M00263.AR.000785
MCRD PARRIS ISLAND
5090.3a

SAMPLING AND ANALYSIS PLAN FOR MUNITIONS RESPONSE PROGRAM SITE INSPECTIONS AT EIGHT MUNITIONS RESPONSE SITES VOLUME 1 OF 2 TEXT AND APPENDICES B THROUGH D MCRD PARRIS ISLAND SC
1/1/2010
TETRA TECH NUS

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-04-D-0055

Rev. 1
01/10

Sampling and Analysis Plan for Munitions Response Program Site Inspections at Eight Munitions Response Sites

Marine Corps Recruit Depot
Parris Island, South Carolina

Contract Task Order 0089

January 2010
Volume I of II
Text and Appendices B through D

NAVFAC
Naval Facilities Engineering Command
NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH NUS, Inc.

SAP Worksheet #1 -- Title and Approval Page
(UFP-QAPP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN
FOR
MUNITIONS RESPONSE PROGRAM
SITE INSPECTIONS AT EIGHT MUNITIONS RESPONSE SITES
MARINE CORPS RECRUIT DEPOT
PARRIS ISLAND, SOUTH CAROLINA

December 2009

Prepared for:
Naval Facilities Engineering Command Southeast
NAS Jacksonville
Jacksonville, FL 32212-0300

Prepared by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, PA 15220-2745
(412)921-7090

Prepared under:
Comprehensive Long-Term Environmental Action Navy Contract
No. N62467-04-D-0055
Contract Task Order 0089

Review Signatures:

Mark Sladic
Task Order Manager
Tetra Tech NUS, Inc.

Kelly Carper
QA Manager
Tetra Tech NUS, Inc.

Approval Signatures:

NAVFAC QAO/Chemist
Printed Name
Approval Authority

TUCKERJONATHAN.P.1239524180

Digitally signed by TUCKERJONATHAN.P.1239524180
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=TUCKERJONATHAN.P.1239524180
Date: 2010.01.04 15:50:49 -05'00'

Charles Cook
Navy Remedial Project Manager
NAVFAC SE

SAP Worksheets **Page**

SAP Worksheet #1 -- Title and Approval Page 1
SAP Worksheet #2 -- SAP Identifying Information 13
SAP Worksheet #3 -- Distribution List 17
SAP Worksheet #4 -- Project Personnel Sign-Off Sheet 20
SAP Worksheet #5 -- Project Organizational Chart 23
SAP Worksheet #6 -- Communication Pathways 24
SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table 27
SAP Worksheet #8 -- Special Personnel Training Requirements Table 33
SAP Worksheet #9 -- Project Scoping Session Participants Sheet 34
SAP Worksheet #10 -- Problem Definition, Site History and Background 40
SAP Worksheet #11.1 - Data Quality Objectives for the Rifle Range at Ballast Creek (UXO 02) 66
SAP Worksheet #11.2 - Data Quality Objectives for Field Artillery West Main Range (UXO 04) and Field Artillery East Shrapnel Range (UXO 05 and 06) 69
SAP Worksheet #12 -- Measurement Performance Criteria Table Field Quality Control Sample – All fractions 74
SAP Worksheet #13 -- Secondary Data Criteria and Limitations Table 75
SAP Worksheet #14 -- Summary of Project Tasks 76
SAP Worksheet #15 – Reference Limits and Evaluation Table 83
SAP Worksheet #16 -- Project Schedule/Timeline Table 87
SAP Worksheet #17 – Sampling Design and Rationale 89
SAP Worksheet #18.1 – Rifle Range at Ballast Creek (UXO 02) Sampling Locations and Methods/SOP Requirements Table 96
SAP Worksheet #18.2 – Field Artillery West Main Range (UXO 04) Sampling Locations and Methods/SOP Requirements Table 98
SAP Worksheet #18.3 – Field Artillery East Shrapnel Range (UXO 05) Sampling Locations and Methods/SOP Requirements Table 104
SAP Worksheet #18.4 – Field Artillery East Shrapnel Range (UXO 06) Sampling Locations and Methods/SOP Requirements Table 105
SAP Worksheet #19 -- Analytical SOP Requirements Table 106
SAP Worksheet #20 -- Field Quality Control Sample Summary Table – Analytical Samples 107
SAP Worksheet #21 -- Project Sampling SOP References Table 109
SAP Worksheet #22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table 111
SAP Worksheet #23 -- Analytical SOP References Table 113
SAP Worksheet #24 -- Analytical Instrument Calibration Table 114
SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table 117
SAP Worksheet #26 -- Sample Handling System 119
SAP Worksheet #27 – Sample Custody Requirements Table 120
SAP Worksheet #28 -- Laboratory QC Samples Table 122
SAP Worksheet #29 -- Project Documents and Records Table 129
SAP Worksheet #30 -- Analytical Services Table 131
SAP Worksheet #31 -- Planned Project Assessments Table 132
SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses 133
SAP Worksheet #33 -- QA Management Reports Table 134
SAP Worksheet #34 -- Verification (Step I) Process Table 135
SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table 137
SAP Worksheet #36 –Analytical Data Validation (Steps IIa and IIb) Summary Table 140
SAP Worksheet #37 -- Usability Assessment 143

List of Figures

ES-1 Facility Location Map
ES-2 UXO 01, 02, 03, 04, 05, 06, 07, & 08 Location Map

10.1 Grenade Range Near Old Swimming Pool (UCO 01), Site Location
10.2 Rifle Range at Ballast Creek (UXO 02), Site Location
10.3 Aerial Bombing Target at Parade Deck (UXO 03), Site Location
10.4 Field Artillery West Main Range (UXO 04), Site Location
10.5 Field Artillery East Shrapnel Range (UXO 05/UXO 06), Site Location
10.6 Aerial Bombing Target at Golf Course (UXO 07), Site Location
10.7 Aerial Bombing Target at Southern Tidal Flats (UXO 08), Site Location

17.1 Rifle Range at Ballast Creek (UXO 02), MC Investigation Area
17.2 Field Artillery West Main Range (UXO 04), MC Investigation Area
17.3 Field Artillery East Shrapnel Range (UXO 05/UXO 06), MC Investigation Area

List of Appendices

Appendix A: UFP SAP for MEC (Volume II)
Appendix B: Project Support Information (on CD)
B1: Facility Background Concentrations
B2: Worksheet 15 Reference Limits and Background Tables
B3: Partnering Meeting Minutes and Meeting Notes
B4: Technical Site Information
B5: References
Appendix C: MC Field Standard Operating Procedures
Appendix D: Laboratory Standard Operating Procedures (on CD)

ACRONYMS

AET	Apparent Effects Threshold
ASR	Archive Search Report
AVS	Acid Volatile Sulfide
bgs	below ground surface
CAS	Chemical Abstract Service
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CD	Compact disk
CEC	cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHSO	Company Health and Safety Officer
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chain of custody
COMMARSYSCOM	Commander, Marine Corps Systems Command, Program Manager of Ammunition
CPR	Cardiopulmonary Resuscitation
CSM	Conceptual Site Model
CTO	Contract Task Order
CWAP	Comprehensive Work Approval Process
DDESB	Department of Defense Explosive Safety Board
DI	Deionized
DMM	Discarded Military Munitions
DoD	Department of Defense
DQI	Data Quality Indicator
DQO	Data Quality Objective
DVM	Data Validation Manager
EDD	Electronic data deliverable
Eco-SSL	Ecological Soil Screening Level
ELAP	Environmental Laboratory Approval Program
EOD	Explosive Ordnance Disposal
FFA	Federal Facilities Agreement
FOL	Field Operations Leader

FTMR	Field Task Modification Request
FUDS	Formerly Used Defense Sites
GIS	Geographic Information System
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDOP	Horizontal dilution of precision
HE	High Explosive
HPLC	High Performance Liquid Chromatography
HSM	Health and Safety Manager
IAS	Initial Assessment Study
IC	Initial calibration
ICP-MS	Inductively Coupled Plasma – Mass Spectrophotometer
ICV	Initial calibration verification
IDW	Investigation derived waste
IS	Incremental Sampling
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LIMS	Laboratory Information Management System
LUC	Land Use Control
MC	Munitions Constituents
MCRD	Marine Corps Recruit Depot
MDL	Method detection limit
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MPC	Measurement Performance Criteria
MPPEH	Material Potentially Presenting an Explosive Hazard
MRA/S	Munitions Response Area or Munitions Response Site
MRP	Munitions Response Program
MS	Matrix spike
MSD	Matrix spike duplicate
msl	mean sea level
NA	Not applicable
NAVFAC	Naval Facilities Engineering Command
NFA	No Further Action
NFESC	Naval Facilities Engineering Service Center

NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOSSA	Naval Ordnance Safety and Security Activity
OSHA	Occupational Safety and Health Administration
PAL	Project Action Limit
PM	Project Manager
POC	Point of Contact
ppm	parts per million
PPE	Personal Protective Equipment
PQLG	Project Quantitation Limit Goal
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
QSM	Quality Service Manual
RDX	cyclotrimethylene trinitramine
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSL	Regional screening level
SAP	Sampling and Analysis Plan
SCAR	Subcaliber aerial rockets
SCDHEC	South Carolina Department of Health and Environment Control
SDG	Sample delivery group
SDSL	Sediment Screening Level
SEM	Simultaneously extracted metals
SI	Site Inspection
SOP	Standard Operating Procedure
SQL	Structured query language
SSL	Soil Screening Level
SSO	Site Safety Officer
TBD	to be determined
TtNUS	Tetra Tech NUS, Inc.
TNT	trinitrotoluene

TOC	Total Organic Carbon
TOM	Task Order Manager
TP	Technical Paper
USEPA	United States Environmental Protection Agency
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
UV	Ultraviolet Detector
UXO	Unexploded Ordnance
WPTBN	Weapons and Field Training Battalion
WWII	World War II
XRF	X-ray Fluorescence

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has prepared this Sampling and Analysis Plan (SAP) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62467-04-D-0055 Contract Task Order (CTO) 89. This plan has been prepared for a Site Inspection (SI) at eight Munitions Response Areas or Munitions Response Sites (MRA/Ss) located at Marine Corps Recruit Depot (MCRD) Parris Island, South Carolina. The general location of MCRD Parris Island is shown on Figure ES-1.

