.
RPD = Relative percent difference.
µg/kg = Micrograms per kilogram.
µg/L = Micrograms per liter.

Table 2-14

PESTICIDES/PCBs
EPA CONTRACT LABORATORY PROGRAM OLM01.8
NYSDEC ASP METHOD 91-3
GC

	Contract Required Quantitation Limits		QC Criteria - Matrix Spike[a]			
			Water		Soil	
Compound	Water (µg/L)	Soil/ Sediment (µg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
Alpha-BHC	0.05	1.7	—	—	—	—
Beta-BHC	0.05	1.7	—	—	—	—
Delta-BHC	0.05	1.7	—	—	—	—
Gamma-BHC (lindane)	0.05	1.7	15	56 - 123	50	46 - 127
Heptachlor	0.05	1.7	20	40 - 131	31	35 - 130
Aldrin	0.05	1.7	22	40 - 120	43	34 - 132
Heptachlor epoxide	0.05	1.7	—	—	—	—
Endosulfan I	0.05	1.7	—	—	—	—
Dieldrin	0.10	3.3	18	52 - 126	38	31 - 134
4,4'-DDE	0.10	3.3	—	—	—	—
Endrin	0.10	3.3	21	56 - 121	45	42 - 139
Endosulfan II	0.10	3.3	—	—	—	—
4,4'-DDD	0.10	3.3	—	—	—	—
Endosulfan sulfate	0.10	3.3	—	—	—	—
4,4'-DDT	0.10	3.3	27	38 - 127	50	23 - 134
Endrin ketone	0.10	3.3	—	—	—	—
Endrin aldehyde	0.10	3.3	—	—	—	—
Methoxychlor	0.50	17.0	—	—	—	—
Alpha-chlordane	0.05	1.7	—	—	—	—
Gamma-chlordane	0.05	1.7	—	—	—	—

Key at end of table.

Table 2-14

PESTICIDES/PCBs
EPA CONTRACT LABORATORY PROGRAM OLM01.8
NYSDEC ASP METHOD 91-3
GC

Compound	Contract Required Quantitation Limits		QC Criteria - Matrix Spike[a]			
			Water		Soil	
	Water (µg/L)	Soil/ Sediment (µg/kg)	Duplicate RPD	% Spike Recovery	Duplicate RPD	% Spike Recovery
Toxaphene	5.0	170	—	—	—	—
AROCLOR-1016	1.0	33.0	—	—	—	—
AROCLOR-1221	2.0	67.0	—	—	—	—
AROCLOR-1232	1.0	33.0	—	—	—	—
AROCLOR-1242	1.0	33.0	—	—	—	—
AROCLOR-1248	1.0	33.0	—	—	—	—
AROCLOR-1254	1.0	33.0	—	—	—	—
AROCLOR-1260	1.0	33.0	—	—	—	—

Note: Medium soil/sediment quantitation limits for semivolatile target compound list compounds are 30 times the individual low soil/sediment detection limits.

[a] Selected compounds.

Key:

ASP Analytical Services Protocol.
BHC = Benzenehexachloride.
DDD = Dichlorodiphenyldichloroethane.
DDT = Dichlorodiphenyltrichloroethane.
CLP = Contract Laboratory Program.
EPA = United States Environmental Protection Agency.
GC/MS = Gas chromatography/mass spectrometry.
NYSDEC = New York State Department of Environmental Conservation.
µg/kg = Micrograms per kilogram.
µg/L = Micrograms per liter.
QC = Quality control.
RPD = Relative percent difference.

Table 2-15

EPA CONTRACT LABORATORY PROGRAM [OLM01.8] NYSDEC ASP METHODS 91-1, 91-2, AND 91-3 SYSTEM MONITORING AND SURROGATE RECOVERY LIMITS

		Percent Recovery Control Limits	
Parameter	Method	Water	Soil
1,2 Dichloroethane-d_4	VOA;GC/MS	76 - 114	70 - 121
Toluene-d_8	VOA;GC/MS	88 - 110	84 - 138
4-Bromofluorobenzene	VOA;GC/MS	86 - 115	59 - 113
Nitrobenzene-d_5	BNA;GC/MS	35 - 114	23 - 120
2-Fluorobiphenyl	BNA;GC/MS	43 - 116	30 - 115
Terphenyl d_{14}	BNA;GC/MS	33 - 141	18 - 137
2-Fluorophenol	BNA;GC/MS	21 - 110	25 - 121
Phenol-d_5	BNA;GC/MS	10 - 110	24 - 113
2,4,6-Tribromophenol	BNA;GC/MS	10 - 123	19 - 122
2-Chlorophenol-d_4	BNA;GC/MS	33 - 110[a]	20 - 130[a]
1,2-Dichlorobenzene-d_4	BNA;GC/MS	16 - 110[a]	20 - 130[a]
Tetrachloro-m-xylene	pesticide/PCB;GC	60 - 150[a]	60 - 150[a]
Decachlorobiphenyl	pesticide/PCB;GC	60 - 150[a]	60 - 150[a]

[a] These limits are advisory.

Key:

ASP = Analytical Services Protocol.
BNA = Base/neutral and acid extractable organics.
EPA = United States Environmental Protection Agency.
GC/MS = Gas chromatography/mass spectrometry.
NYSDEC = New York State Department of Environmental Conservation.
PCB = Polychlorinated biphenyl.
VOA = Volatile organic analysis.

Table 2-16

VOLATILE SCREENING PROCEDURE LABORATORY EFFICIENCY INFORMATION FOR SOILS

Parameter	Target % Recovery	Target % RPD
Benzene	53 - 135	13
Toluene	77 - 116	18
Ethylbenzene	65 - 107	23
1,2-Dichlorobenzene	56 - 106	20
1,3-Dichlorobenzene	59 - 104	21
1,4-Dichlorobenzene	58 - 107	20
Trans-1,2-dichloroethene	10 - 172	29
1,1-Dichloroethane	34 - 178	17
1,1,1-Trichloroethane	62 - 135	16
1,2-Dichloroethane	63 - 132	20
Trichloroethene	62 - 124	32
Tetrachloroethene	59 - 118	29
1,1-Dichloroethene	0 - 132	38

Key:

RPD = Relative percent difference (laboratory-derived value)

Table 2-17

PESTICIDE/PCB SCREENING PROCEDURE LABORATORY EFFICIENCY INFORMATION FOR SOILS

Parameter	Target % Recovery	Target % RPD[a]
Aldrin	81 - 152	14
Dieldrin	86 - 154	14
Endrin	88 - 154	13
4,4'-DDT	78 - 153	15
Lindane	70 - 143	16
Heptachlor	67 - 149	18
PCB-1254	83 - 158	15

[a] Value is a coarse approximation calculated from percent relative standard deviation (%RSD) as follows: relative percent difference (%RPD) = %RSD X $\sqrt{2}$. Reference: United States Environmental Protection Agency "Data Quality Objectives for Remedial Response Activities," EPA/540/G-87/003, March 1987.

Key:

DDT = Dichlorodiphenyltrichloroethane.
PCB = Polychlorinated biphenyl.

Table 2-18

METALS SCREENING PROCEDURE LABORATORY EFFICIENCY INFORMATION FOR SOILS

Analyte	Target % Recovery	Target % RPD
Arsenic	77 - 116	35
Cadmium	77 - 115	35
Chromium	86 - 119	35
Copper	82 - 113	35
Lead	70 - 126	35
Nickel	84 - 110	35
Silver	79 - 114	35
Zinc	80 - 110	35

Key:

RPD = Relative percent difference.

Table 2-19

PAH AND PHENOL SCREENING PROCEDURE LABORATORY EFFICIENCY INFORMATION FOR SOILS

Parameter	Target % Recovery	Target % RPD[a]
PAH Screen	20-120	35
2,4,6-Trichlorophenol	22 - 122	32.5
TRPH	44 - 134	24.0

[a] Value is a coarse approximation calculated from percent relative standard deviation (%RSD) as follows: relative percent difference (%RPD) = %RPD X $\sqrt{2}$. Reference: United States Environmental Protection Agency "Data Quality Objectives for Remedial Response Activities," EPA/540/G-87/003, March 1987.

Key:

PAH = Polynuclear aromatic hydrocarbon.
RPD = Relative percent difference.
TRPH = Total Recoverable Petroleum Hydrocarbons.

Table 2-20

FIELD QUALITY CONTROL GUIDELINES

Definitive Analyses	
Field duplicate	One per matrix per 10 samples for each analysis.
Trip blank[a]	One per shipping container containing VOA samples; analyzed for volatiles only.
Field equipment blank	One per matrix per 20 samples or per sampling event for each analysis.
Screening Analyses	
Field duplicate	One per matrix per 40 samples for each analysis.
Field equipment blank	One per matrix per sampling event for each analysis.

[a] Trip blanks are typically required for water/liquid matrix only.

Key:

VOA = Volatile organic analysis.

Table 2-21

LABORATORY QUALITY CONTROL GUIDELINES

DEFINITIVE ANALYSES	
Method blank	One per batch of 20 samples or less (for each analysis)
Matrix spike	One per batch of 20 samples or less (for each analysis)
Matrix spike duplicate or replicate	One per batch of 20 samples or less (for each analysis)
Reference standards	One per 10 samples (for each analysis), except GC/MS
Internal standard	All samples (GC/MS analyses only)
Laboratory control sample	One per batch of 20 samples or less
SCREENING ANALYSES	
Method blank	One per batch of 20 samples or less
Matrix spike	One per batch of 20 samples or less
Duplicates	Only field duplicates
Calibration standards	Beginning and end of shift

Key:

GC/MS = Gas chromatography/mass spectrometry.

Table 2-22

ROUTINE FIELD EQUIPMENT MAINTENANCE

Instrument	Operation	Frequency
HNu Systems Photoionization Detector	- Clean lamps and ion chamber	Every 6 months
	- Check pogo and pin alignment	Every 6 months
	- Clean all amp board contacts	Every 6 months
	- Check calibration	Prior to shipment or every 6 months
	- Allow to run 4 to 6 hours to ensure proper operation	Every 6 months
OVA	- Check particle filters	Daily in the fields
	- Check quad rings	Weekly in the field
	- Clean burner chamber	Weekly in the field
	- Check pumping system	Daily in the field
	- Remove and clean particle filters	Every 6 months
	- Clean or change packing gland and quad rings	Every 6 months
	- Additional maintenance according to manufacturer's instructions	Every 6 months
0_2/explosimeter	- Charge for 16 hours when not in use	Weekly
	- Run the unit 8 to 10 hours and charge 24 to 36 hours	Monthly
	- Check operation of O_2 sensor	Monthly
	- Calibrate lower explosive limit sensor and O_2 sensor	Every 6 months
pH/conductivity meter	- Calibrate meter	Prior to shipment or every 6 months, plus daily in the field
	- Change battery	As needed
	- Replace electrode storage solution	Upon return from field

Key:

OVA = Organic vapor analyzer.

Table 2-23

ROUTINE LABORATORY INSTRUMENT MAINTENANCE

Instrument	Operation	Frequency
AAS-graphite furnace	- Replace graphite tube	Daily or as needed
	- Clean windows and lenses	Daily or as needed
	- Change injection tubing	As needed
ICP	- Change nebulizer tips	As needed
	- Change pump tubing	Daily or as needed
	- Change injector tips and torches	As needed
GC and HPLC	- Change septum	As needed
	- Change injection port liner	As needed
	- Change column	As needed
	- Bake detectors	As needed
	- Check carrier gas	Daily
	- Change carrier gas	As needed
MS	- Clean source	As needed
Purge-and-trap unit	- Change trap	As needed
	- Steam clean lines	As needed
	- Refurbish	Annually
	- Run cleanout blank	As needed
Infrared spectrometer	- Clean cells	As needed
	- Change dessicant	As needed
Ion chromatograph	- Change column	Every 6 months
TOC analyzer	- Change septum	As needed
	- Change quartz wool	Daily
HPLC	- Change column	As needed
	- Change guard column frit	Weekly
Balances	- Calibrate by manufacturer	Annually
	- Check with Class S weights	Daily or before use
Refrigerators	- Check temperature	Daily
Ovens	- Check temperature	When used
Autoanalyzer	- Change tubing	As needed

Table 2-23

ROUTINE LABORATORY INSTRUMENT MAINTENANCE

Instrument	Operation	Frequency
TOX analyzer	- Change pyrolysis tube	As needed
	- Change electrolyte	As needed
	- Change Agar bridge	As needed
	- Clean electrodes	As needed
	- Change reference solutions	As needed
Spectrophotometer	- Clean cells	As needed
	- Replace lamp	As needed
Calorimeter	- Change deionized water	Daily
	- Change belt	As needed
	- Clean bomb (honed out when pitted)	As needed
pH meter	- Clean electrodes	As needed
	- Change electrode solutions	As needed
Conductivity meter	- Clean cell	As needed
	- New cell constant	Annually
Turbidimeter	- Clean cells	As needed
	- Maintain charge	As needed
Specific ion electrodes	- Change electrode solutions	As needed
	- Clean electrode	As needed
Dissolved oxygen meter	- Change membrane	As needed
Flash point	- Change gas	As needed
	- Change stir belt	As needed

Key:

AAS = Atomic absorption spectroscopy.
GC/MS = Gas chromatography/mass spectrometry.
HPLC = High-performance liquid chromatography.
ICP = Inductively coupled argon plasma spectrometry.
PCB = Polychlorinated biphenyl.
TOC = Total organic carbon.
TOX = Total organic halogen.

Table 2-24

LIST OF TYPICAL FIELD MONITORING EQUIPMENT

•	MSA 260 O_2 Explosimeter
•	HNu PI-101 Photoionization Analyzer
•	OVA Foxboro (128)
•	Dissolved Oxygen Meter
•	Thermometer
•	pH/Conductivity Meter (portable)
•	Automatic Sampler

Note: Calibrated, maintained, and operated according to manufacturer's specifications and all quality control protocol within the appropriate methodology. Both lamps (10.2 ev, 11.7 ev) will be used with the HNu photoionizer. Isobutylene will be used as the calibration gas.

Key:

MSA = Mine safety apparatus.
OVA = Organic vapor analyzer.

Table 2-25

ASC INSTRUMENTATION LIST

- Hewlett Packard (HP) 5995C GC/MS with dual (packed/capillary) column capability. Purchase date: 1985.
- Five HP5970 GC/MSs for capillary column operation, each equipped with a jet separator for packed columns. Purchase dates: 1985 (1), 1986 (1), 1987 (2), and 1989 (1).
- Five HP1000 computers, one with RTE-6 and four with a Series operating system; equipped with Aquarius software for control and data acquisition from the six GC/MS systems listed above. Purchase and lease dates: 1985 (1), 1986 (1), 1987 (1), 1990 (1), and 1991 (1).
- Two HP Unix Operating Systems for GC/MS. Purchase date: 1994.
- Five Tekmar LSC-2 liquid sample concentrators for VOA. Purchase dates: 1984 (1), 1985 (1), 1986 (2), and 1987 (1).
- Two Tekmar Model 4200 automatic heated sampler modules for volatile soil analysis. Purchase dates: 1985 (1) and 1988 (1).
- Eight Tekmar LSC-2000 liquid sample concentrators for VOA. Purchase dates: 1989 (3), 1990 (2), and 1991 (3).
- Eight Tekmar ALS-2016 automatic samplers for volatile organic water and soil analysis. Purchase dates: 1989 (3), 1990 (2), and 1991 (3).
- Two Tekmar Model 5010 thermal desorbers for desorption of volatile components from air trap tubes. Purchase dates: 1987 (1) and 1988 (1).
- SUMMA Canister cleaning apparatus (1) and autosampler rack. Purchase date: 1992.
- Perkin-Elmer (PE) Nelson data system with ACCESS CHROM software for VAX system computer. Purchase date: 1991.
- One 01 Analytical Purge-and-Trap unit, including Model 4551 vial autosampler and Model 4560 sample concentrator. Purchase date: 1994.
- Two Dynatech Precision PTA 30 w/s Purge-and-Trap autosamplers. Purchase Date: 1992.
- One Nutech Model 3550A Air System for Automated Method T014 analysis. Purchase Date: 1994.
- Three HP Series 1050 high-performance liquid chromatographs with programmable fluorescence and variable ultraviolet detector. Purchase and lease date: 1990.
- One Nutech Autosampler for air canisters. Purchase date: 1994.
- Seven Varian Model 3400 GCs with dual electron capture detectors and Varian 4270 computing integrators. Lease dates: 1989 (5) and 1990 (2).
- Varian Model 3600 GC equipped with Hall and photoionization detectors. Purchase date: 1991.
- Varian Model 3700 GC with flame ionization, thermoionic, Hall, and electron capture detectors. Purchase date: 1980.
- Six Varian Vista 6000 GCs with electron capture and flame photometric, photoionization, flame ionization, and Hall detectors and capillary capability. Purchase dates: 1984 (1), 1985 (1), 1986 (2), 1987 (1), and 1994 (1).