The Navy has conducted various testing, training, and disposal activities related to military munitions at MCRD Parris Island which was established in 1915 as a recruit training facility. As a result of these activities, munitions and explosives of concern (MEC) and munitions constituents (MC) may be present at various sites throughout MCRD Parris Island. The term MEC includes Discarded Military Munitions (DMM), Unexploded Ordnance (UXO), and MC in high enough concentrations to pose an explosive hazard. MC is any material originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address MC and MEC at closed ranges. The DoD is following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for the investigation and remediation of these sites. The Navy is responsible for implementing the Munitions Response Program (MRP) at MCRD Parris Island.

An Archive Search Report (ASR) and Range Identification and Preliminary Range Assessment were completed in May 1999. Eight MRA/Ss were identified for further investigation at MCRD Parris Island. The eight MRA/Ss and their locations are described in the ASR and Range Identification and Preliminary Assessment and are shown on Figure ES-2 and listed below.

- Grenade Range Near Old Swimming Pool at Weapons and Field Battalion Area (UXO 01)
- Rifle Range at Ballast Creek (UXO 02)
- Aerial Bombing Target at Parade Deck (UXO 03)
- Field Artillery West Main Range (UXO 04)
- Field Artillery East Shrapnel Range (UXO 05 and UXO 06)
- Aerial Bombing Target at Golf Course (UXO 07), and
- Aerial Bombing Target at Southern Tidal Flats (UXO 08).

This Quality Assurance Project Plan (QAPP)-SAP has been prepared in accordance with the DoD requirements for developing QAPPs for the management of environmental data collection and the use of environmental data as described in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP aka UFP-SAP).

The SI objective is to determine whether further response actions or remedial investigations (RIs) are appropriate for any of the sites identified in the ASR and Range Identification and Preliminary Range Assessment to restore the sites to an acceptable environmental condition. The SI investigative plan is based on background information provided in the ASR and will govern the collection of supplemental site-specific environmental data to further characterize the nature and extent of MEC and MC at the sites identified in the ASR.

This SI plan for the eight sites consists of two distinctly different investigations, which will be conducted in two phases. The first phase consists of the MEC investigations which include detector-aided surface surveys for MEC followed by subsurface geophysics investigations. These investigations will be conducted at all sites other than UXO 01 and UXO 02. As discussed below UXO 01 will not be investigated and MEC is not of concern at UXO 02. The SAP for the MEC investigation is described in Appendix A to this SAP. The second phase of investigation consists of the MC investigation. The results of the detector-aided surface and geophysics investigations will be used to determine the locations where samples will be collected in the MC investigation at UXO 04, 05, and 06. This SAP (except Appendix A) describes the MC investigation.

UXO 02, UXO 04, UXO 05, and UXO 06 are scheduled for MC investigations. MC investigations will not be conducted at UXO 03; however, this site will be investigated to determine types of construction material and depth of grade of the parade deck. UXO 04, UXO 05, UXO 06, UXO 07, and UXO 08 are scheduled for MEC investigations. Figure ES-1 presents a location map of MCRD Parris Island and Figure ES-2 shows the locations of the eight UXO sites listed above. Brief summaries of these sites are presented below.

Grenade Range Near Old Swimming Pool at Weapons and Field Battalion Area (UXO 01)

Identification of this grenade range is based solely on the recollection of a single interviewee, out of the 25 who were contacted during the ASR. This interviewee indicated the potential for a grenade range to have existed near the old swimming pool at the Weapons and Field Battalion Area during his recruit training in 1943. Details of the interview are provided in the ASR and Appendix B4 of this UFP-SAP. The existence of this grenade range could not be confirmed after a search of contemporary maps, aerial

photographs from 1945, and other historical documents. Based on the lack of evidence (i.e., records indicating location, use, operating procedures, etc.) supporting the existence of the Grenade Range, the Project Team concluded that the range did not exist at this location and this grenade range will not be investigated as part of this SI. A summary of the grenade range interview, physical evidence related to the location of the site, and historical records is presented in Worksheet 10 of this SAP.

Rifle Range at Ballast Creek (UXO 02)

The Rifle Range at Ballast Creek was the first identified range in use at Parris Island and was located on the high ground of an inside bend of Ballast Creek, south of the contemporary Quarantine/Receiving Station. If present, the highest concentration of antimony, arsenic, copper, lead, and zinc are expected to be located in sediment (0 to 6 inches and 2 to 3 feet below the sediment surface), in the area of the concrete target foundations and in the surface soil upgradient of the concrete target foundations. Lead is the primary constituent of concern because it is the primary constituent in the spent munitions used at this site. Data must be collected to determine whether lead, which is also used as a marker chemical for the presence of antimony, arsenic, copper, and zinc, is present at concentrations that pose a potential unacceptable risk to human health and the environment, and whether further investigation of the site is required. The MC SI field investigation includes the collection of sediment samples in the area of the concrete target foundation and surface soil samples in areas upgradient of the concrete target foundations for lead analysis.

Aerial Bombing Target at Parade Deck (UXO 03)

The former Aerial Bombing Target at Parade Deck was known to be located on the parade deck as early as 1937. The target consisted of concentric circles outlined on the ground which would have been visible from the air. Target use ceased when the parade field was paved in the early 1940s. Additional paved parking lots and buildings have also been built in this area since that time. Reportedly, miniature practice bombs were the ordnance used for target practice at this time. The existence of MEC in subsurface soil (depths of 2 bgs or greater) is unknown in unpaved areas of UXO 03. The subsurface soil will be investigated during the SI in an attempt to find MEC at this site. The MEC SI field investigation will include subsurface geophysical surveys of the unpaved area north of the parade deck. Sample cores will also be collected from the parade deck to determine construction materials and depth of grade.

Field Artillery West Main Range (UXO 04)

In 1937, the Marines established two impact areas for field artillery firing, the West Main Range (being the larger of the two) and the Field Artillery East Shrapnel Range. Munitions use included artillery

ammunition for 75mm guns and howitzers, M1897 and M1, respectively. Types of munitions used at this range included High Explosive (HE) and shrapnel. The primary types of MC which may be present at the Field Artillery West Main Range are trinitrotoluene (TNT), black powder, and lead. It is unknown whether MEC or MC contamination exists at the Field Artillery West Main Range in the soil or sediment at the impact/target areas or firing points. Soil and sediment will be investigated during the SI to determine whether MEC or MC are present in quantities, conditions, or concentrations that pose a safety hazard or a potential unacceptable risk to human health or the environment, and whether further investigation of the site is required. In addition to investigating this site for potentially unacceptable concentrations of select metals and explosives, at the UXO 04 Impact Area, begin to delineate potentially unacceptable contamination, if found. The MEC SI field investigation will include detector-aided surface surveys, land-based subsurface geophysical surveys, and boat-based aquatic geophysical surveys. The MC SI field investigation will include XRF field screening for lead, Incremental Sampling (IS) of select soil or sediment locations for explosives analysis, and discrete soil or sediment sampling at select locations for lead analysis.

Field Artillery East Shrapnel Range (UXO 05 and UXO 06)

The Field Artillery East Shrapnel Range has been designated as UXO 05 (northern portion which includes the firing point) and UXO 06 (southern portion which includes the impact area). Presumably, the ordnance used included 75mm gun ammunition. The primary types of MC at the Field Artillery East Shrapnel Range are TNT, black powder, and lead. Soil and sediment will to be investigated during the SI to determine if MEC or MC are present in quantities, conditions, or concentrations that pose a safety hazard or a potential unacceptable risk to human health or the environment, and if further investigation of the site is required. At UXO 05, the MEC SI field investigation will include detector-aided surface surveys and a boat-based aquatic geophysical survey. The MC field investigation will consist of the collection of one IS sample at the firing point for explosives analysis and two discrete soil samples for lead analysis. At UXO 06, a boat-based aquatic geophysical survey combined with a limited detector-aided surface survey of selected dry accessible areas is planned. Two potentially dry areas within the impact end of the range fan have also been selected for detector-aided surface surveys. The MC field investigation at UXO 6 will consist of collection of discrete sediment samples within the accessible waterways for analysis of explosives and lead and possibly the collection of additional discrete sediment samples if dry areas of the site are found that are accessible by foot.

Aerial Bombing Target at Golf Course (UXO 07)

The former Aerial Bombing Target at Golf Course was established as a replacement for the Aerial Bombing Target at Page Field in 1942. At both of these targets, miniature practice bombs were used and there is no evidence that other types of bombs were used at the Aerial Bombing Target at Golf Course. Range use is thought to have ceased in July 1946. The construction of a golf course was completed over the target area in 1948. The former target center was located on the green of the present day eighth hole. It is unknown whether MEC contamination is present on the surface or in the subsurface soil at the former Aerial Bombing Target location of the Golf Course. Soil will be investigated during the SI in an attempt to find MEC. The MEC SI field investigation will include detector-aided surface surveys and subsurface geophysical surveys in the undeveloped areas of the golf course bomb target area. Subsurface geophysical surveys will also be conducted in the developed area of the golf course green.

Aerial Bombing Target at Southern Tidal Flats (UXO 08)

The former Aerial Bombing Target at Southern Tidal Flats existed on the tidal flats south of the golf course. Presumably, the time frame of range use spanned World War II (WWII), though the target is barely discernable on 1945 aerial imagery. Two 10-foot tall metal posts, which formed the target's center, and other rusty sheet metal debris apparently from 100-pound practice bombs have been found. This rusty sheet metal debris is considered munitions debris (MD) and not MEC. Sediment will be investigated during the SI to determine whether MEC are present in quantities or a condition that pose a safety hazard. The MEC SI field investigation includes detector-aided surface and subsurface geophysical surveys within a 650-foot-diameter area centered on the bombing target circle.

SAP Worksheet #2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: MCRD, Parris Island, South Carolina
Operable Units: UXO 01, 02, 03, 04, 05, 06, 07, and 08
Contractor Name: Tetra Tech NUS, Inc. (TtNUS)
Contract Number: N62467-04-D-0055
Contract Title: CLEAN
Work Assignment Number (optional): CTO 0089

1. This SAP was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (U.S. EPA, 2005) and *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (2002)*.

2. Identify regulatory program: DoD Military MRP using the general CERCLA process.

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Meeting No. 1 – Kick-off Meeting	March 18 & 19, 2009
Meeting No. 2 – Data Quality Objective (DQO) Facilitation	May 18-20, 2009

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Not applicable – This is the initial MRP SI	

6. List organizational partners (stakeholders) and connection with lead organization:

United States Environmental Protection Agency (USEPA) Region 4 – Regulatory Oversight for MCRD Parris Island
South Carolina Department of Health and Environment Control (SCDHEC) – Regulatory Oversight for MCRD Parris Island
Marine Corps Recruit Depot (MCRD) Parris Island – Facility Oversight

7. Lead organization (see WS 7 for detailed list of data users)
Naval Facilities Engineering Command (NAVFAC) Southeast

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

   All SAP elements and required information are applicable.

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	NA
2	Table of Contents SAP Identifying Information	NA
3	Distribution List	NA
4	Project Personnel Sign-Off Sheet	NA
Project Organization		
5	Project Organizational Chart	NA
6	Communication Pathways	NA
7	Personnel Responsibilities and Qualifications Table	NA
8	Special Personnel Training Requirements Table	NA
Project Planning/Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	NA
10	Problem Definition, Site History, and Background. Site Maps (historical and current)	NA
11	Site-Specific Project Quality Objectives	NA
12	Measurement Performance Criteria Table	NA
13	Sources of Secondary Data and Information, Secondary Data Criteria and Limitations Table	NA
14	Summary of Project Tasks	NA
15	Reference Limits and Evaluation Table	NA
16	Project Schedule/Timeline Table	NA
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	NA
18	Sampling Locations and Methods/Standard Operating Procedure (SOP) Requirements Table Sample Location Map(s)	NA
19	Analytical Methods/SOP Requirements Table	NA
20	Field Quality Control Sample Summary Table	NA
21	Project Sampling SOP References Table, Sampling SOPs	NA
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	NA
Analytical Tasks		
23	Analytical SOPs, Analytical SOP References Table	NA
24	Analytical Instrument Calibration Table	NA
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	NA

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving, and Disposal Sample Handling Flow Diagram	NA
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	NA
Quality Control (QC) Samples		
28	QC Samples Table, Screening/Confirmatory Analysis Decision Tree	NA
Data Management Tasks		
29	Project Documents and Records Table	NA
30	Analytical Services Table Analytical and Data Management SOPs	NA
C. Assessment Oversight		
31	Planned Project Assessments Table, Audit Checklists	NA
32	Assessment Findings and Corrective Action Responses Table	NA
33	Quality Assurance (QA) Management Reports Table	NA
D. Data Review		
34	Verification (Step I) Process Table	NA
35	Validation (Steps IIa and IIb) Process Table	NA
36	Validation (Steps IIa and IIb) Summary Table	NA
37	Usability Assessment	NA

SAP Worksheet #3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipient	Title/Role	Organization	Telephone Number (Optional)	E-Mail or Mailing Address	Document Control Number (Optional)
Charles Cook	Navy Remedial Project Manager (RPM)/Manages Project Activities for Navy	NAVFAC Southeast	904.542.6409	charles.cook2@navy.mil	Not Applicable (NA)
Tim Harrington	MCRD Point of Contact (POC)/Manages Site Activities	MCRD Parris Island	843.228.3423	timothy.j.harrington@usmc.mil	NA
Meredith Amick	SCDHEC Project Manager (PM)/Provides State Regulator Input	SCDHEC	803.896.4218	amickms@dhec.sc.gov	NA
Annie Gerry	SCDHEC Geologist/Hydrologist/Provides State Regulator Input	SCDHEC	803.896.4018	gerryam@dhec.sc.gov	NA
Lila Llamas	USEPA Region 4 RPM/Provides USEPA Regulator Input	USEPA Region 4	404.562.9969	llamas.lila@epa.gov	NA
Debbie Humbert	Program Manager/Manages Program Activities	TtNUS	412.921.8968	debra.humbert@tetratech.com	NA

Name of SAP Recipient	Title/Role	Organization	Telephone Number (Optional)	E-Mail or Mailing Address	Document Control Number (Optional)
Mark Sladic	Task Order Manager (TOM)/Manages Project Activities	TtNUS	412.921.8216	mark.sladic@tetratech.com	NA
Ralph Brooks	UXO/MEC Manager/Manages Corporate MEC Hazards and Risks	TtNUS	770.413.0965 x231	ralph.brooks@tetratech.com	NA
Stanley Conti	Field Operations Leader MC FOL/Manages Field Operations	TtNUS	412.921.8422	stanley.conti@tetratech.com	NA
Matt Kraus (shared copy with Joe Samchuck)	Project Chemist/Provides Technical Coordination with Laboratories	TtNUS	412.921.8729	matt.kraus@tetratech.com	NA
Joseph Samchuck (shared copy with Matt Kraus)	Data Validation Manager (DVM) /Manages Data Validation	TtNUS	412.921.8510	joseph.samchuck@tetratech.com	NA
Matt Soltis [Health and Safety Plan (HASP)]	Health and Safety Manager (HSM)/Manages Corporate Health and Safety Program	TtNUS	412.921.8912	matt.soltis@tetratech.com	NA
Kate Zaleski	Laboratory PM/Representative for Laboratory and Analytical Issues	Katahdin Analytical Services	207.874.2400 x17	kzaleski@katahdinlab.com	NA

Name of SAP Recipient	Title/Role	Organization	Telephone Number (Optional)	E-Mail or Mailing Address	Document Control Number (Optional)
David Howell	Laboratory PM/Representative for Laboratory and Analytical Issues	GPL Laboratories	301.694.5310	howell@gplab.com	NA

SAP Worksheet #4 -- Project Personnel Sign-Off Sheet

(UFP-QAPP Manual Section 2.3.2)

Certification that project personnel have read the text will be obtained by one of the following methods as applicable:

1. In the case of regulatory agency personnel with oversight authority approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters / e-mails will be retained in the project files and are listed in Worksheet 29 as project records.

2. E-mails will be sent to Navy, TtNUS, and subcontractor project personnel whom will be requested to verify by e-mail that they have read the applicable SAP / sections and the date on which they were reviewed. Copies of the verification e-mail will be included in the project files and identified in Worksheet 29.

A copy of the signed Worksheet 4 will be retained in the project files and identified as a project document in Worksheet 29.

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Navy and Regulator Project Team Personnel					
Charles Cook	Navy RPM/Manages Project Activities for Navy	904.542.6409	See Worksheet 1 for signature	All	
Tim Harrington	MCRD POC/Manages Site Activities	843.228.3423		All	
Meredith Amick	SCDHEC PM/Provides Regulator Input	803.896.4218		All	

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Annie Gerry	SCDHEC Geologist/Hydrologist/Provides Regulator Input	803.896.4018		All	
Lila Llamas	USEPA Region 4 RPM/Provides USEPA Regulator Input	404.562.9969		All	

TtNUS Project Team Personnel

Mark Sladic	TOM/Manages Project Activities	412.921.8216	See Worksheet 1 for signature	All	
Ralph Brooks	UXO/MEC Manager/Manages Corporate MEC Hazards and Risk	770.413.0965 x231		Worksheets 10, 11, and 17	
Stanley Conti	MC FOL/Manages Field Operations	412.921.8422		MC Worksheets	
Kelly Carper	Quality Assurance Manager (QAM)/Manages Corporate QA Program and Implementation	412.921.7273	See Worksheet 1 for signature	All	
Matt Kraus	Project Chemist/Provides Coordination with Laboratories	412.921.8729		Worksheets 12, 14, 15, 19, 20, 23-28, 30, 34-37	
Matt Soltis	HSM/Manages Corporate Health and Safety Program	412.921.8912	See signature on HASP	HASP Worksheet 17	

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Joseph Samchuck	DVM/Manages Data Validation	412.921.8510		Worksheets 12, 14, 15, 19, 20, 23-28, 30, 34-37	

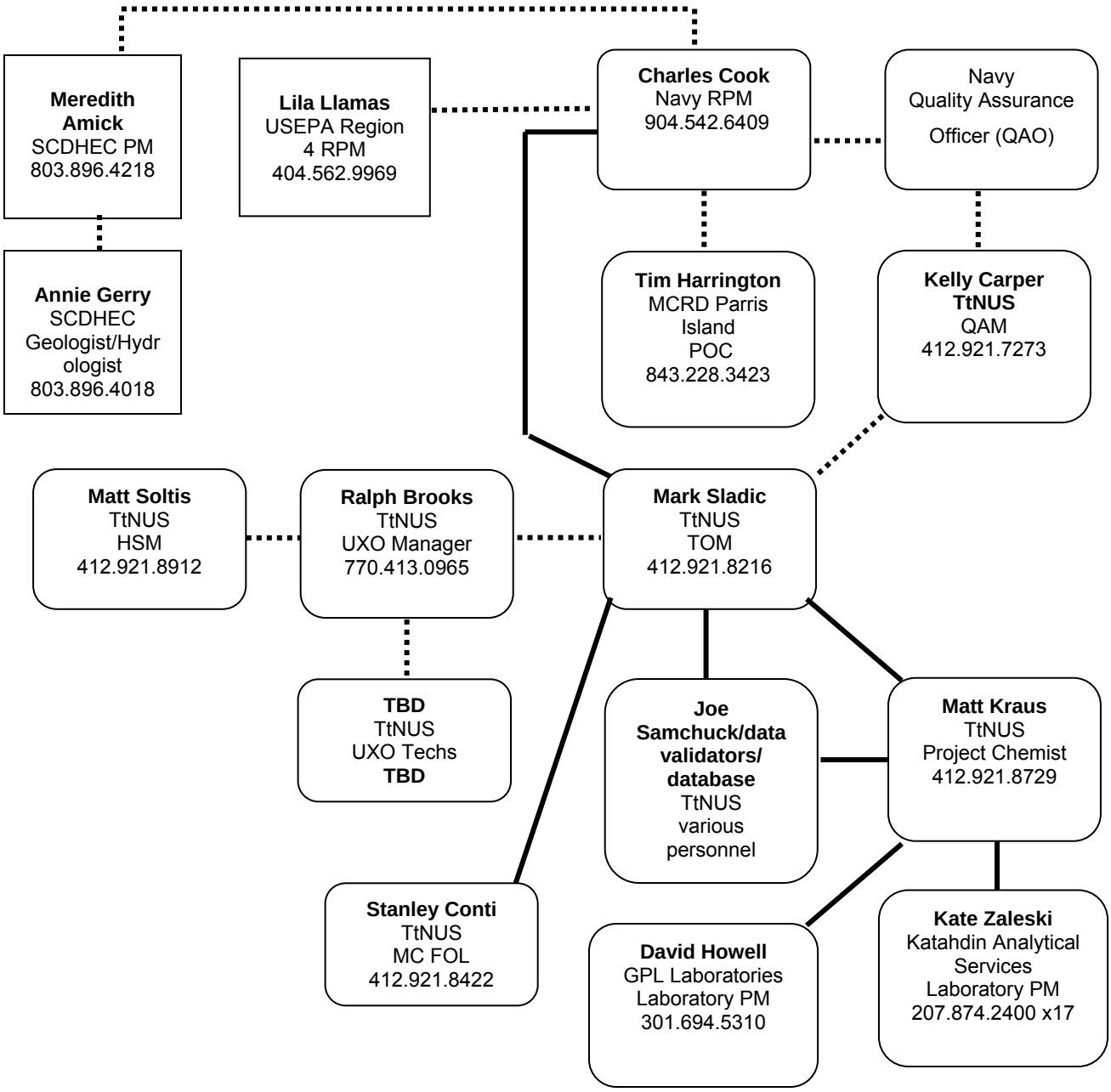
Subcontractor Personnel

Kate Zaleski	Katahdin Analytical Services/Laboratory PM/Representative for Laboratory and Analytical Issues	207.874.2400 x17		Worksheets 12, 14, 15, 19, 20, 23-28, 30, 34-37	
David Howell	GPL Laboratories/Laboratory PM/Representative for Laboratory and Analytical Issues	301.694.5310		Worksheets 12, 14, 15, 19, 20, 23-28, 30, 34-37	