Table 2-25

ASC INSTRUMENTATION LIST

- Three HP5890 GCs equipped with electron capture and flame ionization detectors. Purchase dates: 1985 (1) and 1989 (2).
- HP5890 Series II GC with dual electron capture detectors and dual tower autoinjector. Purchase date: 1991 (1), 1993 (1).
- Four Varian DS654 data systems for processing data from up to eight GC detectors. Purchase dates: 1986 (1), 1987 (1), and 1990 (2).
- Whatmex Model 75-34NA hydrogen generator. Purchase date: 1994 (1).
- Two Varian 4270 computing integrators. Purchase and lease dates: 1985 through 1990.
- Two Spectra-Physics (SP) 4100 and SP4270 computing integrators. Purchase dates: 1980 and 1984.
- Three SP4290 integrators. Purchase and lease dates: 1987 through 1990.
- Two ABC Laboratories Model 601 gel permeation (GPC)/autoevaporation/concentration unit with ultraviolet detector. Purchase date: 1991.
- Jobin Yvon 50P ICP, computer-controlled, high-speed, high-resolution simultaneous polychromator with autosampler. Purchase date: 1990.
- PE Optima XL ICP. Purchase date: 1994.
- PE4100 ZL Zeeman Atomic Absorption Sepctrophotometer (AAS) with Atomizer, background correction system, and autosampler. Purchase date: 1993 (1).
- Two PE 5100 Zeeman fully automated AASs with furnace atomizers, Zeeman background correction systems, and autosamplers. Purchase date: 1991.
- PE 2380 AAS, configures for cold vapor mercury analysis. Purchase date: 1989.
- Dionex 2000i ion chromatograph with conductivity detector for anion analysis, with integrating recorder. Purchase date: 1987.
- Milton Roy Spectronic 601 spectrophotometer. Purchase date: 1990.
- MCI (COSA) TOX-10 total organic halogen (TOH) analyzer. Purchase date: 1985.
- HF Scientific turbidity meter. Purchase date: 1992.
- Dohrmann DC-85 TOC analyzer. Purchase date: 1985.
- Dohrmann DC-80 low-level reaction module. Purchase date: 1991.
- PE Model 1650 FT-IR spectrophotometer using a helium laser beam as a light source. Unit includes 16K of memory, a diffuse reflectance accessory Epson printer, and KBr press. Purchase date: 1990.
- Lachat QuickChem AE automated analyzer with random access sampler, optical dilution module, and heat block. System uses an IBM PS/2 computer and Okidata printer for system and data management. Purchase date: 1990.
- Parr Model 1241 adiabatic oxygen bomb calorimeter for fuel value analysis. Purchase date: 1985.

Table 2-25

ASC INSTRUMENTATION LIST

- Kjeltec Auto 1030 analyzer for ammonia and TKN by automated distillation and colorimetric determination of titration endpoint. Purchase date: 1987.
- Cahn Model 4100 electrobalance. Purchase date: 1992.
- Four Denver S400 balances, capacity 400g.
- Denver XE400 balance, capacity 400g.
- Mettler PM300 balance, capacity 300g.
- Mettler BB240 balance, capacity 240g.
- Mettler H10T analytical balance, capacity 160g, graduation 0.1 mg.
- Mettler AC88 analytical balance, capacity 80g, graduation 1 mg.
- HG Scientific Turbidity Meter.
- Accumet pH Meter 925 (Fisher).
- YSI Model 54A Oxygen Meter.
- YSI Model 31 Conductivity Bridge.
- Precision Scientific, Model P/M, Pensky-Martens closed-cup flash point tester.
- Zeiss phase-contrast microscopes. Purchase date: 1983 (3).
- Reichert-Jung phase contrast microscopes. Purchase date: 1988 (2).
- National Model NLW-66 glassware washer. Purchase date: 1994 (1).
- Bellingham and Stanley Abbé refractometer. Purchase date: 1989 (1).
- Nikon phase-contrast microscopes. Purchase date: 1988 (2).
- Nikon polarized light microscopes for bulk asbestos. Purchase date: 1988 (2) and 1990 (1)
- Nikon polarized light microscopes. Purchase date: 1987 (3).
- Petrolab sulfur analyzer. Purchase date: 1993 (1).
- Midi Cyanide Distillation System, Model 110-1012. Purchase date: 1994 (1).
- Bŭrchi 316 Distillation Unit. Purchase date: 1994 (1)
- Organomation ROT-X-TRACT-HP 8-Position extractor with Soxhlet Extractor Glassware. Purchase date: 1994 (1).

Table 2-26

SUMMARY OF CALIBRATION PROCEDURES

Analytical Group	Number of Standards		Frequency		Curve Type	Acceptance Criteria[b]	
	Init.	Cont.	Init.	Cont.		Init.	Cont.
GC/MS Volatiles	5	1	Annually[a]	12 hours	Linear	Table 2-29	Table 2-29, midlevel
GC/MS Semivolatiles	5	1	Annually[a]	12 hours	Linear	Table 2-29	Table 2-29, midlevel
GC Pesticides/PCB	5	1	As needed	10 samples	Linear	20% RSD or r > 0.995[c]	15% D midlevel
GC-Purgeable halocarbons/ aromatics	5	1	As needed	10 samples	Linear	20% RSD	15% D midlevel
GC-Herbicides -Organophosphorus pesticides -Purgeable nonhalogenated microextractables	5	1	As needed	10 samples	Linear	20% RSD or r > 0.995[c]	15% D midlevel
HPLC	5	1	As needed	Daily	Linear	20% RSD	15% D midlevel
Metals-ICP	2	1	Daily	10 samples	Linear	90-110%R	90-110%R midlevel
-AAS	5	1	Daily	10 samples	Linear	90-110%R	90-110%R midlevel
-Mercury	7	1	Daily	10 samples	Linear	80-120%R	80-120%R midlevel
Spectrophotometers	5	1	6 months[a]	Daily	Linear	r > 0.995[c]	90-110%R midlevel
Infrared spectrometer	6	1	6 months[a]	Daily	Linear	r > 0.995[c]	85-115%R midlevel
Ion chromatograph	5	1	As needed	Daily	Linear	90-110%R	90-110%R midlevel
Ion-selective electrode	3	1	Daily	10 samples	Logarithmic	r > 0.995[c]	85-1157.R midlevel
TOC analyzer	1	1	Daily	10 samples	Percent response	80-120%R	80-120%R midlevel
TOX analyzer	1	1	Daily	10 samples	Equivalency (titration)	95-105%R	95-105%R midlevel
Flash point	1	1	Each batch	—	Temperature	81 ± 1.5°C	81 ± 1.5°C

Table 2-26

SUMMARY OF CALIBRATION PROCEDURES

Analytical Group	Number of Standards		Frequency		Curve Type	Acceptance Criteria[b]	
	Init.	Cont.	Init.	Cont.		Init.	Cont.
Balances	4[d]	2	Annually[d]	Daily	—	Balance-specific	Balance-specific
Leachate Autoanalyzer	5	1	Daily	10 samples	Linear	$r > 0.995$[c]	80-120 midlevel
pH meter	2	1	Daily	10 samples	Logarithmic	Pass tolerance test	± 0.1 s.u. of true value
Conductivity meter	1	1	Daily	10 samples	Logarithmic	91-115%R	—
Turbidimeter	3	1	Daily	10 samples	—	$r > 0.990$[c]	—
Dissolved oxygen meter	1	—	Daily	—	—	Winkler titration	—

[a] All curves are updated on an as-needed basis.

[b] Acceptance criteria are applied to all compounds of interest and may be waived for compounds not detected in the samples but still having response sufficient to quantitation limit.

[c] Correlation coefficient (r) criterion is a minimum and depends on the type of analysis.

[d] Performed by service representative.

Key:

AAS = Atomic absorption spectroscopy.
Cont. = Continuing calibration.
%D = Percent difference from average calibration factor.
GC/MS = Gas chromatography/mass spectrometry.
HPLC = High-performance liquid chromatography.
ICP = Inductively coupled argon plasma spectrometry.
Init. = Initial calibration.
PCB = Polychlorinated biphenyl.
%R = Percent recovery of standard.
%RSD = Percent relative standard deviation of curve calibration factors.
TOC = Total organic carbon.
TOX = Total organic halogen.

Table 2-27

BFB KEY ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
50	15% to 40% of mass 95
75	30% to 60% of mass 95
95	Base peak, 100% relative abundance
96	5% to 9% of mass 95
173	Less than 2% of mass 174
174	Greater than 50% of mass 95
175	5% to 9% of mass 174
176	Greater than 95% but less than 101% of mass 174
177	5% to 9% of mass 176

Key:

BFB = Bromofluorobenzene.

Source: United States Environmental Protection Agency (EPA) SW846 Method 8240A, Revision 1, July 1992.

Table 2-28

DFTPP KEY ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
51	30% to 60% of mass 198
68	Less than 2% of mass 69
70	Less than 2% of mass 69
127	40% to 60% of mass 198
197	Less than 1% of mass 198
198	Base peak, 100% relative abundance
199	5% to 9% of mass 198
275	10% to 30% of mass 198
365	Less than 1% of mass 198
441	Present but less than mass 443
442	<40% of mass 198
443	17% to 23% of mass 442

Key:

DFTPP = Decafluorotriphenylphosphine.

Source: United States Environmental Protection Agency (EPA) SW846 Method 8270A, Revision 1, July 1992.

Table 2-29

GC/MS ACCEPTANCE CRITERIA

System Performance Check Compounds	Minimum Response Factor
GC/MS VOLATILE ANALYSIS	
Chloromethane	0.300
1,1-Dichloroethane	0.300
Bromoform	0.250
1,1,2,2-Tetrachloroethane	0.300
Chlorobenzene	0.300
GC/MS SEMIVOLATILE ANALYSIS (BNA)	
N-nitroso-di-n-propylamine	0.050
Hexachlorocyclopentadiene	0.050
2,4-Dinitrophenol	0.050
4-Nitrophenol	0.050

Calibration Check Compounds	Initial Calibration % RSD[a]	Continuing Calibration %D[b]
GC/MS VOLATILE ANALYSIS		
1,1-Dichloroethene	30%	25%
Chloroform	30%	25%
1,2-Dichloropropane	30%	25%
Toluene	30%	25%
Ethylbenzene	30%	25%
Vinyl chloride	30%	25%
GC/MS SEMIVOLATILE ANALYSIS		
Acenaphthene	30%	30%
1,4-Dichlorobenzene	30%	30%
Hexachlorobutadiene	30%	30%
N-nitroso-di-n-phenylamine	30%	30%
Di-n-octylphthalate	30%	30%
Fluoranthene	30%	30%
Benzo(a)pyrene	30%	30%
4-Chloro-3-methyl phenol	30%	30%
2,4-Dichlorophenol	30%	30%
2-Nitrophenol	30%	30%
Phenol	30%	30%
Pentachlorophenol	30%	30%
2,4,6-Trichlorophenol	30%	30%

[a] Relative standard deviation of curve relative response factors.
[b] Percent difference from average relative response factors.

Key:

GC/MS = Gas Chromatography/Mass Spectrometry.
BNA = Base/neutral and acid extractable organic compounds.
RSD = Relative standard deviation.

Source: United States Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Wastes," SW-846, Third Edition, September 1986, Update I, July 1992.

Table 2-30

REPORTING OF MEASUREMENT DATA CALCULATIONS

Instrument	Methods	Calculation
ORGANICS		
GC/MS	VOCs and BNA	Readout
GC	VOCs and pesticides/ PCBs	Readout Readout calculated for multiple peaks
HPLC	PAH	Readout
METALS		
ICP/Furnace	Water Soil	Readout Readout corrected for sample weight
GENERAL ANALYTICAL		
Lachat (ion chromatograph)	Cyanide, chloride, nitrate, nitrite, sulfate	Readout that includes dilution factor
Spectrophotometer	Hexavalent chromium, total and ortho phosphorus, phenol	Readout corrected for sample volume, dilution factor, etc.
Infrared spectrophotometer	TRPHs	Readout that includes dilution factor
Ion-selective electrode	Fluoride	Curve value multiplied by dilution factor
TOC analyzers	Total organic carbon	Readout multiplied by dilution factor
TOX analyzer	Total organic halide	Readout

Key:

BNA = Base/neutral and acid extractable organic compounds.
GC/MS = Gas chromatograph/mass spectrometer.
HPLC = High-performance liquid chromatograph.
ICP = Inductively coupled argon plasma spectrometer.
PAH = Polynuclear aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
TOC = Total organic carbon.
TOX = Total organic halogen.
TRPHs = Total recoverable petroleum hydrocarbons.
VOC = Volatile organic compound.