SAP Worksheet #5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ——— Lines of Communication



SAP Worksheet #6 -- Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
MEC Detections/Observations	TtNUS Field Staff TtNUS UXO Manager TtNUS TOM Navy RPM MCRD POC SCDHEC PM USEPA RPM	TBD Ralph Brooks Mark Sladic Charles Cook Tim Harrington Meredith Amick Lila Llamas	TBD 770.413.0965 x 231 412.921.8216 904.542.6409 843.228.3423 803.896.4218 404.562.9969	Within 30 minutes TtNUS UXO technician will notify field staff, secure area, and contact TtNUS UXO Manager. TtNUS UXO Manager will verbally inform TtNUS TOM the same day. TtNUS TOM will notify Navy RPM and MCRD POC on the same day. MCRD POC or designee will immediately make base emergency notifications and will notify SCDHEC and USEPA. Navy RPM will inform Commander, Marine Corps Systems Command, Program Manager of Ammunition (COMMARSYSCOM) on the same day as informed.
Field issues that require change in field tasks	TtNUS FOL TtNUS TOM Navy RPM SCDHEC PM USEPA RPM	Stanley Conti Mark Sladic Charles Cook Meredith Amick Lila Llamas	412.921.8422 412.921.8216 904.542.6409 803.896.4218 404.562.9969	TtNUS FOL will inform TtNUS TOM on the day the issue is discovered; TtNUS PM will inform Navy RPM within 1 business day; Navy RPM will issue scope change approval (verbally or via e-mail) if warranted scope change to be implemented before work is executed. Document via Field Task Modification Request (FTMR) form within 2 days. TtNUS TOM will notify SCDHEC and USEPA either verbally or via e-mail.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
SAP amendments	TtNUS TOM Navy RPM	Mark Sladic Charles Cook	412.921.8216 904.542.6409	TtNUS TOM will notify Navy RPM Program Management Office via e-mail within 1 business day. TtNUS TOM will send scope changes to Project Team.
Fieldwork schedule changes	TtNUS TOM MCRD POC SCDHEC PM USEPA RPM	Mark Sladic Tim Harrington Meredith Amick Lila Llamas	412.921.8216 843.228.3423 803.896.4218 404.562.9969	Verbally inform Navy on the day that schedule change is known and document via schedule impact letter as soon as impact is realized. TtNUS TOM will notify SCDHEC and USEPA either verbally or via e-mail.
Field issues that require changes in the scope of field work	TtNUS TOM TtNUS FOL MCRD POC Navy RPM SCDHEC PM USEPA RPM	Mark Sladic Stanley Conti Tim Harrington Charles Cook Meredith Amick Lila Llamas	412.921.8216 412.921.8422 843.228.3423 904.542.6409 803.896.4218 404.562.9969	TtNUS FOL will verbally inform TtNUS TOM on the day that the issue is discovered. TtNUS TOM will inform Navy RPM and MCRD POC. Navy RPM will issue scope change, if warranted; scope change to be implemented before further work is executed. TtNUS TOM will notify SCDHEC and USEPA either verbally or via e-mail.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
Recommendation to stop work and initiate work upon correction action	TtNUS TOM TtNUS FOL TtNUS QAM TtNUS Project Chemist TtNUS HSM Navy RPM MCRD POC	Mark Sladic Stanley Conti Kelly Carper Matt Kraus Matt Soltis Charles Cook Tim Harrington	412.921.8216 412.921.8422 412.921.7273 412.921.8729 412.921.8912 904.542.6409 843.228.3423	Within 1 hour, the TtNUS FOL will (verbally or via e-mail) inform subcontractors and TtNUS TOM. TtNUS TOM will inform the TtNUS QAM, Navy RPM, and the project team.
Field or laboratory data issues	TtNUS FOL TtNUS Project Chemist Analytical Laboratory Analytical Laboratory	Stanley Conti Matt Kraus Kate Zaelski David Howell	412.921.8422 412.921.8729 207.874.2400 x17 301.694.5310	Within 1 day of the time the issues related to chemical data are discovered the analytical laboratory will notify TtNUS Project Chemist. TtNUS Project Chemist will notify (verbally of via e-mail) data validation staff and TtNUS TOM. If field issues, TtNUS FOL will notify TtNUS TOM within 1 day of time issue is discovered.
Corrective action for field program	TtNUS QAM	Kelly Carper	412.921.7273	TtNUS QAM will notify TtNUS TOM within one day that the corrective action has been completed. The TtNUS TOM will then notify the Navy RPM within 1 day.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Debra Humbert	Program Manager	TtNUS	Oversees CLEAN Program.	B.S., Chemical Engineering, over 28 years of environmental experience
Mark Sladic	TOM	TtNUS	Oversees project, financial, schedule, and technical day-to-day management of the project. • Ensures timely resolution of project-related technical, quality, and safety questions associated with TtNUS operations. • Functions as the primary TtNUS interface with the Navy RPM, MCRD Parris Island POC, TtNUS field and office personnel, and laboratory points of contact. • Ensures that TtNUS health and safety issues related to this project are communicated effectively to all personnel and off-site laboratories. • Monitors and evaluates all TtNUS subcontractor performance. • Coordinates and oversees work performed by TtNUS field and office technical staff (including data validation, data interpretation, and report preparation). • Coordinates and oversees maintenance of all TtNUS project records. • Coordinates and oversees review of TtNUS project deliverables. • Prepares and issues final TtNUS deliverables to the Navy.	B.S., Mechanical Engineering, 20 years of environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Ralph Brooks	UXO/MEC Manager	TtNUS	Oversees selection of qualified UXO personnel, establishes overall quality control program for UXO activities, addresses UXO-related issues identified by field personnel.	Graduate of Navy Explosive Ordnance Disposal (EOD) School - Indian Head, 26 years of EOD experience
TBD	UXO Tech III	TtNUS	Provides anomaly avoidance services.	Graduate, Military EOD School, minimum 8 years of military experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Stanley Conti	FOL, Site Safety Officer (SSO)	TtNUS	Supervises, coordinates, and performs field sampling activities. • Ensures that all health and safety requirements unique to the SI are implemented. • Functions as the on-site communications link between field staff members, MCRD Parris Island POC, and TtNUS TOM. • Alerts off-site analytical laboratories of any special health and safety hazards associated with environmental samples. • Oversees the mobilization and demobilization of all field equipment and subcontractors. • Coordinates and manages the field technical staff. • Adheres to the work schedules provided by the TtNUS TOM. • Ensures the proper maintenance of site logbooks, field logbooks, and field recordkeeping. • Initiates FTMRs (field change orders) when necessary. • Identifies and resolves problems in the field, resolves difficulties via consultation with the MCRD Parris Island POC, implements and documents corrective action procedures, and provides communication between the field team and project management. • As the SSO, is responsible for training and monitoring site conditions. The SSO reports to the Company Health and Safety Officer (CHSO) and ito the TtNUS TOM. Details of the SSO's responsibilities are presented in the HASP	Senior Geologist, B.S. Geology, over 25 years of geologic and environmental experience. Registered Licensed Geologist – South Carolina

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Kelly Carper	QAM	TtNUS	Reviews SAP, oversees preparation of laboratory scope, coordinates with laboratory, and data quality review. Ensures quality aspects of the CLEAN program. • Develops, maintains, and monitors QA policies and procedures. • Provides training to TtNUS staff in QA/QC policies and procedures. • Conducts systems and performance audits to monitor compliance with environmental regulations, contractual requirements, SAP requirements, and corporate policies and procedures. • Audits project records. • Monitors subcontractor quality controls and records. • Assists in the development of corrective action plans and ensuring correction of non-conformances reported in internal or external audits. • Ensures that this SAP meets TtNUS, Navy, and SCDHEC requirements. • Oversees the responsibilities of the TtNUS Project QA/QC Advisor. • Prepares QA reports for management.	B.S., Biology, 16 years environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Matt Kraus	Project Chemist	TtNUS	Coordinates analyses with laboratory chemists, ensures the laboratory scope of work is followed, reviews data packages, and communicates with TtNUS staff. • Ensures that the project meets laboratory performance objectives. • Provides technical advice to the TtNUS team on matters of project chemistry. • Monitors and evaluates subcontractor laboratory performance. • Ensures timely resolution of laboratory-related technical, quality, or other issues affecting project goals. • Functions as the primary interface with the subcontracted laboratory and the TtNUS TOM. • Coordinates and oversees work performed by the subcontracted laboratory. • Oversees the completion of TtNUS data validation. • Coordinates and oversees review of laboratory deliverables. • Recommends appropriate laboratory corrective actions.	B.S., Environmental Chemistry, 3 years environmental experience
Joseph Samchuck	DVM	TtNUS	Ensures the QA of data validation deliverables. • Oversees data validation activities • Serves as communication link between TtNUS and laboratories on data validation and electronic data positing activities. Establishes TtNUS data validation protocols in support of projects.	B.S. Chemistry, MBA, M.S. Finance, 23 years environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Matt Soltis	HSM	TtNUS	Oversees CLEAN Program Health and Safety Program • Provides technical advice to the TtNUS TOM on matters of health and safety. • Oversees the development and review of the HASP. • Conducts health and safety audits. • Prepares health and safety reports for management.	B.S., Industrial Safety Sciences, 24 years environmental experience
Kate Zaleski	Laboratory PM	Katahdin Analytical Services	Coordinates analyses with laboratory chemist (and GPL Laboratories), ensures that scope is followed, QAs data packages, and communicates with TtNUS staff.	Available upon request.
David Howell	Laboratory PM	GPL Laboratories	Coordinates analyses with Katahdin Analytical Services, ensures that scope is followed, QAs data packages, and communicates with TtNUS staff.	Available upon request.
TBD	Utility Location	TBD	Utility location.	

SAP Worksheet #8 -- Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/ Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Personnel	(1)	Various	Current	UXO and field sampling personnel	All Field Team Staff/ TtNUS	TtNUS project office and field office
FOL	Supervisor Training(1)	Various	Current	FOL	FOL/TtNUS	TtNUS project office and field office
SSO	First Aid/ Cardiopulmonary Resuscitation (CPR)(1)	Red Cross	Current	Field Personnel	SSO/TtNUS	TtNUS project office and field office
UXO Avoidance	Various training elements, as required in Department of Defense Explosive Safety Board (DDESB) Technical Paper (TP)-18(1)	DoD or other approved formal course	Current	UXO Technicians supporting UXO avoidance	UXO Technician/ TtNUS	TtNUS project office and field office

1. All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed routine training including a 40-hour course (and 8-hour refresher, if applicable) in Hazardous Waste Operations and Emergency Response (HAZWOPER) training as described under Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(b)(4).

SAP Worksheet #9 -- Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

Project Name: MCRD Parris Island SI Projected Date(s) of Sampling: Fall/Winter 2009 Project Manager: Mark Sladic	Site Name: Site Inspection at Eight Munitions Response Sites Site Location: Parris Island – Marine Corps Recruit Depot, Beaufort County, South Carolina

Date of Session: March 18 – 19, 2009

Name	Title	Affiliation	Phone Number	E-Mail Address	Project Role
Tim Harrington	MCRD Parris Island POC	MCRD Parris Island	843.228.3423	timothy.j.harrington@usmc.mil	MCRD POC
Meredith Amick	SCDHEC PM	SCDHEC	803.896.4218	amickMS@dhec.sc.gov	SCDHEC PM
Charles Cook	Navy RPM	NAVFAC SE	904.542.6409	charles.cook2@navy.mil	Navy RPM
Annie Gerry	SCDHEC	SCDHEC	803.896.4018	GerryAM@dhec.sc.gov	SCDHEC
Lila Llamas	USEPA RPM	USEPA Region 4	404.562.9969	Llamas.Lila@epa.gov	USEPA RPM
Heber Pittman	MCRD Parris Island alternate POC	MCRD Parris Island	843.228.3615	darrel.pittman@usmc.mil	MCRD Parris Island
Mac McRae	USEPA Contractor	TechLaw, Inc.	678.493.1247	mmcrae@TechLawInc.com	USEPA Support (General)
Bob Bohn	USEPA Contractor	TechLaw, Inc	360.333.2959	Rbohn@TechLawInc.com	USEPA Support (MRP/UXO)
Joe Bowers	SCDHEC	SCDHEC	803.896.4024	BOWERSJB@dhec.sc.gov	SCDHEC
Laurel Rhoten	SCDHEC	SCDHEC	843.846.1030	RHOTENLA@dhec.sc.gov	SCDHEC District Office
Kelly Taylor	MCRD Contractor	CH2M Hill	214.324.1430	Kelly.Taylor2@ch2m.com	MCRD Support (General)
Debra Kraemer	Meeting Facilitator	The Management Edge	813.254.4535	KRAEMERd@tampabay.rr.com	Meeting Facilitator

Project Name: MCRD Parris Island SI Projected Date(s) of Sampling: Fall/Winter 2009 Project Manager: Mark Sladic	Site Name: Site Inspection at Eight Munitions Response Sites Site Location: Parris Island – Marine Corps Recruit Depot, Beaufort County, South Carolina

Date of Session: March 18 – 19, 2009

Libby Claggett	TtNUS Project Management Support	TtNUS	904.730.4669 x212	libby.claggett@TetraTech.com	Scribe
Mark Sladic	TtNUS TOM	TtNUS	412.921.8216	mark.sladic@tetratech.com	TOM
Ralph Brooks	TtNUS UXO Manager	TtNUS	770.413.0965 x-231	ralph.brooks@tetratech.com	UXO Manager
Ralph Basinski	TtNUS MRP Coordinator	TtNUS	412.921.8308	ralph.basiniski@tetratech.com	MRP Coordinator
Michelle Blanken	TtNUS Technical Support	TtNUS	412.921.8549	michelle.blanken@tetratech.com	Technical Support

Comments/Discussion:

TtNUS provided an overview of the SAP worksheets for the MRP. Team members were provided the opportunity to ask questions regarding the SAP worksheets. SCDHEC e-mailed verbal comments from the meeting and other written comments to TtNUS. After incorporating verbal and e-mailed comments, TtNUS submitted the document in draft form for formal comment. Individual verbal comments on the SAP received during the meeting have been captured and documented in the MCRD Parris Island Partnering Meeting Minutes and TtNUS meeting notes and are presented in Appendix B3. Draft DQOs were developed and DQO outputs of the meeting are presented in the worksheets in this SAP submittal.

Action Items:

- TtNUS to propose soil and sediment project action limits (PALs) to be used for Parris Island in the SAP.
- TtNUS to review the background data set for Site 3 and propose if it is appropriate for use at the UXO sites (for sediment and soil).
- TtNUS to add additional information concerning the existence/non-existence of UXO 01.

- Heber Pittman (MCRD Parris Island) to investigate whether or not permission is required to leave cut vegetation in marsh areas.

- Tim Harrington (MCRD Parris Island) to investigate any flying restrictions associated with the aerial magnetometer survey for UXO 06.

- TtNUS to update SAP with the verbal comments noted carrying the concepts throughout the document to the remaining, similar worksheets.

- MCRD Parris Island to research construction materials and methods for the parade deck and parking lot at UXO 03.

- Any verbal notes/comment from Project Team on SAP not captured during meeting discussion (as documented on Partnering Meeting Minutes) will be e-mailed to TtNUS.

Consensus Decisions:

- UXO 02: Sediment samples will be collected in the area of the concrete target foundations. If located, and if accessible, soil samples will be collected at the firing line. The UXO 02 site boundary will need to be adjusted to account for no stop/no berm for bullets and may need to be revised based on the orientation of the range/firing line and the results of the SI.

- UXO 03: A geophysical investigation will not be conducted on the paved area at this site. It was agreed that the grassy area would be the starting point for UXO 03. Once the results of investigations in grassy area are known, the Project Team will make a decision as to what to do about paved area within site boundary.

- Soil property data may be added to analysis at sites where soils samples are proposed for collection, i.e., pH, total organic carbon (TOC), and cation exchange capacity (CEC). Sediment samples will be analyzed for TOC. Sediment samples will not be analyzed for grain size, acid volatile sulfides (AVS), simultaneously extracted metals (SEM), or other sediment characterization properties during SI phase of investigation if necessary, these parameters will be analyzed during future phases of investigation. Results from these analyses will be utilized in argument(s) regarding the applicability of background and fate and transport (evaluation of mobility and/or leachability of MC in detected site media) with respect to recommendations to investigate additional media (subsurface soil, groundwater, surface water).

Project Name: MCRD Parris Island SI Projected Date(s) of Sampling: Fall/Winter 2009 Project Manager: Mark Sladic	Site Name: Site Inspection at Eight Munitions Response Sites Site Location: Parris Island – Marine Corps Recruit Depot, Beaufort County, South Carolina

Date of Session: May 18 – 20, 2009

Name	Title	Affiliation	Phone Number	E-Mail Address	Project Role
Tim Harrington	MCRD Parris Island POC	MCRD Parris Island	843.228.3423	timothy.j.harrington@usmc.mil	MCRD POC
Meredith Amick	SCDHEC PM	SCDHEC	803.896.4218	amickMS@dhec.sc.gov	SCDHEC PM
Charles Cook	Navy RPM	NAVFAC SE	904.542.6409	charles.cook2@navy.mil	Navy RPM
Annie Gerry	SCDHEC	SCDHEC	803.896.4018	GerryAM@dhec.sc.gov	SCDHEC
Lila Llamas	USEPA RPM	USEPA Region 4	404.562.9969	Llamas.Lila@epa.gov	USEPA RPM
Tim Frederick	USEPA	USEPA Region 4	404.562.8598	frederick.tim@epa.gov	USEPA
Heber Pittman	MCRD Parris Island alternate POC	MCRD Parris Island	843.228.3615	darrel.pittman@usmc.mil	MCRD Parris Island
Mac McRae	USEPA Contractor	TechLaw, Inc.	678.493.1247	mmcrae@TechLawInc.com	USEPA Support (General)
Joe Bowers	SCDHEC	SCDHEC	803.896.4024	BOWERSJB@dhec.sc.gov	SCDHEC
Susan Byrd	SCDHEC	SCDHEC	803.896.4188	byrdsk@dhec.sc.gov	SCDHEC
Stacey French	SDCHEC, Tier II Link	SCDHEC	803.896.4255	frenchsl@dhec.sc.gov	SCDHEC
Pat Franklin	Meeting Facilitator	The Management Edge	843.571.3672	pat.franklin@mail.com	Meeting Facilitator
Libby Claggett	TtNUS Project Management Support	TtNUS	904.730.4669 x212	libby.claggett@tetratech.com	Scribe

Project Name: MCRD Parris Island SI Projected Date(s) of Sampling: Fall/Winter 2009 Project Manager: Mark Sladic	Site Name: Site Inspection at Eight Munitions Response Sites Site Location: Parris Island – Marine Corps Recruit Depot, Beaufort County, South Carolina

Date of Session: May 18 – 20, 2009

Mark Sladic	TtNUS TOM	TtNUS	412. 921.8216	mark.sladic@tetratech.com	TOM
Peggy Churchill	TtNUS	TtNUS	321.636. 6470 x1300	peggy.churchill @tetratech.com	DQO Facilitator
Greg Zimmerman	TtNUS	TtNUS	412.921. 8992	greg.zimmerman@tetratech.com	Technical Support

Comments/Discussion:

There are 7 MRP sites which will be investigated during this SI. Peggy Churchill presented a DQO discussion focusing on Steps 2 and 5 using UXO 03 as an example site. The draft SI Report is due to the Project Team for review by September 2010. DQOs were developed and DQO outputs of the meeting are presented in the worksheets of this SAP submittal

This investigation will require a minimum of two mobilizations, one for the MEC investigation and one for the MC investigation. The SI can provide a means to move forward in the CERCLA process without delineation [No Further Action (NFA), NA, Land Use Controls (LUCs)]. SCDHEC stated its position on LUCs, the Department's intent with LUCs is not to prohibit the use of the property, but instead to ensure protection of future users. From munitions sites at a minimum, a LUC is a form of notification in the base master plan about use related to digging, notification that is was a munitions site, etc.