Administrative Procedures

Archiving All-In-One Document
Administration of Site Work
EQTRP Equipment Program
Computer Documentation
Maintaining Project Files
Conflict-of-Interest Policy & Procedures
Confidentiality Business/Information Policy

General Technical Procedures

Field Investigation Equipment Calibration, Operation, and Maintenance
Project Management Procedures
High-Volume Air Sampling
Aerial Photograph Interpretation
Surface Water Sampling
Writing Field Investigation Reports
Technical/Peer Review
Emergency Response
Management of Investigation-Derived Waste
Radiological Site Inspection/Investigation
Hazard Ranking System (HRS) Procedures
Sample Packaging and Shipping
Drum Sampling
Technical Software and Computer Program for Use on IBM PC

Design Procedures

Engineering Design Control
Design Analysis Documentation
Design Review

Chemical Analysis Procedures

Field Analytical Support Project Methods for Multimatrix Chemical Analysis

Health and Safety Procedures

Training Program
Site Entry
Personnel Decontamination
Health and Safety during Drill Rig Operations
Heat Stress Monitoring
Confined Space Entry
Medical Monitoring Policy

Geotechnical Procedures

Logging and Describing Soil and Rock Samples
Surface Geophysical Techniques
Electromagnetic Conductivity Surveys
Magnetometer Surveys
Seismic Reflection and Refraction Surveys
Ground-Penetrating Radar Surveys
Monitoring-Well Installation
Borehole Sampling
Groundwater Sampling
Geologic Logging
Application of Borehole Geophysical Techniques
Soil Sampling
Well Development
Slug Tests
Groundwater Well Sampling
Water-Level Measurement
Controlled Pumping Test
Vertical Electrical Soundings
VES Computer Program
Soil-Gas Monitoring Surveys
Aquifer Testing
Drilling Methods and Techniques
Stream Monitoring
Geostatistics

Figure 2-1: SELECTED E & E STANDARD OPERATING PROCEDURES FOR FIELD PROCEDURES

PACKAGE RECEIPT LOG

ITEM NO.	CLIENT NAME and/or JOB NO.	DATE RECEIVED	RECEIVED FROM (e.g., carrier)	CARRIER I.D. NO. or INITIALS	SHIPPING INVOICE NO. (Place in file)	PACKAGE DESCRIPTION (e.g., 1 cooler, 1 jar, etc.)	PACKAGE RECEIVED BY (Custodian's Initials)	PACKAGE SECURED		MANNER PACKAGE SECURED				PACKAGE CONTENTS RECEIVED COLD			PACKAGE DISPOSITION					SAMPLES LOGGED-IN BY (Custodian's Initials)
										Custody Seal	Fiberglass Tape	Other	Deficiencies (Explain and footnote if necessary. File deficiency report.)				SAMPLE LOGGED		TEMPORARY SECURE STORAGE AREA	ASC Custody Seal Affixed		
								YES	NO					YES	NO	NA	YES	NO		YES	NO	

EXPLANATIONS:

308019

Figure 2-2 E & E PACKAGE RECEIPT LOG

E & E PACKAGE RECEIPT #:__________

NUMBER OF COOLERS:__________**

DATE RECEIVED:__________

A. PRELIMINARY EXAMINATION PHASF:

E & E PROJECT #:__________

PROJECT/SITE NAME:__________

Date cooler(s) opened: __________ C-O-C Numbers:__________

Opened by (print):__________(sign):__________

(Circle One)

1. Did cooler(s) come with a air bill or packing slip?__________ YES NO

If YES, please enter name of carrier and air bill #:__________

2. Did cooler(s) have custody seals on the outside?__________ YES NO

If YES, how many and where:__________

Were custody seals dated and signed? If YES, seal date:__________, name on seal:__________

3. Were custody seals unbroken and intact on receipt?__________ YES NO*

4. Were C-O-C forms sealed in plastic bag and taped inside to the lid?__________ YES NO

5. Was the project identifiable from the C-O-C form? If YES, enter the project name and number above.____ YES NO

6. Have designated person initial here to acknowledge receipt of cooler:__________ date:__________

B. UNPACKING PHASE

7. Describe type of packing used in cooler:__________

8. If required, was enough ice used?____ Type of ice: WET DRY __________ YES NO*

9. Was a temperature blank used? If YES, temperature =__________°C__________ YES NO

10. Were all containers sealed in separate plastic bags?__________ YES NO

11. Did all containers arrive unbroken and in good condition?__________ YES NO*

C. LOGIN PHASE:

Date samples were logged in to the Laboratory Management Information System (LABMIS):__________

Samples logged in by (print)__________(sign)__________

12. Were all container labels complete (e.g. ID,date,time,preservative,etc.)?__________ YES NO*

13. Were C-O-C forms filled out properly in ink and signed?__________ YES NO

14. Did the containers listed on C-O-C form(s) agree with the containers received?__________ YES NO*

15. Were the correct containers used for the tests indicated?__________ YES NO*

16. If required, were the correct preservatives listed on the sample label?__________ YES NO*

17. Was a sufficient amount of sample sent for the tests indicated?__________ YES NO*

18. Were all volatile samples received without bubbles?__________ YES NO*

* If NO, notify project manager and a deficiency/descrepency form must be filled out detailing the problems.

** If all coolers are not received in the same condition, then a separate form for each cooler must be filled out.

Figure 2-3 ECOLOGY AND ENVIRONMENT COOLER RECEIPT FORM

Ecology & Environment, Inc.

DESTRUCTION AUTHORIZATION

No: __________

TO: Custodian

FROM: Laboratory Manager ____________________
(Authorized Signature)

DATE: ______________

RE: Sample I.D. No. ______________________________

Job No. ______________________________

You are hereby authorized to release the samples for destruction. Prior to release, you must do the following:

- o Verify that the sample released corresponds to the identification numbers above.
- o Once the sample destruction is verified, on the Sample Receipt Log, place a check mark under the sample disposition column in the destruction category and indicate the date destruction took place.
- o Sign and file this form in the job file.

☐ Sanitary Sever Sample No.: ______________________________

____

____

☐ Sanitary Landfill Sample No.: ______________________________

____

____

☐ Approved Disposal Facility (See part 2 attached)

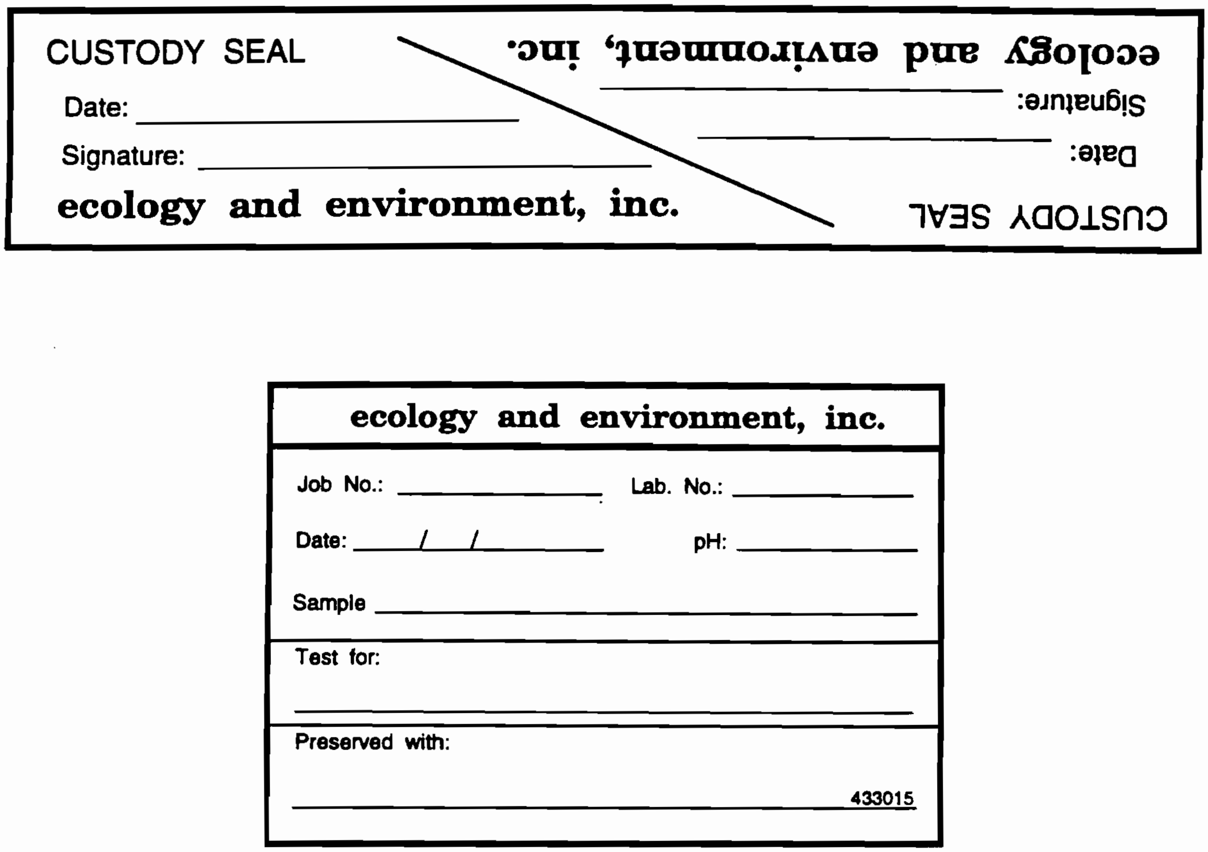
____
(Custodian Signature)

Date: ____________________

39710

Figure 2-4 DESTRUCTION AUTHORIZATION FORM

QAPP\D307961.CDR



CUSTODY SEAL

Date: ______________________

Signature: ______________________

ecology and environment, inc.

CUSTODY SEAL

Date: ______________________

Signature: ______________________

ecology and environment, inc.

ecology and environment, inc.

Job No.: ____________	Lab. No.: ____________
Date: ___/___/_______	pH: ____________

Sample ______________________________

Test for:

____

Preserved with:

______________________________ 433015

Figure 2-5 SAMPLE CUSTODY SEAL/LABEL

ecology and environment, inc.
368 PLEASANTVIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716-684-8060

CHAIN-OF-CUSTODY

Page ____ of ____

Project No.:	Project Name:	Project Manager:
Samplers: (Signatures)		Field Team Leader:

STATION NUMBER	DATE	TIME	SAMPLE TYPE			SAMPLE INFORMATION	STATION LOCATION	NUMBER OF CON-TAINERS	REMARKS
			COMP	GRAB	AIR	EXPECTED COMPOUNDS			

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Ship Via	
Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Relinquished By: (Signature)	Date/Time	Received By: (Signature)	BL/Airbill Number:	Date
Relinquished By: (Signature)	Date/Time	Received for Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time	Received for Laboratory By: (Signature)		

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files
*See CONCENTRATION RANGE on back of form.

Figure 2-6 SAMPLE CHAIN-OF-CUSTODY FORM

3079_CC.PM5

3 Assessment/Oversight

E & E's assessment and oversight procedures will be implemented in accordance with E & E's corporate Quality Management Plan. The Quality Management Plan outlines general roles and responsibilities for the project team, and the details of the procedures are documented in E & E internal SOPs. These procedures will be evaluated and adapted, if necessary, to ensure all contractual obligations are met and any EPA regional guidance is incorporated. 3Specific assessment procedures required to ensure project DQOs are met will be incorporated into the site-specific QAPjP. Brief descriptions of E & E's procedures are provided in this section.

3.1 Assessment and Response Actions

E & E's assessment activities include: peer review, management systems review (e.g., office audits), technical system audits (e.g., laboratory and field), and performance evaluation. Procedures for assessment and audit of data quality are described in Section 4 of this MQAP. E & E's approach to implementing a corrective action response program for both field and laboratory situations also is provided below.

3.1.1 Peer Review

E & E implements peer review for all project deliverables as outlined in E & E SOPs for environmental investigations and engineering design. Project deliverables include work plans, QAPjPs, draft and final reports, and technical memoranda. The peer review process provides for a critical evaluation of the deliverable by an individual or team to determine whether the deliverable will meet the established criteria, DQOs, technical standards, and contractual obligations. The project manager will assign peer reviewers, depending on the nature and complexity of the project, when the publications schedule is established. The publications staff will be responsible for ensuring all peer reviewers participate in the review process and approve all final deliverables. For technical memoranda and other project documents, the project manager will be responsible for obtaining principal review and approval.

3.1.2 Management Systems Review

E & E has established internal audit guidelines for all regional and satellite offices. The guidelines include comprehensive checklists as follows:

- Office Audit Checklist for general office procedures, timekeeping, expense reports, purchasing, cash on hand, administration, project files, logbooks, and management information system.
- Health and Safety Office Audit Checklist for files, site safety plans, personnel proficiency, and library of references.
- Inventory Control/Equipment Audit Checklist for inventory control, personal field clothing, personal protective equipment, survey and monitoring equipment, sampling equipment, vehicles, and warehouse.
- Field Audit Checklist for scheduling/interview, safety, sampling plan, site/sampling inspection, field measurements, decontamination, COC procedures, sample packaging and shipping, IDW, site administration, and oversight role.

The project manager is responsible for ensuring internal office and field audits are performed with sufficient frequency so that all project and office activities conform with contract requirements and stated procedures and protocol. The audit team and audit team leader will be established independently of the office through cooperation with the corporate QA director. The conduct and general findings of internal audits will be included in the QA section of the monthly report. Checklists and detailed findings will be maintained in the project file. The project manager will be responsible for responding to all findings so that corrective action can be initiated.

3.1.3 Technical Systems Audits and Performance Evaluation

Performance and systems audits are an integral part of the overall QA program at E & E. The following discussion describes the types of audits conducted, the frequency of these audits, and the personnel responsible for conducting the audits.

Field Audits

The type and number of field audits for a specific project are documented in the site-specific QAPjP. Field and laboratory audits often are performed in conjunction to evaluate the overall performance of the QA/QC aspects of the project. The field audit is conducted using the field logbook audit form shown in Figure 3-1 and the field audit checklist shown in Figure 3-2.

Laboratory Audits

Systems. Internal audits of laboratory functional groups take place at approximately six-week intervals. A designated QA chemist will audit a laboratory by reviewing the analytical logbooks, control charts, and job files for the period since the previous audit and by preparing a report for laboratory management listing discrepancies from acceptable procedures. Checklists used for internal laboratory audits are provided in Figure 3-3. Follow-up action by management may include sample reanalysis, an amended report to a client (if necessary), and additional training of personnel.

Internal laboratory audits are documented in an internal memorandum to the laboratory director. The laboratory QA coordinator also maintains a file of the completed checklists. All corrective actions for the internal audits are documented on Item Action Reports (IARs) as described in Section 3.2.

External systems audits occur at an approximate frequency of once every two months and are performed by certifying agencies such as EPA, various state agencies such as NYSDOH, the American Industrial Hygiene Association, the United States Army Corps of Engineers, the United States Air Force, the United States Navy, and major industrial clients. These external audits are specific to the needs of the individual agency or client; however, all of the audits include reviews of analytical capabilities and procedures, COC procedures, documentation, QA/QC, and laboratory organization. External certifications are listed in Table 3-1.

Performance. All of the external laboratory audits discussed above include analysis of blind samples for performance evaluation. Performance evaluation samples are submitted quarterly to E & E's ASC for analysis by NYSDOH and by an industrial client. In addition, EPA submits blind samples for CLP organic analysis every quarter and its water pollution study for analysis every six months. The frequency and comprehensive nature of the external systems/performance audits provide a vital and objective element to E & E's QA program.

3.1.4 Corrective Action

In conjunction with the QA officers and QA coordinators, the project manager is responsible for initiating corrective action and implementing it in the field, and the ASC director is responsible for implementing it in the laboratory. It is their combined responsibility to see that all sampling and analytical procedures are followed as specified and that the data generated meet the prescribed acceptance criteria. Specific corrective actions necessary to ensure that DQOs are met for critical items will be clearly documented in the site-specific QAPjP.

Field Situations

The need for corrective action in the field may be determined by field audits or by more direct means such as equipment malfunction. Once a problem has been identified, it may be addressed immediately or an audit report may serve as notification to project management staff that corrective action is necessary. Immediate corrective actions taken in the field will be documented in the project logbook.

After a corrective action has been implemented, its effectiveness will be verified. If the action does not resolve the problem, appropriate personnel will be assigned to investigate and effectively remediate the problem. Table 3-2 provides corrective actions for potential out-of-control field situations. Corrective actions recommended by the client will be addressed in a timely manner.

Laboratory Situations

The need for corrective action as a result of laboratory audits will be initiated by the ASC QA coordinator or ASC director in consultation with the ASC QA officer. Table 3-3 lists corrective actions for laboratory situations. Corrective actions may include, but are not limited to:

- Reanalyzing samples, if holding times permit;
- Correcting laboratory procedures;
- Recalibrating instruments using freshly prepared standards;

- Replacing solvents or other reagents that give unacceptable blank values;
- Training additional laboratory personnel in correct sample preparation and analysis procedures; and
- Accepting data with an acknowledged level of uncertainty.

Whenever corrective action is deemed necessary, the ASC director will ensure that the following steps are taken:

- The problem is defined;
- The cause of the problem is investigated and determined;
- Appropriate corrective action is determined; and
- Corrective action is implemented and its effectiveness verified by the ASC director or QA coordinator.

Laboratory supervisors are responsible for reporting events that may require corrective action by filing a QA/QC discrepancy form (see Figure 3-4) with the job file, ASC director, and QA coordinator. The ASC director and QA coordinator can then agree on the corrective action proposed or determine other action.

Long-Term Corrective Actions

Long-term corrective actions are developed and implemented under the direction of the QA director or laboratory director. Long-term corrective action refers to overall changes in the QA program or project made in response to any problems found after examination of field and/or laboratory QC samples, laboratory control charts, field and/or laboratory audits, and/or data validation. Long-term corrective actions target the overall system performance to help alleviate continual quality problems with instrumentation or sample analysis or to prevent recurrence of one-time incidences. When long-term corrective actions are implemented, the project manager or QA officer will evaluate the impact on previously generated data and determine whether appropriate qualification should be added to previous data sets.

Documentation of laboratory corrective actions are tracked on a continuing QA form (see Figure 3-5). These forms aid in initiating, investigating, and remediating continual or acute QC concerns. With the ASC QA coordinator as intermediary, the form is issued with a resolution provided by the addressee. Items are tracked to determine whether long-term corrective actions are effective in improving the ASC QA program.

3.2 Reports to Management

The specific contract-required reports and deliverables may include the following:

- **Audit Reports.** Audit reports are prepared by the audit team leader immediately after completion of the audit. The report will list findings and recommendations and will be provided to the project manager, QA director, and ASC QA officer. Reports will also include detailed checklists as described in Section 3.1.
- **Data Validation Reports.** Data validation reports will be completed by the data reviewer and provided to the project manager and ASC QA officer. Impacts on the usability of the data will be tracked by adding qualifiers to individual data points as described in Section 4.
- **Project Status Reports.** Project status reports are completed by the project manager to document the overall assessment of the project during project closeout or at critical points throughout the project. The reports are used by team members to improve the overall quality of performance on projects.

Upon completion of a project sampling effort, analytical and QC data will be included in a comprehensive report that summarizes the work and provides a data evaluation. A discussion of the validity of the results in the context of QA/QC procedures and a summation of all QA/QC activities will be made.

All raw data, control charts, COC, logbooks, and instrument calibration sample-related information will be stored at the ASC. The data will be stored at the ASC for one year and then transferred to a secure warehouse where they will be maintained for five years.

Serious analytical problems will be reported immediately to the client. Time and type of corrected action (if needed) will depend on the severity of the problem and relative overall project importance. Corrective actions may include altering procedures in the field, conducting an audit, or modifying laboratory protocol.

In addition to the laboratory report narrative, specialized QA reports that include any contractual requirements also may be provided to the client. QA reports can be submitted with the analytical data on a monthly basis or at the conclusion of the project. Specialized

QA reports must be specified in the site-specific MQAP and specifically included in the analytical costs. Reports may include the following:

- Summary of field QC sample results;
- Summary of "out-of-control" events and appropriate corrective actions;
- Results of any split samples sent to a referee laboratory;
- Summary of performance evaluation sample results;
- Control charts for analytes of interest; and
- Summary of all analytical data.

Laboratory QA Documentation

The ASC maintains a rigorous documentation system to ensure that all data are compared against established QC criteria. Specific procedures for each laboratory are documented in SOPs approved by the ASC QA coordinator, the ASC director, and section supervisor. In general, all QC data are reviewed by the analyst and approved by the supervisor, who determines whether reanalysis is necessary and what corrective actions should be taken. An out-of-control event that is submitted for reporting must be accompanied by a QA/QC discrepancy form describing qualifications placed on the data and the corrective action taken.

The ASC QA coordinator maintains a file of all QA/QC discrepancy forms and coordinates with the ASC director to ensure that follow-up corrective action is taken. The ASC QA coordinator or designee reviews 20% of all final data reports and corrects the report if a problem is encountered.

When laboratory audits are received, items of concern are documented and acted upon by issuing an IAR to appropriate ASC supervisory personnel (see Figure 3-6). The following procedure is used for closing out audit items:

- An IAR will be delivered to the laboratory supervisor;
- The supervisor will review the action items and determine and institute necessary remediation;
- The supervisor, laboratory director, or ASC QA coordinator (and in the case of internal audits, the auditor) will verify remediation; and

- Final closing will occur when all items have been verified as to remediation and final approval is given by the ASC director or ASC QA coordinator.

Table 3-1

ASC CERTIFICATIONS AND QUALIFICATIONS

United States Air Force	Audited for analysis for IRP wastewater, solid waste, and hazardous and toxic waste.
United States Army Corps of Engineers	Approved for analysis for federal Superfund remedial design/construction projects and the Department of Defense Environmental Restoration Program.
United States Department of the Navy	Approved for analysis under the IRP. Proficiency in organics, inorganics, and general analyses.
American Industrial Hygiene Association	Accredited for general analyses.
NIOSH	Proficiency analytical testing program; metal, solvent, and airborne asbestos analysis.
California DOH Services	Certified for hazardous waste testing of inorganics, organics, and asbestos; waste extraction test.
Connecticut DOH Services	Approved environmental laboratory for potable water, wastewater, and hazardous waste testing for inorganics and organics.
FDEP and FDHRS	Certified by FDHRS for analysis of wastewater and hazardous waste pursuant to statewide environmental chemistry laboratory QA program. Approved CompQAP with FDEP.
Kansas Department of Health and Environment	Certified for inorganic, physical, chemical, and organic chemical analysis and hazardous material characterization.
New Jersey Department of Environmental Protection	Certified for metals, general inorganics, and partial organics in wastewater.
New York State DOH	State CLP certification for organic and inorganic analysis for state-sponsored Superfund activities.
New York State DOH	Environmental Laboratory Approval Program; certified for analysis of bulk asbestos, potable/nonpotable water, solid/hazardous waste, air and emissions, metals, organics, inorganics, and pesticides.
North Carolina Department of Environment, Health, and Resources	Certified for analysis of wastewater for inorganic parameters.
South Carolina Department of Health and Environmental Control	Certified for environmental testing.
Tennessee Department of Conservation	Approved by UST division for total petroleum hydrocarbon and benzene/toluene/xylene analysis.

Table 3-1

ASC CERTIFICATIONS AND QUALIFICATIONS

Utah Department of Health	Certified for environmental monitoring of wastewater and hazardous waste.
Washington Department of Ecology	Accredited for analysis of organic and inorganic chemical parameters.
Wisconsin Department of Natural Resources	Certified for full organics, inorganics, and General III categories.

Key:

CLP = Contract Laboratory Program.
CompQAP = Comprehensive Quality Assurance Plan.
DOH = Department of Health.
FDEP = Florida Department of Environmental Protection.
FDHRS = Florida Department of Health and Rehabilitative Services.
IRP = Installation Restoration Program.
NIOSH = National Institute of Occupational Safety and Health.
QA = Quality assurance.
UST = Underground storage tank.

Table 3-2

FIELD CORRECTIVE ACTIONS

QC Activity	Acceptance Criteria	Corrective Action
pH meter standard check	0.2 pH unit above or below standard value	Recalibrate instrument; check battery.
Specific conductance meter check	Within ±1% of standard	Recalibrate instrument; check battery.
Equipment blanks and trip blanks	≤ MDL	Review date with respect to detected contaminant concentrations; report data and blank data; reanalyze if necessary; identify problem cause and take measures to eliminate problem in the future.
Duplicate	Within precision acceptance limits specified in Table 4-2	Report data with qualifications; identify problem cause and take measures to eliminate the problem in the future.

Key:

MDL = Method detection limit.
QC = Quality control.

Table 3-3

LABORATORY CORRECTIVE ACTIONS

QC Activity	Acceptance Criteria	Corrective Action
Initial calibration	Method-defined	Reanalyze; if still unacceptable, make fresh standards and/or check instrument condition.
Continuing calibration	Method-defined	Reanalyze; if still unacceptable, prepare new initial calibration.
Method blank	<MDL	Reanalyze; if still positive, determine source of contamination, then reextract or redigest all associated samples.
Control sample	Within certified limits	Reanalyze; if still unacceptable, redo analytical batch.
Spiked sample Duplicated sample	Established control limits	None.
BFB/DFTPP use	Method-defined	Repeat; if still unacceptable, clean source.
Surrogate recovery	Method-defined	Reanalyze or reextract.

Key:

BFB = Bromofluorobenzene.
DFTPP = Decafluorotriphenyl phosphine.
MDL = Method detection limit.
QC = Quality control.

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FIELD LOGBOOK AUDIT FORM

Audit Date:

Site Name:

Auditor:

Team Members:

Quality Assurance Notice (QAN):

INITIAL INFORMATION	Yes	No	N/A	Comments
Site Name				
Location				
Client I.D.				
Date of Work				
Arrival/Departure Times				
Proposed Daily Activities				
On-going Weather				
Team Members and Duties				
Other Personnel and Affiliations				
HEALTH AND SAFETY				
Meeting Conducted				
Personnel Attending				
Levels of Protection for each Phase of Work				
Safety Equipment				
Equipment I.D. #				
Calibration				
Background Readings				
On-site Reading				
SAMPLE/DATA COLLECTION EQUIPMENT				
Types				
Serial # (I.D. #)				
Calibration				
Background Readings				
On-site Readings/Locations				

[FORMS]103
Page 1 of 3

Figure 3-1

	Yes	No	N/A	Comments
DECONTAMINATION/DISPOSAL				
Solutions Used				
Procedures for Personnel				
Procedures for Equipment				
Disposal Method for Wastes				
PHOTO DOCUMENTATION				
Camera				
Lens				
Serial #				
Film Type/Roll #				
Sequence #/Frame #				
Photographer				
Direction				
Location/Subject				
Date and Time				
SITE ACTIVITY				
Conversations/Interview with Site Representatives				
Description of Site Management Practices				
Descriptions of Wastes				
Pathways/targets				
Reconnaissance Observations				
Deviations from Approved Workplan				
Site Maps/Sketches				
Field Calculations				
Assumptions				
SAMPLES				
Matrix and Numbers				
Dates/Times Collected				
Who Collected Sample				
Locations				
Depth				
Composite/Grab				

[FORMS]1
Page 2 o

Figure 3-1

SAMPLES (Cont.)	Yes	No	N/A	Comments
Physical Descriptions	___	___	___	______________________________
Field Measurements	___	___	___	______________________________
Sample I.D. #	___	___	___	______________________________
Sampling Techniques	___	___	___	______________________________
Preservation Techniques	___	___	___	______________________________
Receipt for Samples Given	___	___	___	______________________________
Portions Offered to Site Representative	___	___	___	______________________________
Chain-of-custody (COC) Filled Out	___	___	___	______________________________
Crosscheck of Sample Inventory vs. COC	___	___	___	______________________________
GENERAL				
Each Page Signed and Dated by Team Leader	___	___	___	______________________________
Entries Recorded by Anyone Else Initialed	___	___	___	______________________________
Blank Pages/Spaces Voided	___	___	___	______________________________
Corrections Made Properly	___	___	___	______________________________
Entries with 24-Hour Clock Time Notations	___	___	___	______________________________

ADDITIONAL COMMENTS

[FORMS]103
Page 3 of 3

Figure 3-1

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FIELD AUDIT CHECKLIST

PROJECT NAME: ____________________ **PROJECT NUMBER:** ____________________

LOCATION: ____________________

____

____

E & E PERSONNEL: ____________________

PRESAMPLING PROCEDURES

1. Are routine/special sampling requirements discussed and documented in the logbook? ________

Comments: ____________________

____

____

2. Are personnel assigned as:

a. Sample custodian (Name) ____________________

b. Team leader (Name) ____________________

c. Sampler (Name) ____________________

c. Sampler (Name) ____________________

d. H & S (Name) ____________________

3. Does the team member responsible for the following activities know how to complete them:

a. Sample documentation and inventory ________

b. Decontamination procedures ________

c. Photodocumentation ________

d. Chain-of-custody ________

e. Sample packaging and shipping ________

f. Site generated wastes ________

Comments: ____________________

____

____

____

4. Are past problems reviewed, discussed, and solutions identified and document in the logbook? ________

Comments: ____________________

____

____

Figure 3-2 FIELD AUDIT CHECKLIST

5. Are site safety concerns covered during the meeting? ________ Comments: ____________________

SAMPLING PROCEDURES AND DOCUMENTATION

1. Is a copy of the workplan/sampling plan available so the team members understand the procedures required for sampling and sample collection? ________ Comments: ____________________

2. Do team members know what to do if procedures can not be used as identified in the sampling plan?

________ Comments: ____________________

3. Have changes in the sampling procedures been noted in the logbook? ________ Comments: ________

4. Does the team have the necessary equipment for collecting appropriate samples? ________ Comments:

5. Does the team record appropriate information at the time that the sample is collected? (i.e., sample interval, sample type, composite or grab sample, etc.) ________ Comments: ____________________

6. Are sample jars kept clean during transfoer of sample material? ________ Comments: ________

7. Are samples preserved as indicated in the sampling plan? ________ Comments: ____________________

Figure 3-2 FIELD AUDIT CHECKLIST (Cont.)

8. Are there any visible signs of contamination evident on the sampling equipment? ________ Comments:

CHAIN-OF-CUSTODY

1. Are samples kept in a controlled area (i.e., in a locked location or with a team member) at all times?
________ Comments:

2. Is all of the sample information (sample type, date, time, etc.) noted on the chain-of-custody?
________ Comments:

3. Have all samplers signed the chain-of-custody form? ________ Comments:

4. Is the Federal Express air bill number listed on the chain-of-custody form? ________ Comments:

5. Has a separate team member been assigned to cross check the sample inventory and the chain-of-custody prior to shipment? ________ Comments:

6. Is the cross check procedure noted in the logbook? ________ Comments:

7. Are sample numbers and Federal Express bill numbers listed in the sample log or the site logbook?
________ Comments:

8. Were the labels, logbooks, and chain-of-custody form cross checked? ________ Comments:

[FORMS]/98/4
3 of 5

Figure 3-2 FIELD AUDIT CHECKLIST (Cont.)

QUALITY CONTROL SAMPLES

1. What QC samples are required (as per sampling plan)? ________ Comments: ________

2. What frequency must QC samples be collected? ________

3. Are trip blanks being used? ________ Comments: ________

4. Which laboratory provided trip blanks? ________

5. Are appropirate materials used to generate QC samples? ________ Comments: ________

SITE GENERATED WASTES

1. What level of protective clothing is required? ________

2. What equipment is available on site? ________

3. Is the equipment calibrated daily and in accordance with appropriate procedures? ________

   Comments: ________

4. Are calibration data recorded in appropriate logbooks? ________ Comments: ________

5. Is data collected according to specific procedures and recorded in the site logbook? ________

   Comments: ________

SAMPLE PACKAGING AND SHIPPING

1. Describe sample packaging procedures ________

[FORMS]/98/4
4 of 5

Figure 3-2 FIELD AUDIT CHECKLIST (Cont.)