Action Items:

- Meredith to provide the Team with examples of previous LUC language for UXO sites.
- Annie to talk with Joe regarding the need for groundwater samples in the grassy area at the Parade Deck.

- Look for construction records for the parade deck at UXO 03 and examine the building records to determine if pavement, if maintained, can serve as an exposure pathway barrier. Investigate for the presence of MEC or MEC debris in the subsurface through geophysics in the grassy area. Determine potential extent of LUC boundary.

Consensus Decisions:

The Team reached consensus on the following actions for UXO 03 (Parade Deck):

1. Look for records. Use construction records to justify that geophysics are not needed in the paved area.

2. Conduct geophysics in the grassy area. If anomalies are not found in the grassy area, determine whether to investigate for MC. If anomalies are found in the grassy area, investigate the anomalies for the presence of MEC and determine whether to proceed with MC investigation.

3. The LUC for the paved area (Parade Deck) will include keeping the pavement in place to serve as a barrier to the receptor of a potential risk. If work is conducted that disrupts the LUC, workers must be notified the site was a former bombing range through the dig permit process. Notification of use of the location (UXO 03) as a former range will be included in the base master plan.

SAP Worksheet #10 -- Problem Definition, Site History and Background

(UFP-QAPP Manual Section 2.5.2)

10.1 GENERAL INTRODUCTION AND PROBLEM DEFINITION FOR INDIVIDUAL SITES

MCRD Parris Island consists of approximately 8,095 acres of which 3,263 are habitable (MCRD Parris Island Strategic Plan 2008 - 2013), and is located along the southeastern coast of South Carolina approximately 1 mile south of the City of Port Royal and 30 miles northeast of Savannah, Georgia. Hilton Head Island is located approximately 3 miles southwest of MCRD Parris Island across Port Royal Sound. MCRD Parris Island is the reception and recruit training facility for Marine Corps enlisted men from states east of the Mississippi River and for enlisted women nationwide. MCRD Parris Island is the oldest major Marine Corps facility in the United States. The facility has been operated as a recruit training facility for the United States Marine Corps since 1915. Currently access to MCRD Parris Island is controlled at the main entrance, and the surrounding rivers, swamps, and tidal flats make additional ingress difficult.

Prior to its establishment in 1915, MCRD Parris Island had a military past that spanned over 400 years and included fortifications constructed by the Spanish, French and United States Navy. In 1884, the Navy purchased approximately 41 acres of land on the northeastern side of MCRD Parris Island and construction began on the Naval station, in 1891, the facility was officially designated as the United States Naval Station, Port Royal, South Carolina. The name of the post was changed to Marine Barracks, Paris Island, South Carolina, in 1917 and the spelling with two “r”s was mandated in December 1917. Following WWII, MCRD Parris Island’s primary mission remained recruit training, and it was redesignated as the Marine Corps Recruit Depot, Parris Island, South Carolina in 1946. In 1983, the base was officially redesignated Marine Corps Recruit Depot, Eastern Recruiting Region, Parris Island, South Carolina.

MCRD PARRIS ISLAND PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

The following sections provide general information for MCRD Parris Island including climate, topography, geology, soil and vegetation types, hydrology, hydrogeology, cultural and natural resources, and threatened, endangered, and protected species.

Climate

MCRD Parris Island experiences long and hot summers and short and mild winters. Precipitation is abundant, averaging about 49 inches per year, and, in the range of 40 to 58 inches during most years. The abundant supply of warm, moist, relatively unstable air produces frequent scattered showers and

thunderstorms. The winter season is short and mild. Average daily maximum and minimum temperatures are 63º F and 38º F, respectively.

Topography

MCRD Parris Island lies within a system of islands, marshes and interconnecting man-made causeways that form a peninsula. MCRD Parris Island lies in the Lower Coastal Plain physiographic province. Elevations range from sea level to 22 feet above mean sea level (msl). MCRD Parris Island consists of Parris Island (the largest and most developed island), seven smaller named islands, many small unnamed islands, salt marshes, and related tidal creeks. Most of MCRD Parris Island is within the 100-year flood plain. The majority of the area of Parris Island north of Ballast Creek, the east central area of Page Field, and the central part of Horse Island are the only surfaces above the 100-year flood plain (NEESA, 1986).

Geology

The islands comprising MCRD Parris Island consist primarily of barrier-island sand, silt and clay deposits (FFA). A further discussion of the descriptive and structural geology of the Beaufort-Jasper County area can be found in the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998a) or the Initial Assessment Study (IAS) (NEESA, 1986).

Soil and Vegetation Types

Soils at MCRD Parris Island have been mapped by the U.S. Soil Conservation Service as both individual soils and groupings of soils (units). MCRD Parris Island has been mapped as having 15 individual soil types, while three soil units have been mapped for MCRD Parris Island (the Wando-Seabrook-Seewee, Coosaw-Williman-Ridgeland and Bohicket-Capers-Handsboro Soil Unit).

Hydrology

The marsh areas and tidal creeks that border MCRD Parris Island drain into the Beaufort River and Broad River to form the Port Royal Sound. Surface runoff from most of the site flows into the surrounding surface water bodies or storm drains that discharge into the marshes.

Hydrogeology

The hydrogeologic framework of the Parris Island area consists of a shallow unconfined surficial aquifer, existing throughout Parris Island, which is estimated to be 30 feet thick and is typically found at a depth of approximately 3 feet. Beneath the surficial aquifer lies the Floridian Aquifer. The surface of the aquifer lies 40 to 90 feet below the surface of the land with more than 20 feet of the low permeable Hawthorn formation and a layer of clay under the marshes separating the two aquifers. This low permeable formation has been discovered to be thinned or missing in localized areas in and around Parris Island (FFA). The water table in the MCRD Parris Island area usually ranges from 0 to 10 feet bgs and is most commonly found at a depth of 3 feet bgs. The direction of groundwater flow in the upper portion of the shallow surficial aquifer is generally toward the nearest surface water body, such as a pond, river, or tidal creek. A further discussion of the descriptive and hydrogeology can be found in the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998a) or the IAS (NEESA, 1986).

Cultural and Natural Resources

No existing cultural or natural resources were identified during information gathering for the ASR.

Endangered and Special Status Species

No threatened or endangered plant species are known to occur on MCRD Parris Island.

INDIVIDUAL MRP SITE-SPECIFIC CHARACTERISTICS/PROBLEM DEFINITIONS

Eight MRP sites are addressed in this SAP, however, only 7 will be investigated, Table 10-1 summarizes the seven MRP sites at MCRD Parris Island that will be investigated as part of this SI. Figure ES-2 shows the locations of these MRP sites within MCRD Parris Island.

TABLE 10-1

**SUMMARY OF MUNITIONS RESPONSE PROGRAM SITES
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA**

Site Name	UXO Site No.	Size	Historical Use	Dates of Use
Rifle Range at Ballast Creek (Old Rifle Range)	UXO 02	600 yards in length	Rifle and Pistol Range; Flying Field	1916-1919 (rifle and pistol range) 1919-1922 (flying field)
Aerial Bombing Target at Parade Deck	UXO 03	Approximately 11.5 acres including target circle	Target Use	1930s-early 1940s
Field Artillery West Main Range	UXO 04	9,000 Feet in length; 16,500 feet including range fan	Field Artillery	1937-1940
Field Artillery East Shrapnel Range: UXO 05 is the northern section of this range and includes the firing point; UXO 6 is the southern portion of this range and includes the impact areas	UXO 05 and UXO 06	11,000 foot long impact area and 17,000 Foot long danger zone fan	Field Artillery	1937-1940
Aerial Bombing Target at Golf Course	UXO 07	Approximately 0.72 acre including target circles	Bombing Target	1942-1946
Aerial Bombing Target at Southern Tidal Flats	UXO 08	Approximately 3.65 acres including target circles	Bombing Target	1940s (utilized during WWII)

The following sections provide the site-specific background information, conceptual site model (CSM) summaries, and problem definitions for each of the MRP sites located at MCRD Parris Island which will be the focus of this UFP-SAP. In general, for the MC investigation, bullets, bullet fragments, or lead shot observed in a sample are not of interest, it is only the soil and sediment MC concentrations that are a concern.

10.2 GRENADE RANGE NEAR OLD SWIMMING POOL AT WEAPONS AND FIELD TRAINING BATTALION AREA (UXO 01)

Identification of this grenade range is based solely on the recollection of a single interviewee, out of 25 that were contacted during the ASR, who indicated the potential for a grenade range to have existed at this location during his recruit training in 1943. Details are provided in the ASR and Appendix B4 of this UFP-SAP. Despite this individual's recollection, there are no historical records to document the existence of a Grenade Range at the described location as shown on Figure 10.1. During the ASR, a review of contemporary maps did not reveal any ranges in the described area, and a review of aerial photography from 1945 did not reveal any distinct ground features of hardened grenade courts. In addition, the approximate location would have been close to housing areas which existed during the time of the range operation. It is unlikely that a grenade range would have been located in close proximity to housing areas. Based on the lack of evidence (i.e., records indicating location, use, operating procedures, etc.) to support the existence of the grenade range, it is believed that the range did not exist at this location. Therefore, there is no problem associated with UXO 01 that needs to be addressed during this SI and UXO 01, and it will not be addressed in this UFP-SAP. A summary of the grenade range interview, physical evidence related to the location of the site, and historical records will be presented in the SI Report to be compiled at the completion of this SI.