2. Is packaging done at the end of the day, or as samples are collected? ____________

3. Was an inventory conducted for chain-of-custody, logbook, and sample containers? ____________

Comments: ____________

4. Are samples packed on ice? ____________ Comments: ____________

5. Is the proper information being entered on the Federal Express form for billing purposes (i.e., project number and cost code)? ____________ Comments: ____________

PERSONNEL MANAGEMENT

1. Is the team leader noting the time that each team member arrives and departs the site in the logbook?

____________ Comments: ____________

2. Do the weekly time reports reflect the on-site time only? ____________ Comments: ____________

FIELD AUDITOR: ____________

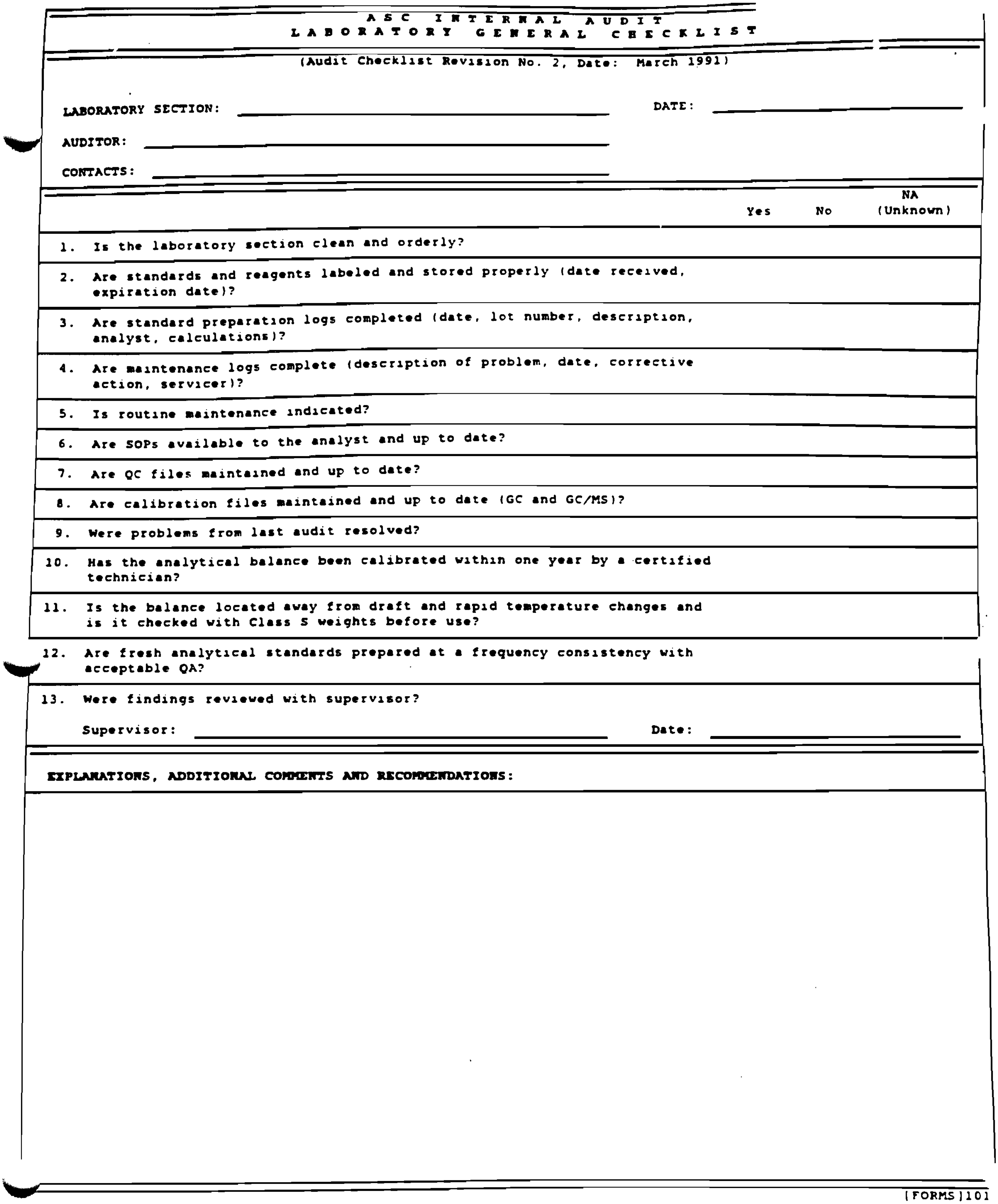
DATE OF AUDIT: ____________

FIELD TEAM LEADER: ____________

Revised 11-90

FORMS/98/4
5 of 5

Figure 3-2 FIELD AUDIT CHECKLIST (Cont.)



ASC INTERNAL AUDIT
LABORATORY GENERAL CHECKLIST

(Audit Checklist Revision No. 2, Date: March 1991)

LABORATORY SECTION: ______________________ **DATE:** ______________

AUDITOR: ______________________

CONTACTS: ______________________

	Yes	No	NA (Unknown)
1. Is the laboratory section clean and orderly?			
2. Are standards and reagents labeled and stored properly (date received, expiration date)?			
3. Are standard preparation logs completed (date, lot number, description, analyst, calculations)?			
4. Are maintenance logs complete (description of problem, date, corrective action, servicer)?			
5. Is routine maintenance indicated?			
6. Are SOPs available to the analyst and up to date?			
7. Are QC files maintained and up to date?			
8. Are calibration files maintained and up to date (GC and GC/MS)?			
9. Were problems from last audit resolved?			
10. Has the analytical balance been calibrated within one year by a certified technician?			
11. Is the balance located away from draft and rapid temperature changes and is it checked with Class S weights before use?			
12. Are fresh analytical standards prepared at a frequency consistency with acceptable QA?			
13. Were findings reviewed with supervisor?			

Supervisor: ______________________ Date: ______________

EXPLANATIONS, ADDITIONAL COMMENTS AND RECOMMENDATIONS:

(FORMS)101
Page 1 of 5

Figure 3-3 ASC INTERNAL AUDIT CHECKLIST

Revision No. 2
March 1991

ASC INTERNAL AUDIT
LOGBOOK AND METHOD REVIEW CHECKLIST

LABORATORY SECTION: ______________________ **DATE:** ______________

AUDITOR: ______________________

LOGBOOKS REVIEWED: ______________________ **PAGES:** ________ **TO** ________

CONTACTS: ______________________

	Yes	No	NA (Unknown)
1. Are logbooks neat?			
2. Are all cross outs initialed and dated?			
3. Are logbooks signed daily by supervisor?			
4. Is the analyst responsible for each phase of work clearly indicated?			
5. Is the percentage of QC analyzed acceptable?			
6. Were a percentage of calculations checked and found acceptable?			
7. Are standards traceable to preparation log?			
8. Are control charts complete and up to date?			
9. Was initial review done by supervisors and raw data initialed?			
10. Was data stamped in or out of control?			
11. Any out-of-control analyses: Were discrepancy forms completed? Was follow-up action taken?			
12. Are SOP complete?			
13. Are procedures consistent with SOP?			

EXPLANATIONS, ADDITIONAL COMMENTS AND RECOMMENDATIONS:

1. Were findings reviewed with supervisor?

Supervisor: ______________________ Date: ______________

[FORMS] 1
Page 2 of 5

Figure 3-3 ASC INTERNAL AUDIT CHECKLIST (Cont.)

Revision No. 2
March 1991

ASC INTERNAL AUDIT
REPORT FILE REVIEW CHECKLIST

LABORATORY SECTION: ____________________ DATE: ____________

AUDITOR: ____________________

CONTACTS: ____________________

LOGBOOKS REVIEWED: ____________________ PAGES: ________ TO ________

REPORT FILE JOB NO.: __________ CLIENT: ____________________ DATE: ________

	Yes	No	NA (Unknown)
1. Was data marked in control/out-of-control?			
2. Were discrepancy forms submitted for out-of-control results?			
3. Are chain-of-custody forms (unless client sampled) present?			
4. Are correspondences documented?			
5. Are method data sheets and/or copy of raw data present?			
6. Was a draft report present and did final report include corrections to the draft?			
7. Was the cost breakdown summary included?			
8. Was destruction authorized form present?			
9. Is Quality Assurance Protocol Review (QAPR) cover sheet complete?			
10. Was QAPR initiated by report writer and first draft reviewed by area supervisors? By ASC manager?			
11. Was report approved and invoiced by reports coordinator?			
12. Were appropriate jobs reviewed by QA coordinator (numbers ending 2 and 7 and above $10K)?			
13. Was report to client within 30 days (note the total days for typing is appropriate)?			

EXPLANATIONS, ADDITIONAL COMMENTS AND RECOMMENDATIONS:

1. Were findings reviewed with supervisor?

Supervisor: ____________________ Date: ____________

|FORMS|101
Page 3 of 5

Figure 3-3 ASC INTERNAL AUDIT CHECKLIST (Cont.)

Revision No. 2
March 1991

ASC INTERNAL AUDIT
SAMPLE MANAGEMENT CHECKLIST

AUDITOR: ____________________ **DATE:** ____________

CONTACTS: ____________________

	Yes	No	NA (Unknown)
1. Is the section clean and tidy?			
2. Are SOPs available and up to date?			
3. Storage areas (including back areas):			
Is overall cleanliness and adequate space maintained?			
Are temperatures of the cold storage areas recorded daily in a logbook?			
Are storage blanks initiated (CLP only)?			
Are coolers opened in a manner which prevents possible contamination?			
Are samples stored in such a way as to maintain preservation?			
Are standards stored in such a manner that they are not compromised (e.g., away from samples and extracts/digestates)?			
4. Chain-of-custody (see SOP SM.1 to SM.4):			
Is package receipt log completed according to SOP?			
Was sample cooler relative temperature checked (i.e., ice present/absent)?			
Was sample container integrity checked?			
Are sample log sheets signed and filed?			
Was custody transfer record complete?			
Are all cross outs initialed and dated?			
Were QA/QC discrepancy forms submitted if necessary?			
5. Sample Destruction:			
Are sample destructions up-to-date?			
Are appropriate waste disposal means available?			
Are appropriate forms and manifesting information completed?			

EXPLANATIONS, ADDITIONAL COMMENTS AND RECOMMENDATIONS:

1. Were findings reviewed with supervisor?

Supervisor: ____________________ Date: ____________

Figure 3-3 ASC INTERNAL AUDIT CHECKLIST (Cont.)

Revison No. 2
March 1991

ASC INTERNAL AUDIT
HEALTH AND SAFETY REVIEW CHECKLIST

AUDITOR: ______________________ DATE: ______________

CONTACTS: ______________________

	Yes	No	NA (Unknown)
1. Are material safety data sheets (MSDS) available in each section for chemicals used?			
2. Were any hazards noted in laboratory sections or general areas?			
3. Are the following safety equipment accessible to laboratory personnel: ____ Fire extinguisher ____ Eyewash (date last checked ____________)? ____ Shower (date last checked ____________)? ____ First aid kits? ____ Spill kits?			
4. Are health and safety evaluations performed as required for: Fume hoods? Asbestos monitoring? OVM tests? Area acid tests?			

EXPLANATIONS, ADDITIONAL COMMENTS AND RECOMMENDATIONS:

1. Were findings reviewed with Health and Safety officer?

Supervisor: ______________________ Date: ______________

Figure 3-3 ASC INTERNAL AUDIT CHECKLIST (Cont.)

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QA/QC DISCREPANCY

Laboratory Section ____________ Date of Analysis ____________

Type of Analysis ____________ Book ________ Page ________

Job No.(s) ____________

Sample(s) Affected ____________

Submitted To ____________ By ____________

Date ____________ Request Further Action ☐ YES* ☐ NO

*Complete Follow up Report Within Two Weeks

Date Closed ____________

Standard	________	Recovery	High	Low	Error in C-O-D	________
Surrogate	________	Recovery	High	Low	Incorrect Preservation	________
Spike	________	Recovery	High	Low	Samples Warm	________
EPA Known	________	Recovery	High	Low	Headspace in VOA Vial	________
Replicate	________	RPD Outside Limits			Damaged Shipment	________
Lab Blank	________	Contaminated With			Other	________

Hold Time Violation ________ / ________ Days

Analytical Sequence Error ____________

Transcription Error ____________

Run Outside Clock ________ / ________ Hrs.

Insufficient QC Analyzed ____________

Calculation Error ____________

Problem Explanation ____________

Corrective Action ____________

Follow Up Report ____________

Corrective Action Approved: ____________ Date ____________

____________ Date ____________

QA Review Completed ____________ Date ____________ Report Date ____________

Distribution: Sheet 1 (White) - Job File
Sheet 2 (Green) - ASC Manager
Sheet 3 (Canary) - QA Coordinator

Figure 3-4 QA/QC DISCREPANCY FORM

Form No. ____________

Cf Previous Form No. ____________

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DATA CONCERN AND RESOLUTION FORM

Lab Job No. ________ Client ____________________

Name(s) of Reviewer: ____________________ Date Sent: ____________

Name(s) of Lab Contact: ____________________ Date Returned: ____________

ITEM	RESOLUTION	ITEM RESOLVED*

Signature and Date of ASC QA Coordinator

Signature and Date of Reviewer

Are all items closed (Y/N)? ______ If yes, inform contact.

*To be completed by reviewer on return. If unresolved, submit a new form and complete previous form number section at top with number or date of previous form.

02:X0120:MEREDITH-08/28/91-01

Figure 3-5 CONTINUING QA FORM

IAR No. ________________

Date of Issuance ________________

By ________________

To Laboratory ________________

Cf. previous IAR ________________

In reference to audit report (if applicable) ________________

________________ Date of Audit ________________

Item No. or Description: ________________

Action Taken: ________________

Date Taken: ________________

Verification By: ________________ Date ________________

Item No. or Description: ________________

Action Taken: ________________

Date Taken: ________________

Verification By: ________________ Date ________________

Item No. or Description: ________________

Action Taken: ________________

Date Taken: ________________

Verification By: ________________ Date ________________

Final Concurrence on IAR item nos. ________ Lab Manager, Date	Final Concurrence on IAR item nos. ________ QA Coordinator, Date

Figure 3-6 **QA/QC ITEM ACTION REPORT**

4 Data Validation and Usability

For projects requiring data validation, E & E will implement the general procedures for data validation and usability described below. These procedures will be adapted, if necessary, to meet EPA regional guidance requirements. In addition, data validation procedures will vary depending on the type of analytical laboratory used for the project. Data validation requirements are specified as part of the analytical procurement process and will be approved by EPA on a case-by-case basis. The data validation and usability requirements are developed as part of the DQO process and will be documented in site-specific QAPjPs. In addition, the site-specific QAPjPs will address data review criteria for nonanalytical data or data manipulations subsequent to direct measurements.

4.1 Data Review, Validation, and Verification Requirements

All data generated will be reviewed by comparing calibration, accuracy, and precision to the QC criteria listed in the method and in the site-specific QAPjP.

The data flow/reporting scheme from the collection of raw data through the validated report is presented in Figure 4-1. Raw data, generated by instrumentation with data storage capabilities, are stored on that instrument. If notebook entries are necessary, the entries are made by the analyst and checked and signed by the supervisors on a daily basis. All data generated by the analyst and documented in logbooks, on data sheets, or on magnetic tape are received by the respective section supervisor, who approves the data or requests reanalysis. Approved data may be entered into the VAX computer for storage and used in generating the laboratory report or may be submitted in written format to the job file. A data entry clerk is responsible for entering all results. The report is generated by the Laboratory Reports Group and reviewed by the laboratory reports coordinator to check for transcription and/or data entry errors. The report is approved, in turn, by the group manager(s) and the laboratory director after the addition of any qualifiers deemed necessary. The ASC project manager is responsible for submitting quarterly reports, if required by the client, that would identify problems or concerns to the regional QA coordinator and is also responsible for assuring that the requirements of the MQAP have been met. The laboratory QA coordinator reviews 20% of all analytical reports. Each review step is documented on the Quality Assurance Protocol Review, as illustrated in Figure 4-2.

The internal validation procedure for the laboratory is generally composed of the following steps:

- Verify that correct samples were analyzed and reported in appropriate units;
- Verify that the sample preparation logs are consistent with the instrument readouts;
- Verify that sample analyses are within holding times;
- Verify that the calibration curve is valid and checked daily;
- Verify that any analytes present in the method blanks are due to common laboratory contaminants and that one blank is run every 20 samples;
- Verify that a reference sample is run every 20 samples and that %R is within 20% of the known amount or as stated in the method;
- Verify that a replicate and matrix spike or matrix spike and spike duplicate are run every 20 samples and that QC criteria are in control;
- Check for transcription errors at all stages; and
- Check for custody integrity for the samples.

All steps are performed by the individual analyst and then checked by the section supervisor. All calculations and data manipulations are included in the appropriate method or internal SOPs. QC data are plotted on control charts or tabulated by the analyst. Some QC data are tabulated by the analyst and entered into LABMIS by the data entry clerk. Laboratory section supervisors will verify all QC sample calculations and at least 10% of the sample calculations to ensure data manipulations are correct. The laboratory section supervisor will also check all instrument and sample preparation logbooks on a weekly basis. Control charts are checked by the supervisor and audited routinely by a QC chemist.

After receipt from the laboratory and if required by the client, project data will be validated using the following steps:

- A chemist will review the data to check field and laboratory QC data to verify that holding times were met and to note any anomalous values.
- The chemist will alert the project manager to any QC problems, obvious anomalous values, or discrepancies noted during the review.
- The project manager will review the data and compare the laboratory data package to field documentation (e.g., COC, field logbooks). QC problems will be discussed in the QA/QC section of the final report.
- The project manager will also prepare an analytical data summary table. This table will summarize those samples and analytes for which detectable concentrations were exhibited. The table will include field QC samples.
- During publication of the report, the project manager will check the summary table against the original laboratory data for transcription errors after typing.
- The project director provides final QA/QC during the technical review.

If required by the project, qualified E & E chemists will fully validate data packages according to *EPA CLP National Functional Guidelines for Organic or Inorganic Data Review,* EPA 5401R-94/012 or 013, February 1994. E & E chemists will complete the appropriate data review checklists and produce a report consistent with EPA regional guidance.

4.2 Validation and Verification Methods

Data evaluation and validation are interpretative processes by which data quality is compared to preestablished data quality criteria, including completeness of deliverables, QC criteria for each analytical method, project DQOs, and the usability of data for specific projects. Ultimately, the purpose of data validation is to assess whether data are usable, eliminate results that are not "real" (e.g., attributable to background contamination), and qualify results caused by problems with the sampling or analytical procedures. The data validation chemist evaluates these concerns in light of the criticality of the sample results to project objectives. The degree of required data validation is determined by each project's data quality criteria.

Project data quality criteria are determined, with the help of the QA officer, at the proposal stage or during initial project scoping meetings with the client. The client may have very specific data quality requirements or may rely on E & E to determine the requirements based on the project objectives.

Generally, there are no "universal" data quality criteria that can be applied to all projects. Data quality criteria are clearly specified in E & E work plans and site-specific QAPjPs. The relevant sections of the documents (e.g., for sampling procedures: analytical methods; data reporting) are based on the data quality requirements. All members of a project team, including the field crew, the QA officer, and laboratory personnel, have copies of the documents and are responsible for meeting project DQOs.

Data evaluation and validation are performed when the data have been received from the laboratory. Only the results that are truly valid for samples are used in E & E technical reports.

4.2.1 Data Validation Personnel

E & E's Data Validation Group is composed primarily of chemists. Key technical personnel in related fields assist in the validation of nonchemical data. Members of the data validation group are approved by the corporate QA director or his designee. Data validation chemists work independently of E & E's ASC (or the laboratory used) and project management.

Each data validation chemist has a bachelor's degree in chemistry or a related field with at least 20 hours in chemistry, plus at least one year's analytical experience or an equivalent educational background. The lead data validation chemist must have at least one year's experience in evaluating CLP data packages. Other technical personnel have equivalent experience in their fields. The corporate QA group maintains a file of qualifications for all approved data validation personnel.

The QA officer also works independently of project management and the laboratory. The QA officer is responsible for reviewing data validation reports and resolving discrepancies between the data validation chemist(s), laboratory, and project management. If problems have been noted during the data validation, the QA officer reviews corrective actions with the project manager and identifies final action items and areas of concern. Major QA/QC problems are reported to the corporate QA director for further review.

4.2.2 Standard Operating Procedure

Data validation procedures are briefly outlined below. The data validation chemist obtains the necessary information from the project manager and the laboratory and reviews the information to assess data quality and determine whether the data are valid for their intended purpose.

The project manager provides the data validation chemist with a summary sheet containing the following information:

- Site name;
- Job number/project number;
- Site manager's name;
- Complete list of samples from the field logbooks with all field QC samples (i.e., trip/rinsate/field blanks and field duplicates) clearly identified;
- Any problems noted in the field; and
- The intended data use and/or DQOs.

The laboratory provides a CLP data package for all samples. The package includes a copy of the COC and summary forms for sample identification, analytical requirements, and sample preparation and analysis.

Evaluation of Completeness

The data validation chemist verifies that the laboratory information matches the field information and that the following items are included in the data package:

- COC forms;
- Case narrative describing any out-of-control events and summarizing analytical procedures;
- QA/QC summary forms;
- Calibration summary forms and associated raw data;
- Instrument and method performance data;
- Data report forms (i.e., Form I); and
- Raw data.

Backup documentation for the determination of method detection limits is sent to the QA officer annually for organic analysis and quarterly for inorganic analysis. If the data package is incomplete, the data validation chemist informs the QA officer or contacts the laboratory, which must provide all missing information within 10 calendar days.

Evaluation of Compliance

The actual data validation follows procedures outlined in *EPA CLP National Functional Guidelines for Inorganics or Organics Review*, EPA 540/R-94012 or 013, February 1994, or EPA regional guidance. The procedures are briefly outlined below:

- Check all summary forms for compliance with technical criteria provided in the QAPjP and EPA functional guidelines;
- Determine appropriate data qualifiers;
- Verify representative calculations and check data for one randomly chosen sample per analysis;
- Verify one calculation per page for all initial and continuing calibration summary forms, and any other QC summary forms;
- Review chromatograms, mass spectra, and other raw data for apparent anomalies;
- Ensure all analytical problems and corrections are reported in the case narrative; and

- For any problems identified, review concerns with the laboratory, obtain additional information if necessary, and check all related data to determine the extent of the error.

Data Validation Report Deliverables

The data validation chemist completes the following deliverables:

- Data assessment summary forms;
- All calculations checked and initialed as verified on the original data package;
- Copy of Form I Data Summaries with additional data qualifiers, if necessary;
- Glossary of data qualifiers used for validation, if necessary;
- Summary of field QC sample results;
- Assessment of data usability;
- Brief summary of major and minor concerns noted on the data assessment summary form with a reference to the specific page number where the concern was noted and a recommended corrective action (including a copy of all relevant telephone logs);
- Overall appraisal of the data package and data quality; and
- A copy of the laboratory's case narrative.

All data and summary forms are given to the QA officer for final review. The QA officer is independent of both laboratory and project management. The QA officer resolves discrepancies between the laboratory and data validation chemist(s) and makes the final determination regarding data usability. The data validator enters qualifiers in the database, if necessary. If problems have been noted by the data validation chemist, the QA officer reviews corrective actions with the project manager and identifies final action items and areas of concern on the data summary assessment forms. The project manager uses the data as qualified on the Form I copies provided by the data validation chemist or the electronic database. The laboratory also provides a copy of all forms with significant changes.

Individual data packages are completed for all samples delivered daily from the site. Data validation tasks are assigned, completed, and summarized for individual data packages within 30 days after receipt of each package from the laboratory. Once approved by the QA officer and the project manager, all summary forms and Form I copies and electronic data are sent to the EPA representative for review.

The project manager and QA officer are responsible for addressing any concerns with respect to data quality or data validation procedures. The QA officer provides any necessary backup information. The project manager ensures that the data validation results are discussed in the final report and that only valid data are used.

4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

E & E will perform data quality assessments in accordance with EPA "Guidance for Conducting Environmental Data Quality Assessments," EPA/QA/G-9, when the final version becomes available in the spring of 1995. For routine assessments of data quality, E & E will implement the data validation procedures described in Section 4.2 and assign appropriate data qualifiers to indicate limitations on the data. The data validator will be responsible for evaluating precision, accuracy, representativeness, comparability, and completeness of the data using procedures described in Section 2.5 of this MQAP. Any deviations from the analytical DQOs for the project will be documented in the data validation memo provided to the data users for the project.

The final users of the data will be responsible for performing data quality assessments. The assessment process involves applying statistical tools to determine whether the variability and bias in the data meet the overall DQOs established for the project in the site-specific QAPjP. The statistical evaluation, along with a subjective evaluation of the data qualifiers, forms the basis for the user to assess the usability of the data for the overall project.

Data users will follow specific EPA guidelines when applicable. For example, risk assessors will follow procedures outlined in EPA "Guidance for Data Usability in Risk Assessment (Part A)," OSWER 9285.7-09A, April 1992.

Data that are determined to be not usable for the project will be discussed in the final report. If critical data points are involved that impact the ability to complete the project objectives, the data users will report immediately to the project manager and QA officer. The project manager will discuss the resolution of the issue with the client and implement the necessary corrective actions (for example, resampling).

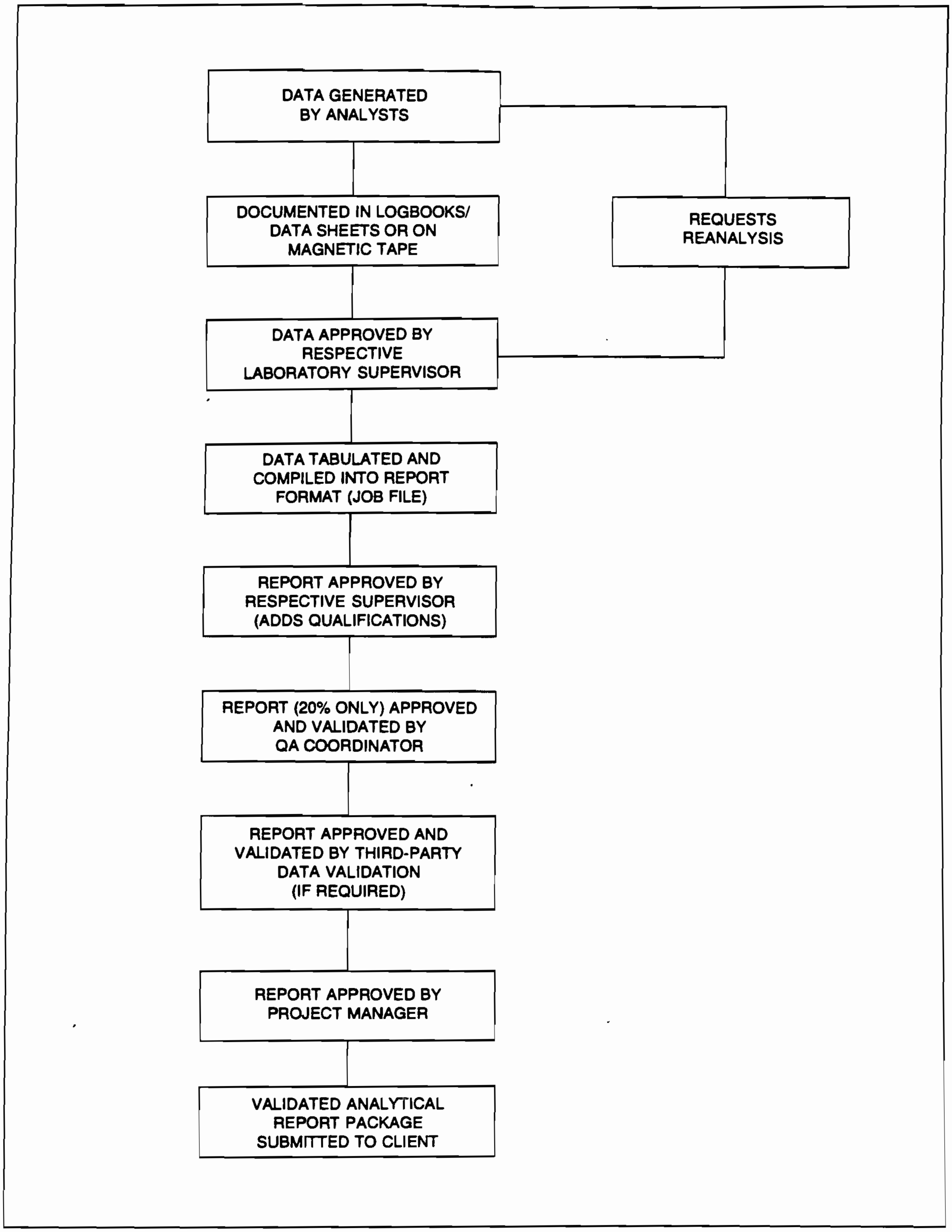

Figure 4-1 **DATA FLOW/REPORTING SCHEME**

ecology and environment, inc.

QUALITY ASSURANCE PROTOCOL REVIEW

Job No.: ______________________ Date: ______________________

Report Title: ______________________

Client: ______________________

____

Laboratory Data Review	Supervisor	Date
Metals		
General Chemistry		
GC		
GC/MS		
Micro. Asbestos		
Other		

Report Review: ______________________

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____

____

	Signature	Date
Report Written by:		
1st Draft Reviewed by:		
2nd Draft Reviewed by: (If Needed)		
Final Review by Author:		
ASC Manager:		
QA Officer:		
Corp. Project Manager: (Internal Job)		
________ Copies of Report Sent to:		
Report Accepted by Client:		
________ Invoices Sent to Accounting		

Figure 4-2 **QUALITY ASSURANCE PROTOCOL REVIEW**

QAPjP: Griffiss
Appendix No.: C-K
Revision No.: 0
Date: August 1997

C-K Internal QC Procedures and Acceptance Criteria—Additions

Table C-K-1

SUMMARY OF INTERNAL QUALITY CONTROL PROCEDURES AND QUALITY CONTROL ACCEPTANCE CRITERIA

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SW846 8310	**PAHs**	**Field QC**			
		Duplicate	1 for every 10 field samples collected	Water samples—RPD <20% Soil samples—RPD <30%	Review laboratory QC data to determine whether they are in control. If not in control, flag data. Use data to evaluate whether proper collection procedures were followed.
		Rinsate	1 for every 10 field samples collected	Less than reported detection limits	Qualify data.
		Laboratory QC			
		Initial calibration	Before analysis and when continuing calibration fails criteria	5 pt. calibrations; % RSD must be <20% for all analytes	Recalibrate instrument.
		Continuing calibration	Daily	Response factors must be <15% from average of initial calibration	Rerun continuing calibration. If still out of control, recalibrate instrument.
		Method blank	Daily	Compounds must be below respective detection limits	Step 1: Reanalyze. Step 2: If second blank exceeds criteria, clean the analytical system. Step 3: Document the corrective action taken and qualify all associated data.
		Surrogate spike	All blanks, standards, QC samples, field samples	Recovery: 56-113%	Step 1: Reanalyze. Step 2: If recovery still outside control limits, re-extract.
		MS/MSD	1 per every 20 samples	See Appendix M for current control limits for each parameter; overall range: 25-145%	Rerun samples. If still out of control, qualify data.

Table C-K-1 (Cont.)

Key:

MS/MSD = Matrix spike/matrix spike duplicate.
QC = Quality control.
RPD = Relative percent difference.
RSD = Relative standard deviation.