10.3 CSM SUMMARY AND PROBLEM DEFINITION FOR RIFLE RANGE AT BALLAST CREEK (UXO 02)

10.3.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Rifle Range at Ballast Creek. Figure 10.2 shows an aerial view of UXO 02 and also shows the site boundary as presented in the ASR.

10.3.1.1 Site Setting and Background

This former 600 yard rifle range first appeared on site maps in 1916, but may have been constructed earlier. The site is also thought to have contained a small pistol range. The site was sometimes referred to as the "Old Rifle Range" to differentiate it from the rifle and pistol ranges constructed in the Weapons and Field Training Battalion Area in 1918. Following WWI through 1922, this range was used as an aircraft flying field. Most of the land associated with this range has since been covered by dredge fill. The exact location of the firing line is unknown. Photographs 10-3.1 and 10-3.2 below present the site as observed during the March 2009 MCRD Parris Island Project Team site visit. Photograph 10-3.3 shows

concrete target foundations that are still present at the site. Additionally, during the ASR site visit and walk, caliber .30 bullets were found scattered about the area near the concrete target foundations.

Photograph 10-3.1 and 10-3.2: UXO 02 Rifle Range at Ballast Creek (2009)

Photograph 10-3.3: Concrete target foundations located at UXO 2 (2009)

Later, warehouses, and storage structures were built and remain, as does a dredge spoil area at the site. The locations of utilities that may be present at this site are unknown at this time.

10.3.1.2 Potential or Known Sources of MC Contamination

Munitions employed at this range were .30 caliber cartridges. There is minimal potential for complete munition rounds to be found at the firing line, and for spent projectiles (which are not UXO) to be found anywhere within the range. For small arms ammunition, the primary MC of concern is lead from bullets and to a lesser extent antimony and arsenic which are associated with lead and copper and zinc which are associated with bullet jackets. Lead accounts for more than 85 percent of the weight of the projectile. Antimony is added to bullets as a hardening agent in quantities ranging from 0.1 to 2 percent. Arsenic is

naturally present in lead at trace levels (0.001 to 0.05 percent). Antimony and arsenic, if present, would be spatially correlated with the lead because they are associated with the lead in the bullets. The USEPA screening value commonly used to indicate the presence of potentially unacceptable levels of antimony in soil and sediment is 31 mg/kg; the screening value for arsenic is 0.39 mg/kg and is within the typical soil and sediment background concentration range of up to about 15 mg/kg. Using the relative concentrations of these metals in projectiles, lead would have to be present in soil or sediment at a concentration greater than 600 mg/kg for arsenic, antimony, copper, or zinc from bullets to be present at potentially unacceptable levels. Therefore, lead, which is easier to measure in some respects, is a useful indicator of potentially unacceptable concentrations of any of these five metals in soil or sediment. A similar argument can be made for copper (typical background concentrations equal 10 mg/kg) and zinc (typical background concentrations equal 50 mg/kg).

Arsenic and antimony found in soil either naturally occurring or from anthropogenic releases forms insoluble complexes with iron, aluminum, and magnesium oxides found in soil surfaces, and in this form, they are relatively immobile. Under reducing conditions, arsenic and antimony can be released from the solid phase, resulting in soluble mobile forms, which may potentially leach into groundwater or result in runoff into surface waters. However, because many arsenic and antimony compounds tend to partition to soil or sediment under oxidizing conditions, leaching usually does not transport arsenic and antimony to any great depth. Downward migration has been shown to be greater in a sandy soil than in a clay loam. The arsenic and antimony cycle in soils is complex, with many biotic and abiotic processes controlling its overall fate and environmental impact.

Sampling was conducted in 2007 and 2008 within the Weapons and Field Training Battalion (WFTBN) impact area as part of the Sediment Characterization Report (CH2MHill, 2009). The sediment characterization study targeted small arms ranges/munitions projectiles. Several findings of this report are relevant to the UXO 2 investigation. This characterization study and a referenced United States Army Corps of Engineers (USACE) study identified lead as the primary MC associated with small arms ranges. The majority of the projectiles found during the WFTBN field investigation were whole with jackets in various states of deterioration. Metals concentrations were found to generally decrease with increasing depth. This study also found that elevated SEM/AVS were present within the depths of either 0- to 6-inches bgs or 6- to 12-inches bgs, indicating that the metals potentially bioavailable are near the surface. The study further stated that the metals in the subsurface sediments are not likely to be bioavailable if these sediments were exposed at a future time. During XRF screening, data indicated elevated concentrations of metals in sediment that appeared to occur in localized hot spots, with no apparent concentration gradients that would suggest transport away from a point source of contamination. A preliminary human health screening conducted as part of the study indicated that

potential risks from direct contact with sediment under a recreational scenario were not a concern. The preliminary ecological risk screening indicated that impact to receptors exposed to sediments were possible to those constituents with limited mobility but that the potential for population-level impacts to upper trophic level receptors was low due to the isolated nature of elevated concentrations and because these receptors would have a greater mobility.

The greatest number of bullets is expected to be found in the area near the concrete target foundation blocks. The penetration depth of small arms on the range floor is estimated to be 1 foot or less (ITRC document: Characterization and Remediation of Soils at Closed Small Arms Firing Ranges, January 2003), and fragments would be expected to be present within the top 6 inches of media. For this reason, lead in sediment in the area of the concrete target foundations would be the primary source of lead contamination at the Rifle Range at Ballast Creek and will be the focus of this SI. Additionally, surface soil samples will be also be collected from areas upgradient/upland of the concrete target foundations in order to determine if rounds may have fallen short of the targets.

10.3.1.3 Contaminant Migration Pathways and Receptors

Sediment in the area of the concrete target foundations and soil upgradient of the concrete target foundations at the Rifle Range at Ballast Creek could be contaminated with lead (and to a lesser extent antimony, arsenic, copper, and zinc), contamination, if present at this site, could infiltrate into the subsurface soil and deep sediment and ultimately leach into the groundwater. An additional migration pathway at this site includes storm water run-off that could have transported lead contaminated sediment, soil, and dissolved contaminants to impact nearby media. Additionally, lead migration in surface water and groundwater may occur through influences of the rising and falling tides.

Human receptors at this site include military and civilian personnel, contractors, maintenance workers, recreational users, and trespassers. Ecological receptors at this site would consist of common flora and fauna including fish, shellfish, crustaceans, wading birds, ospreys, and pelicans, which would also be potential receptors in areas where sediment has been impacted. Human receptors (fishermen) could also contact contaminants through the food chain because fishing is permitted at MCRD Parris Island. Ecological receptors could contact MC contaminants through the food chain when ingesting fish and vegetation at this site.

10.3.2 Problem Statement

If present, the highest concentration of antimony, arsenic, copper, lead, and zinc are expected to be located in sediment (0 to 6 inches and 2 to 3 feet below the sediment surface), in the area of the concrete target foundations. Lead may also be present in surface soil (0 to 1 foot bgs) in areas upgradient of the concrete target foundations. Lead is the primary constituent of concern because it is the primary constituent in the spent munitions used at this site. Data must be collected to determine whether lead, which is also used as a chemical marker for the presence of antimony, arsenic, copper, and zinc, is present at concentrations that pose a potential unacceptable risk to human health and the environment, and whether further investigation of the site is required.

10.4 CSM SUMMARY AND PROBLEM DEFINITION FOR AERIAL BOMBING TARGET AT PARADE DECK (UXO 03)

10.4.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Aerial Bombing Target at Parade Deck. Figure 10.3 shows an aerial view of UXO 03.

10.4.1.1 Site Setting and Background

The former Bombing Target at the Parade Deck center is known to have been located at the site of the current parade deck as early as 1937 (Figure 10.3). The bomb target consisted of concentric circles outlined on the ground (sometimes with lime), which would have been visible from the air. Target use ceased when the parade field which was paved in the early 1940s. Miniature inert practice bombs with pyrotechnic signal cartridges are reported to have been the ordnance used for target practice at the time. An open area/field, parking lot areas, and several buildings currently surround the former target area. It is assumed, but not confirmed, that any practice bombs/munitions discovered during construction of the parade deck, parking lot, and other structures in the area (which cover a majority of the site) would have been removed during construction. The open area/field to the north of the bomb target and other non-paved areas surrounding the target may have received ricochets or impacts from bombs that had missed their targets, but this has not been confirmed.

The Parade Deck is used regularly for ceremonies with military personnel, and visitors frequent the site and the surrounding area.

10.4.1.2 Potential or Known Sources of MEC and MC Contamination

MEC Presence

Munitions used at this range were miniature practice bombs with pyrotechnic signal cartridges. It is unknown, but assumed that any practice bombs/munitions located during construction of the parade deck, parking lot, and other structures in the area would have been removed during construction. The ASR did not uncover any information concerning range clearances at this location. The unpaved area to the north of the target area may have received ricochets or impacts from bombs that had missed their targets. Penetration depths for these types of practice bombs are estimated to be up to 2 feet bgs depending on the angle of impact. It is possible that MEC (practice bombs) is present in subsurface soil

of the unpaved areas of the sites. MEC are not expected to be present on the surface at this site. It is assumed that any MEC that might have been present on the surface would have been discovered and removed. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. There is no documentation indicating that MEC has ever been found at this site. The unpaved portions of the site will be investigated during the MEC phase of this SI (see Appendix A for MEC UFP-SAP), upon receipt of the results of the MEC phase of the SI, the Project Team will evaluate the need to investigate the paved portions of the site.

MC Presence

Munitions used at this range were miniature practice bombs with pyrotechnic signal cartridges. For practice bombs of this type, the spotting charge signal contains a black powder expelling charge and a red phosphorous pyrotechnic mixture to provide smoke and burn brightly. MC associated with the practice bombs used at this site may be present. Black powder (mixture of sulfur, charcoal, and potassium nitrate), red phosphorous (often used as a component of matchbook strike plates or as an ingredient in rat and cockroach poisons), and fluorescein dye are the primary MC associated with the practice bombs used at this site. Sulfur and charcoal do not pose an environmental concern at the concentration levels in the environment that could be associated with the site activities. The other MC are not persistent in the environment and would not be expected to be remaining at this site after approximately 70 years and there are no published toxicity criteria for fluorescein dye. However, if MEC/practice bombs are located at this site during the SI geophysical survey, the MCRD Parris Island Project Team will evaluate the need for future MC we plan on completing the field work portion of this project in March 2010 and investigations of this site.