C-L

List of Analytes of Interest and Detection Limits

Table C-L-1

DETECTION LIMITS FOR ANALYTES OF INTEREST, TOTAL METALS AND MISCELLANEOUS ANALYTES, PRELIMINARY ASSESSMENT/SITE INVESTIGATION GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/ Component	MDL[a]	Units	PQL	Units
General Chemistry						
ASTM D2216-80	S	Moisture Content	1	%	1	%
EPA 418.1	W	Petroleum hydrocarbons	1	mg/L	1	mg/L
SW 9073	S	Petroleum hydrocarbons	5	mg/kg	20	mg/kg
Hazardous Waste Characteristics						
SW 1010	S/W	Ignitability	NA	°C or °F	NA	°C or °F
EPA 150.1	W	Corrosivity	0.1	+ su	0.1	+ su
EPA 150.1	S	Corrosivity	0.1	+ su	0.1	+ su
SW Chapter 7, 9010	S/W	Reactivity (cyanide)	0.5	mg/kg	0.5	mg/kg
SW Chapter 7, 9030	S/W	Reactivity (sulfide)	50	mg/kg	50	mg/kg
SW 1311	S/W	TCLP	NA	NA	NA	NA
Metals						
SW 6010	W	Aluminum	13.3	µg/L	100	µg/L
SW 6010	S	Aluminum	1.33	mg/kg	10	mg/kg
SW 7041	W	Antimony	3	µg/L	3	µg/L
SW 7041	S	Antimony	0.3	mg/kg	0.3	mg/kg
SW 6010	W	Arsenic	2.6	µg/L	5	µg/L
SW 6010	S	Arsenic	0.26	mg/kg	0.5	mg/kg
SW 6010	W	Barium	10.5	µg/L	20	µg/L
SW 6010	S	Barium	1.05	mg/kg	0.2	mg/kg
SW 6010	W	Beryllium	0.310	µg/L	5	µg/L
SW 6010	S	Beryllium	0.031	mg/kg	0.5	mg/kg
SW 6010	W	Cadmium	0.16	µg/L	5	µg/L

Key at end of table.

Table C-L-1

DETECTION LIMITS FOR ANALYTES OF INTEREST, TOTAL METALS AND MISCELLANEOUS ANALYTES, PRELIMINARY ASSESSMENT/SITE INVESTIGATION GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/ Component	MDL[a]	Units	PQL	Units
SW 6010	S	Cadmium	0.016	mg/kg	0.5	mg/kg
SW 6010	W	Calcium	314	µg/L	500	µg/L
SW 6010	S	Calcium	31.4	mg/kg	50	mg/kg
SW 6010	W	Chromium	0.290	µg/L	10	µg/L
SW 6010	S	Chromium	0.029	mg/kg	0.1	mg/kg
SW 6010	W	Cobalt	1.09	µg/L	20	µg/L
SW 6010	S	Cobalt	0.109	mg/kg	0.2	mg/kg
SW 6010	W	Copper	1.63	µg/L	20	µg/L
SW 6010	S	Copper	0.163	mg/kg	0.2	mg/kg
SW 6010	W	Iron	4.04	µg/L	50	µg/L
SW 6010	S	Iron	0.404	mg/kg	5	mg/kg
SW 6010	W	Lead	5.0	µg/L	5	µg/L
SW 6010	S	Lead	0.5	mg/kg	0.5	mg/kg
SW 6010	W	Magnesium	221	µg/L	500	µg/L
SW 6010	S	Magnesium	22.1	mg/kg	50	mg/kg
SW 6010	W	Manganese	0.25	µg/L	10	µg/L
SW 6010	S	Manganese	0.025	mg/kg	1.0	mg/kg
SW 7470	W	Mercury	0.2	µg/L	0.2	µg/L
SW 7471	S	Mercury	0.1	mg/kg	0.1	mg/kg
SW 6010	W	Nickel	1.44	µg/L	20	µg/L
SW 6010	S	Nickel	0.14	mg/kg	2	mg/kg
SW 6010	W	Potassium	239	µg/L	900	µg/L
SW 6010	S	Potassium	23.9	mg/kg	90	mg/kg
SW 6010	W	Selenium	2	µg/L	5	µg/L
SW 6010	S	Selenium	0.2	mg/kg	0.5	mg/kg

Key at end of table.

Table C-L-1

DETECTION LIMITS FOR ANALYTES OF INTEREST, TOTAL METALS AND MISCELLANEOUS ANALYTES, PRELIMINARY ASSESSMENT/SITE INVESTIGATION GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/ Component	MDL[a]	Units	PQL	Units
SW 6010	W	Silver	0.60	µg/L	10	µg/L
SW 6010	S	Silver	0.06	mg/kg	0.1	mg/kg
SW 6010	W	Sodium	235	µg/L	500	µg/L
SW 6010	S	Sodium	23.5	mg/kg	50	mg/kg
SW 6010	W	Thallium	2.0	µg/L	2	µg/L
SW 6010	S	Thallium	0.2	mg/kg	0.2	mg/kg
SW 6010	W	Vanadium	2.45	µg/L	20	µg/L
SW 6010	S	Vanadium	0.245	mg/kg	0.2	mg/kg
SW 6010	W	Zinc	0.65	µg/L	10	µg/L
SW 6010	S	Zinc	0.065	mg/kg	0.1	mg/kg

[a] For metals, instrument detection limits are reported.

Key:

ASTM = American Society for Testing and Materials.
EPA = United States Environmental Protection Agency Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.
MDL = Method detection limit (most current); may be higher for reporting purposes.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable.
PQL = Practical quantitation limits.
S = Soil, sediment, and sludges.
SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1986, including update I, 1993.
TCLP = Toxicity characteristic leaching procedure.
TOC = Total organic carbon.
µg/L = Micrograms per liter.
W = Groundwater and surface water.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
Organics						
SW 8270 and/or EPA 625	**W**	**Base/Neutral and Acid Extractable Organic Compounds**				
		bis(2-Chloroethyl) ether	7.17	µg/L	10	µg/L
		1,3-Dichlorobenzene	4.70	µg/L	10	µg/L
		1,4-Dichlorobenzene	5.72	µg/L	10	µg/L
		Benzyl Alcohol[b]	10	µg/L	10	µg/L
		1,2-Dichlorobenzene	4.33	µg/L	10	µg/L
		bis(2-Chloroisopropyl) ether	6.98	µg/L	10	µg/L
		N-Nitroso-Dipropylamine	6.18	µg/L	10	µg/L
		Hexachloroethane	5.04	µg/L	10	µg/L
		Nitrobenzene	8.98	µg/L	10	µg/L
		Isophorone	6.95	µg/L	10	µg/L
		Benzoic Acid[a]	50	µg/L	50	µg/L
		bis(2-Chloroethoxy) methane	6.53	µg/L	10	µg/L
		1,2,4-Trichlorobenzene	5.87	µg/L	10	µg/L
		Naphthalene	3.11	µg/L	10	µg/L
		4-Chloroaniline	9.08	µg/L	10	µg/L
		Hexachlorobutadiene	6.45	µg/L	10	µg/L
		2-Methylnaphthalene	4.78	µg/L	10	µg/L
		Hexachlorocyclopentadiene	6.31	µg/L	10	µg/L
		2-Chloronaphthalene	4.87	µg/L	10	µg/L
		2-Nitroaniline	7.99	µg/L	50	µg/L
		Dimethyl Phthalate	6.10	µg/L	10	µg/L
		Acenaphthylene	2.69	µg/L	10	µg/L
		3-Nitroaniline	10.41	µg/L	50	µg/L
		Acenaphthene	2.42	µg/L	10	µg/L
		Dibenzofuran	5.96	µg/L	10	µg/L
		2,4-Dinitrotoluene	6.41	µg/L	10	µg/L
		2,6-Dinitrotoluene	7.28	µg/L	10	µg/L
		Diethylphthalate	6.09	µg/L	10	µg/L

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		4-Chlorophenyl phenyl ether	7.17	µg/L	10	µg/L
		Fluorene	2.44	µg/L	10	µg/L
		4-Nitroaniline	19.86	µg/L	50	µg/L
		N-Nitrosodiphenylamine	5.80	µg/L	10	µg/L
		4-Bromophenyl phenyl ether	6.85	µg/L	10	µg/L
		Hexachlorobenzene	7.01	µg/L	10	µg/L
		Phenanthrene	2.42	µg/L	10	µg/L
		Anthracene	2.67	µg/L	10	µg/L
		Di-n-butylphthalate	5.19	µg/L	10	µg/L
		Fluoranthene	2.37	µg/L	10	µg/L
		Pyrene	9.80	µg/L	10	µg/L
		Butyl Benzyl Phthalate	9.98	µg/L	10	µg/L
		3,3'-Dichlorobenzidine	6.14	µg/L	20	µg/L
		Benzo(a)anthracene	3.71	µg/L	10	µg/L
		bis(2-ethylhexyl)phthalate	6.07	µg/L	10	µg/L
		Chrysene	3.34	µg/L	10	µg/L
		Di-n-octyl Phthalate	6.88	µg/L	10	µg/L
		Benzo(b)fluoranthene	1.98	µg/L	10	µg/L
		Benzo(k)fluoranthene	5.09	µg/L	10	µg/L
		Benzo(a)pyrene	1.59	µg/L	10	µg/L
		Indeno(1,2,3-cd)pyrene	5.44	µg/L	10	µg/L
		Dibenzo(a,h)anthracene	4.00	µg/L	10	µg/L
		Benzo(ghi)perylene	4.15	µg/L	10	µg/L
		Phenol	6.87	µg/L	10	µg/L
		2-Chlorophenol	6.50	µg/L	10	µg/L
		2-Methylphenol	5.74	µg/L	10	µg/L
		4-Methylphenol	5.22	µg/L	10	µg/L
		2-Nitrophenol	7.08	µg/L	50	µg/L
		2,4-Dimethylphenol	7.72	µg/L	10	µg/L
		2,4-Dichlorophenol	7.33	µg/L	10	µg/L

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		4-Chloro-3-methylphenol	8.56	µg/L	10	µg/L
		2,4,6-Trichlorophenol	6.57	µg/L	10	µg/L
		2,4,5-Trichlorophenol	6.73	µg/L	50	µg/L
		2,4-Dinitrophenol	12.06	µg/L	50	µg/L
		4,6-Dinitro-2-methylphenol	6.62	µg/L	50	µg/L
		4-Nitrophenol	12.58	µg/L	50	µg/L
		Pentachlorophenol	4.43	µg/L	50	µg/L
		Nitrobenzene-d5 (surrogate)	—	—	—	—
		2-Fluorobiphenyl (surrogate)	—	—	—	—
		Terphenyl-d14 (surrogate)	—	—	—	—
		2-Fluorophenol (surrogate)	—	—	—	—
		Phenol-d5 (surrogate)	—	—	—	—
		2,4,6-Tribromophenol (surrogate)	—	—	—	—
SW 8270	S	**Base/Neutral and Acid Extractable Organic Compounds**				
		bis(2-Chloroethyl) ether	143	µg/kg	330	µg/kg
		1,3-Dichlorobenzene	208	µg/kg	330	µg/kg
		1,4-Dichlorobenzene	136	µg/kg	330	µg/kg
		Benzyl Alcohol	333[a]	µg/kg	330	µg/kg
		1,2-Dichlorobenzene	196	µg/kg	330	µg/kg
		bis(2-Chloroisopropyl) ether	255	µg/kg	330	µg/kg
		N-Nitroso-Dipropylamine	209	µg/kg	330	µg/kg
		Hexachloroethane	230	µg/kg	330	µg/kg
		Nitrobenzene	203	µg/kg	330	µg/kg
		Isophorone	208	µg/kg	330	µg/kg
		Benzoic Acid	1,600[a]	µg/kg	1,600	µg/kg
		bis(2-Chloroethoxy) methane	214	µg/kg	330	µg/kg
		1,2,4-Trichlorobenzene	216	µg/kg	330	µg/kg
		Naphthalene	113	µg/kg	330	µg/kg
		4-Chloroaniline	117	µg/kg	330	µg/kg
		Hexachlorobutadiene	226	µg/kg	330	µg/kg

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		2-Methylnaphthalene	231	µg/kg	330	µg/kg
		Hexachlorocyclopentadiene	324	µg/kg	330	µg/kg
		2-Chloronaphthalene	238	µg/kg	330	µg/kg
		2-Nitroaniline	248	µg/kg	1,600	µg/kg
		Dimethyl Phthalate	265	µg/kg	330	µg/kg
		Acenaphthylene	136	µg/kg	330	µg/kg
		3-Nitroaniline	629	µg/kg	1,600	µg/kg
		Acenaphthene	113	µg/kg	330	µg/kg
		Dibenzofuran	261	µg/kg	330	µg/kg
		2,4-Dinitrotoluene	401	µg/kg	330	µg/kg
		2,6-Dinitrotoluene	291	µg/kg	330	µg/kg
		Diethylphthalate	101	µg/kg	330	µg/kg
		4-Chlorophenyl phenyl ether	248	µg/kg	330	µg/kg
		Fluorene	156	µg/kg	330	µg/kg
		4-Nitroaniline	345	µg/kg	1,600	µg/kg
		N-Nitrosodiphenylamine	208	µg/kg	330	µg/kg
		4-Bromophenyl phenyl ether	202	µg/kg	330	µg/kg
		Hexachlorobenzene	216	µg/kg	330	µg/kg
		Phenanthrene	97	µg/kg	330	µg/kg
		Anthracene	144	µg/kg	330	µg/kg
		Di-n-butylphthalate	163	µg/kg	330	µg/kg
		Fluoranthene	201	µg/kg	330	µg/kg
		Pyrene	141	µg/kg	330	µg/kg
		Butyl Benzyl Phthalate	297	µg/kg	330	µg/kg
		3,3'-Dichlorobenzidine	278	µg/kg	660	µg/kg
		Benzo(a)anthracene	112	µg/kg	330	µg/kg
		bis(2-ethylhexyl)phthalate	301	µg/kg	330	µg/kg
		Chrysene	150	µg/kg	330	µg/kg
		Di-n-octyl Phthalate	330	µg/kg	330	µg/kg
		Benzo(b)fluoranthene	167	µg/kg	330	µg/kg

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		Benzo(k)fluoranthene	203	µg/kg	330	µg/kg
		Benzo(a)pyrene	118	µg/kg	330	µg/kg
		Indeno(1,2,3-cd)pyrene	154	µg/kg	330	µg/kg
		Dibenzo(a,h)anthracene	171	µg/kg	330	µg/kg
		Benzo(ghi)perylene	134	µg/kg	330	µg/kg
		Phenol	145	µg/kg	330	µg/kg
		2-Chlorophenol	133	µg/kg	330	µg/kg
		2-Methylphenol	273	µg/kg	330	µg/kg
		4-Methylphenol	269	µg/kg	330	µg/kg
		2-Nitrophenol	248	µg/kg	330	µg/kg
		2,4-Dimethylphenol	282	µg/kg	330	µg/kg
		2,4-Dichlorophenol	216	µg/kg	330	µg/kg
		4-Chloro-3-methylphenol	231	µg/kg	330	µg/kg
		2,4,6-Trichlorophenol	249	µg/kg	330	µg/kg
		2,4,5-Trichlorophenol	262	µg/kg	1,600	µg/kg
		2,4-Dinitrophenol	592	µg/kg	1,600	µg/kg
		4,6-Dinitro-2-methylphenol	429	µg/kg	1,600	µg/kg
		4-Nitrophenol	313	µg/kg	1,600	µg/kg
		Pentachlorophenol	312	µg/kg	1,600	µg/kg
		Nitrobenzene-d5 (surrogate)	—	—	—	—
		2-Fluorobiphenyl (surrogate)	—	—	—	—
		Terphenyl-d14 (surrogate)	—	—	—	—
		2-Fluorophenol (surrogate)	—	—	—	—
		Phenol-d5 (surrogate)	—	—	—	—
		2,4,6-Tribromophenol (surrogate)	—	—	—	—
SW 8246 and/or EPA 624	W	**Volatile Organic Compounds**				
		Chloromethane	7.50	µg/L	10	µg/L
		Bromomethane	1.39	µg/L	10	µg/L
		Vinyl Chloride	2.26	µg/L	10	µg/L
		Chloroethane	1.52	µg/L	10	µg/L

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		Methylene Chloride	0.75	µg/L	5	µg/L
		Acetone	2.20	µg/L	10	µg/L
		Carbon Disulfide	1.44	µg/L	5	µg/L
		1,1-Dichloroethene	1.47	µg/L	5	µg/L
		1,1-Dichloroethane	1.17	µg/L	5	µg/L
		1,2-Dichloroethene (total)	1.50	µg/L	5	µg/L
		Chloroform	1.11	µg/L	5	µg/L
		1,2-Dichloroethane	0.83	µg/L	5	µg/L
		2-Butanone	4.22	µg/L	10	µg/L
		1,1,1-Trichloroethane	1.52	µg/L	5	µg/L
		Carbon Tetrachloride	1.49	µg/L	5	µg/L
		Vinyl Acetate	6.87	µg/L	10	µg/L
		Bromodichloromethane	1.11	µg/L	5	µg/L
		1,1,2,2-Tetrachloroethane	1.87	µg/L	5	µg/L
		1,2-Dichloropropane	1.02	µg/L	5	µg/L
		trans-1,3-Dichloropropene	0.97	µg/L	5	µg/L
		Trichloroethene	2.56	µg/L	5	µg/L
		Dibromochloromethane	1.10	µg/L	5	µg/L
		1,1,2-Trichloroethane	1.23	µg/L	5	µg/L
		Benzene	1.43	µg/L	5	µg/L
		cis-1,3-Dichloropropene	1.08	µg/L	5	µg/L
		Bromoform	1.21	µg/L	5	µg/L
		2-Hexanone	2.26	µg/L	10	µg/L
		4-Methyl-2-pentanone	1.94	µg/L	10	µg/L
		Tetrachloroethene	1.49	µg/L	5	µg/L
		Toluene	1.40	µg/L	5	µg/L
		Chlorobenzene	1.27	µg/L	5	µg/L
		Ethyl Benzene	1.52	µg/L	5	µg/L
		Styrene	1.57	µg/L	5	µg/L
		Total Xylenes	3.23	µg/L	5	µg/L

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		1,2-Dichloroethane (surrogate)	—	—	—	—
		Toluene-d8 (surrogate)	—	—	—	—
		4-Bromofluorobenzene (surrogate)	—	—	—	—
SW 8260	**S**	**Volatile Organic Compounds**				
		Chloromethane	2.59	µg/kg	10	µg/kg
		Bromomethane	1.78	µg/kg	10	µg/kg
		Vinyl Chloride	1.73	µg/kg	10	µg/kg
		Chloroethane	3.81	µg/kg	10	µg/kg
		Methylene Chloride	1.43	µg/kg	5	µg/kg
		Acetone	9.41	µg/kg	10	µg/kg
		Carbon Disulfide	1.48	µg/kg	5	µg/kg
		1,1-Dichloroethene	1.65	µg/kg	5	µg/kg
		1,1-Dichloroethane	1.59	µg/kg	5	µg/kg
		1,2-Dichloroethene (total)	2.05	µg/kg	5	µg/kg
		Chloroform	1.91	µg/kg	5	µg/kg
		1,2-Dichloroethane	2.35	µg/kg	5	µg/kg
		2-Butanone	4.97	µg/kg	5	µg/kg
		1,1,1-Trichloroethane	1.14	µg/kg	5	µg/kg
		Carbon Tetrachloride	2.04	µg/kg	5	µg/kg
		Vinyl Acetate	5[a]	µg/kg	10	µg/kg
		Bromodichloromethane	1.88	µg/kg	5	µg/kg
		1,1,2,2-Tetrachloroethane	2.52	µg/kg	5	µg/kg
		1,2-Dichloropropane	2.28	µg/kg	5	µg/kg
		trans-1,3-Dichloropropene	2.17	µg/kg	5	µg/kg
		Trichloroethene	1.54	µg/kg	5	µg/kg
		Dibromochloromethane	2.39	µg/kg	5	µg/kg
		1,1,2-Trichloroethane	2.81	µg/kg	5	µg/kg
		Benzene	2.14	µg/kg	5	µg/kg
		cis-1,3-Dichloropropene	1.83	µg/kg	5	µg/kg
		Bromoform	2.62	µg/kg	5	µg/kg

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		2-Hexanone	3.85	µg/kg	10	µg/kg
		4-Methyl-2-pentanone	5.60	µg/kg	10	µg/kg
		Tetrachloroethene	1.61	µg/kg	5	µg/kg
		Toluene	1.90	µg/kg	5	µg/kg
		Chlorobenzene	2.17	µg/kg	5	µg/kg
		Ethyl Benzene	1.93	µg/kg	5	µg/kg
		Styrene	1.44	µg/kg	5	µg/kg
		Total Xylenes	2.95	µg/kg	5	µg/kg
		1,2-Dichloroethane (surrogate)	—	—	—	—
		Toluene-d8 (surrogate)	—	—	—	—
		4-Bromofluorobenzene (surrogate)	—	—	—	—
SW 8081 and/or EPA 608	**W**	**Pesticides/PCBs**				
		alpha-BHC	0.0028	µg/L	0.025	µg/L
		beta-BHC	0.0064	µg/L	0.025	µg/L
		delta-BHC	0.0076	µg/L	0.025	µg/L
		gamma-BHC (lindane)	0.0026	µg/L	0.025	µg/L
		Heptachlor	0.0115	µg/L	0.025	µg/L
		Aldrin	0.0117	µg/L	0.025	µg/L
		Heptachlor Epoxide	0.0040	µg/L	0.050	µg/L
		Endosulfan I	0.0018	µg/L	0.050	µg/L
		Dieldrin	0.0076	µg/L	0.050	µg/L
		4,4'-DDE	0.0081	µg/L	0.050	µg/L
		Endrin	0.0065	µg/L	0.050	µg/L
		Endosulfan II	0.0092	µg/L	0.050	µg/L
		4,4'-DDD	0.0033	µg/L	0.050	µg/L
		Endosulfan Sulfate	0.0188	µg/L	0.10	µg/L
		4,4'-DDT	0.0050	µg/L	0.10	µg/L
		Endrin Aldehyde	0.0198	µg/L	0.10	µg/L
		Methoxychlor	0.0408	µg/L	0.40	µg/L
		Chlordane	0.0043	µg/L	0.20	µg/L

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		Toxaphene	0.354	µg/L	1.0	µg/L
		Aroclor 1016	0.318	µg/L	0.50	µg/L
		Aroclor 1221	0.394	µg/L	0.50	µg/L
		Aroclor 1232	0.310	µg/L	0.50	µg/L
		Aroclor 1242	0.308	µg/L	0.50	µg/L
		Aroclor 1248	0.427	µg/L	0.50	µg/L
		Aroclor 1254	0.208	µg/L	0.50	µg/L
		Aroclor 1260	0.165	µg/L	0.50	µg/L
		Dibutylchlorendate (surrogate)	—	—	—	—
SW 8081	**S**	**Pesticides/PCBs**				
		alpha-BHC	0.093	µg/kg	1.0	µg/kg
		beta-BHC	0.213	µg/kg	1.0	µg/kg
		delta-BHC	0.255	µg/kg	1.0	µg/kg
		gamma-BHC (lindane)	0.87	µg/kg	1.0	µg/kg
		Heptachlor	0.384	µg/kg	1.0	µg/kg
		Aldrin	0.393	µg/kg	1.0	µg/kg
		Heptachlor Epoxide	0.135	µg/kg	1.0	µg/kg
		Endosulfan I	0.063	µg/kg	2.0	µg/kg
		Dieldrin	0.255	µg/kg	2.0	µg/kg
		4,4'-DDE	0.270	µg/kg	2.0	µg/kg
		Endrin	0.216	µg/kg	2.0	µg/kg
		Endosulfan II	0.307	µg/kg	2.0	µg/kg
		4,4'-DDD	0.111	µg/kg	2.0	µg/kg
		Endosulfan Sulfate	0.627	µg/kg	5.0	µg/kg
		4,4'-DDT	0.167	µg/kg	5.0	µg/kg
		Endrin Aldehyde	0.662	µg/kg	5.0	µg/kg
		Methoxychlor	1.36	µg/kg	16	µg/kg
		Chlordane	0.113	µg/kg	8.0	µg/kg
		Toxaphene	11.8	µg/kg	50	µg/kg
		Aroclor 1016	10.6	µg/kg	20	µg/kg

Key at end of table.

Table C-L-2

DETECTION LIMITS FOR ANALYTES OF INTEREST FOR ORGANIC METHODS, PRELIMINARY ASSESSMENT/SITE INVESTIGATION, GRIFFISS AFB, ROME, NEW YORK

Method	Matrix	Analyte/Component	MDL	Units	PQL	Units
		Aroclor 1221	13.1	µg/kg	20	µg/kg
		Aroclor 1232	10.3	µg/kg	20	µg/kg
		Aroclor 1242	10.2	µg/kg	20	µg/kg
		Aroclor 1248	14.2	µg/kg	20	µg/kg
		Aroclor 1254	6.95	µg/kg	20	µg/kg
		Aroclor 1260	5.52	µg/kg	20	µg/kg
		Dibutylchlorendate (surrogate)	—	—	—	—
SW 8310	**W**	**PAHs**				
		Naphthalene	0.8	µg/L	5	µg/L
		Acenaphthylene	0.7	µg/L	5	µg/L
		Acenaphthene	0.8	µg/L	5	µg/L
		Fluorene	0.1	µg/L	1.0	µg/L
		Phenanthrene	0.1	µg/L	1.0	µg/L
		Anthracene	0.2	µg/L	1.0	µg/L
		Fluoranthene	0.3	µg/L	2.5	µg/L
		Pyrene	0.4	µg/L	2.5	µg/L
		Benzo(a)anthracene	0.2	µg/L	1.0	µg/L
		Chrysene	0.1	µg/L	1.0	µg/L
		Benzo(b)fluoranthene	0.1	µg/L	1.0	µg/L
		Benzo(k)fluoranthene	0.1	µg/L	1.0	µg/L
		Benzo(a)pyrene	0.1	µg/L	1.0	µg/L
		Dibenzo(a,h)anthracene	0.2	µg/L	2.5	µg/L
		Benzo(ghi)perylene	0.1	µg/L	2.5	µg/L
		Indeno(1,2,3-cd)pyrene	0.1	µg/L	1.0	µg/L
		1-Methylnaphthalene	5	µg/L	5	µg/L
		2-Methylnaphthalene	5	µg/L	5	µg/L
		Terphenyl-d14 (surrogate)	—	—	—	—

Key at end of table.

Table C-L-2 (Cont.)

[a] MDL to be developed. The United States Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Contract-Required Detection Limit is shown.

Key:

BHC = Benzenehexachloride.
D = Detectable. Result must be greater than 0.
EPA = United States Environmental Protection Agency Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.
MDL = Method detection limit, most current.
PAHs = Polynuclear aromatic hydrocarbons.
PCBs = Polychlorinated biphenyls.
PQL = Practical quantitation limit.
RPD = Relative percent difference.
S = Soil, sediment, and sludges.
SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1986, including update I, 1993.
µg/L = Micrograms per liter.
µg/kg = Micrograms per kilogram.
W = Groundwater and surface water.

C-M

Control Limits for Analytical Methods—Updates

Table C-M-7

PERCENT RECOVERY LIMITS FOR METALS
(Matrix Spike)
EPA METHODS 6010/7000 SERIES
UPDATED

	Water[a]	Soil/Sediment[a]
Cyanide	75-125 (20)	75-125 (35)
Aluminum	75-125 (20)	75-125 (35)
Antimony	75-125 (20)	75-125 (35)
Barium	75-125 (20)	75-125 (35)
Beryllium	75-125 (20)	75-125 (35)
Cadmium	75-125 (20)	75-125 (35)
Calcium	75-125 (20)	75-125 (35)
Chromium	75-125 (20)	75-125 (35)
Cobalt	75-125 (20)	75-125 (35)
Copper	75-125 (20)	75-125 (35)
Iron	75-125 (20)	75-125 (35)
Magnesium	75-125 (20)	75-125 (35)
Manganese	75-125 (20)	75-125 (35)
Nickel	75-125 (20)	75-125 (35)
Potassium	75-125 (20)	75-125 (35)
Silver	75-125 (20)	75-125 (35)
Vanadium	75-125 (20)	75-125 (35)
Zinc	75-125 (20)	75-125 (35)
Strontium	75-125 (20)	75-125 (35)
Arsenic	75-125 (20)	75-125 (35)
Lead	75-125 (20)	75-125 (35)
Selenium	75-125 (20)	75-125 (35)
Thallium	85-115 (20)	85-115 (35)
Mercury	85-115 (25)	85-115 (35)
Other nonspecified parameters such as total suspended solids, total dissolved solids, etc.	80-120 (20)	85-115 (35)

[a] Maximum relative percent difference (RPD) between duplicate samples is listed in parentheses.

Modified
Table C-M-9

PERCENT RECOVERY LIMITS FOR SEMIVOLATILES FOR EPA METHOD 8270

SURROGATE SPIKE		
Surrogate Compound	**Water**	**Soil/Sediment**
Nitrobenzene-d_5	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
Terphenyl-d_{14}	33-141	18-137
Phenol-d_6	10-94	24-113
2-Fluorophenol	21-100	25-121
2,4,6-Triboromophenol	10-123	19-122

MATRIX SPIKES		
Matrix Compound	**Water**	**Soil/Sediment**
1,2,4-Trichlorobenzene	39-98 (28)	38-107 (23)
Acenaphthene	46-118 (31)	31-137 (19)
2,4-Dinitrotoluene	24-106 (38)	28-89 (47)
Pyrene	26-127 (31)	35-142 (36)
N-Nitrosodi-n-propylamine	41-116 (38)	41-126 (38)
1,4-Dichlorobenzene	36-97 (28)	28-104 (27)
Pentachlorophenol	9-110 (50)	17-109 (47)
Phenol	12-89 (42)	26-90 (35)
2-Chlorophenol	27-123 (40)	25-102 (50)
4-Chloro-3-methylphenol	23-97 (42)	26-103 (33)
4-Nitrophenol	10-100 (50)	11-114 (50)

Note: Maximum relative percent difference (RPD) between matrix spike and matrix spike duplicate samples is listed in parentheses.

Table C-M-13

QA ACCEPTANCE CRITERIA FOR EPA METHOD 8310

Parameter	Water Control Limits
Acenaphthene	43-134
Acenaphthylene	34-121
Anthracene	44-93
Benzo(a)anthracene	41-153
Benzo(a)pyrene	28-131
Benzo(ghi)perylene	20-137
Benzo(k)fluoranthene	29-134
Chrysene	40-131
Dibenzo(a,h)anthracene	20-136
Fluoranthene	40-145
Fluorene	41-139
Indeno(1,2,3-cd)pyrene	22-134
Naphthalene	42-114
Phenanthrene	42-120
Pyrene	43-140
Terphenyl-d14 (surrogate)	56-113

Key:

EPA = United States Environmental Protection Agency.
QA = Quality assurance.