10.4.1.3 Contaminant Migration Pathways and Receptors

Subsurface soil at the Aerial Bombing Target at the Parade Deck could be impacted by MEC. If MEC are present in the subsurface soil, migration is not expected to be significant. Penetration depths for these types of practice bombs are expected to be up to 2 feet bgs. However, penetration may be deeper because the target area and most of the area surrounding it have been paved over, and, the unpaved areas have been maintained. It is also likely that during paving, planting and other grounds keeping procedures, if discovered, any MEC items would have been removed. There is no documentation

indicating that MEC has ever been found at this site. If MEC are present at this site, future construction, excavation and/or maintenance at the site could act as a release mechanism allowing MEC to migrate.

Human receptors at this site include military and civilian personnel, contractors, and maintenance workers who may take part in intrusive activities at this site. It is assumed that visitors attending ceremonies at the parade deck would not take part in intrusive activities. Ecological receptors at this site would consist of common flora and fauna which may burrow into potentially impacted subsurface soil.

10.4.2 Problem Statement

It is unknown whether MEC exists in the subsurface soil (depths of 2 feet bgs or greater) in unpaved areas of UXO 03 Aerial Bombing Target at the Parade Deck. Subsurface soil must be investigated during the SI to determine the absence or presence of MEC. Upon receipt of the results and recommendations of the SI, the Project Team will evaluate the need to investigate the paved areas of the site and may also decide to address MC during future investigations at this site. Additionally, to further aid in characterization of the site, sample cores will be collected from the parade deck in order to determine construction materials and depth of grade. MEC, which is the primary concern at this site at this time, is addressed in the UFP-SAP for MEC (presented as Appendix A). The collection of sample cores from the parade desk will be addressed in Worksheets 14 and 17; however, because environmental samples will not be collected, UXO 03 will not be addressed elsewhere in the MC SAP.

10.5 CSM SUMMARY AND PROBLEM DEFINITION FOR FIELD ARTILLERY WEST MAIN RANGE (UXO 04)

10.5.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Field Artillery West Main Range. Figure 10.4 shows an aerial view of UXO 04 and also shows the site boundaries as presented in the ASR.

10.5.1.1 Site Setting and Background

In 1937, the Marines established two impact areas for field artillery firing, the largest being the Field Artillery West Main Range and the other being the Field Artillery East Shrapnel Range. The Field Artillery West Main Range is believed to have been used from 1937 – 1940, and had a concrete observation point and a total of nine firing positions, including three concrete points (firing points B, H, and R). Firing point R on Horse Island provided the apex of the surface danger zone (range fan). The impact area was 9,000 feet in length and the range fan extended 16,500 feet. The area which previously encompassed the Field Artillery West Main Range is now covered by numerous buildings and other structures, roadways, cleared areas, housing areas (Argonne Trailer Park), Page Field, and marsh/swamp areas. Artillery use is known to have included HE; and shrapnel rounds from the 75mm Model 1897 gun, as well as the 75mm pack howitzer, M1. Other calibers such as 2.95-inch mountain gun, 37mm anti-tank and 105mm howitzer may have been fired, but no evidence has been uncovered to support this. No evidence has been uncovered that this impact area was used for aerial bombing. Photographs 10-5.1 and 10. 5-2 present some of the open, undeveloped areas of UXO 04. Photographs 10-5.3 and 10-5.4 present concrete firing positions B and R.

Photographs 10-5.1 and 10-5.2: UXO 04 Field Artillery West Main Range (2009)

Photograph 10-5.3: Concrete Firing Position B

Photograph 10-5.4: UXO 04Concrete Firing Position R

(photographs from ASR site visit)

The locations of utilities that may be present at the open undeveloped portions of this site are unknown at this time. The Broad River boarders this site on the west and access to this site would be possible from the river.

10.5.1.2 Potential or Known Sources of MEC and MC Contamination

MEC Presence

The sources of potential MEC at the Field Artillery West Main Range are the area surrounding the range fan, the target area/impact areas (assumed to be areas of higher elevation), and the firing points. Former impact area target locations are unknown, and the impact area as it is referred to in the ASR is very large (greater than 1000 acres of marsh and flat land). Sandy high topographic points near the center of the impact area are considered to be the most likely areas for the former impact area targets. These higher areas would have allowed visual observation, kept targets out of tidal wash, and provided access to targets for periodic maintenance. Furthermore, these areas are present at the center of the impact area (where impact area targets would be expected). Therefore, they are surmised to be the most likely location for the impact area targets based on what is known. Additionally, these high points are also relatively distant to Page Field, Page Field Road, the estuary, and more recently developed areas on the western side of the impact area. Penetration depths for the types of munitions used are estimated to be between 5 and 10 feet bgs, depending on the soil type and angle of penetration. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. Expended shrapnel rounds have little ability to penetrate the ground surface and

are typically found on the surface. The impact area within the range fan would have received the most ammunition that failed to detonate (duds). The area around the firing points could potentially contain complete rounds of ammunition. There may have been instances when complete rounds/residue may have been discarded (i.e., thrown or tossed) around the firing points after exercises. Therefore, if present, the discarded rounds would be expected to be present on or near the surface. Four of the nine firing points, D, F, H, and L are located in developed areas of the site, with firing points L and H located on active ranges. MEC would not be expected to be present at these firing points, during development of these areas, any munitions-related items found on or near the surface would have been disposed at that time. Therefore, these firing points will not be investigated during the MEC field investigation.

MC Presence

The sources of potential MC at the Field Artillery West Main Range are the area surrounding the range fan, the target area/impact areas (assumed to be areas of higher elevation), and the firing points. Shrapnel rounds which functioned properly would have deposited lead pellets over target areas. The impact area within the range fan would have received the most ammunition that failed to detonate (duds). The area around the firing points could potentially contain complete rounds of ammunition. There may have been instances when complete rounds/residue may have been discarded (i.e., thrown or tossed) around the firing points after exercises. Therefore, if present, the discarded rounds and any MC would be expected to be present on or near the surface. Four of the nine firing points, D, F, H, and L are located in developed areas of the site, with firing points L and H located on active ranges. Active ranges are excluded from investigation. MEC would not be expected to be present at firing points located in developed areas such as firing points D and F; during development of these areas, any munitions-related items found on or near the surface would have been disposed at that time. However, there is the potential for MC to be located in these areas; therefore, if these firing points are accessible and have not been disturbed/graded/covered by buildings, etc, these two firing points will also be investigated. The primary types of MC which may be present at the Field Artillery West Main Range are TNT, black powder, and lead (technical data sheet presented in Appendix B4). Antimony and arsenic, if present, would be spatially correlated with the lead because they are associated with the lead in the pellets, but they would be present at much lower concentrations as explained in Section 10.3.1.2. Therefore, lead is a useful indicator of the presence or absence of antimony and arsenic at concentrations of environmental concern. Cyclotrimethylene trinitramine (RDX) may also be present based on potential usage during 1940 and there are no published toxicity criteria for fluorescein dye. Nitroglycerin from unburned propellants could have been deposited at firing points; however, nitroglycerin is highly soluble and degrades in the environment and would not be expected to be present as usage of this site ended in 1940.

10.5.1.3 Contaminant Migration Pathways and Receptors

It is assumed that MEC and MC contamination, if present, would be concentrated in impact/target areas (areas of higher elevation) and the firing points. MC contamination in soil and sediment at this site could infiltrate into the subsurface soil and deeper sediment and ultimately leach from the soil and sediment into the groundwater. The potentially impacted groundwater may migrate, thereby contaminating downgradient subsurface soil and expanding the impact to groundwater. An additional migration pathway would also include storm water run-off that could have transported MC contaminated soil, sediment, and dissolved contaminants further impacting nearby soil and sediment. Migration of potential MEC at this site is not expected to be significant. Smaller MEC items and MC contaminants may become mobile within surface soil and sediment and MEC located just beneath ground surface may also become exposed to the surface, particularly during extended periods of surface runoff. MC and MEC contaminant migration and exposure of MEC located at or just below the ground surface, may also occur through influences of the rising and falling tides along the waterways throughout this site. Future construction, excavation and/or maintenance in developed areas of the site could also act as a release mechanism allowing further MEC and MC contaminant migration.

Human receptors would include military and civilian personnel, contractors, maintenance workers, recreational users, and trespassers. Ecological receptors would include common flora and fauna, large mammals (e.g., deer), small mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, and birds. Fish, shellfish, crustaceans, wading birds, ospreys, and pelicans may also be potential receptors in areas where sediment has been impacted. Fishing is permitted at MCRD Parris Island, and this site encompasses several waterways; therefore, human receptors (fishermen) could also contact contaminants through the food chain. Ecological receptors could also contact MC contaminants through the food chain when ingesting fish and vegetation at this site.

10.5.2 Problem Statement

It is unknown whether MEC or MC contamination (explosives, antimony, arsenic, and lead) exists at the Field Artillery West Main Range in the soil or sediment at the impact/target areas (areas of higher elevation) and firing points. Soil and sediment must be investigated during the SI to determine whether MEC are present in unacceptable quantities or a condition exists that presents a safety hazard or if MC are present in surface soil and sediment at concentrations that pose a potential unacceptable risk to human health or the environment, and whether further investigation of the site is required. In addition to investigating this site for potentially unacceptable concentrations of select metals and explosives, at the UXO 04 Impact Area, begin to delineate potentially unacceptable contamination, if found.

10.6 CSM SUMMARY AND PROBLEM DEFINITION FOR FIELD ARTILLERY EAST SHRAPNEL RANGE (UXO 05 AND UXO 06)

10.6.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Field Artillery East Shrapnel Range. Figure 10.5 shows an aerial view of UXO 05 and UXO 06 and also shows the site boundary as presented in the ASR.

10.6.1.1 Site Setting and Background

The Field Artillery East Shrapnel Range had been designated as UXO 05 (northern portion which includes the firing point) and UXO 06 (southern portion which includes the target/impact areas). The current grenade range, which splits this former range into UXO 05 and UXO 06 (shown on Figure 10.5) is not included in this MRP site. Established in 1937 as one of two field artillery ranges, the Field Artillery East Shrapnel Range consisted of a single firing position (firing point T) at Ballast Creek with a southerly direction of fire. The surface danger zone was approximately 17,000 feet long and extends along the eastern edge of MCRD Parris Island. This range does not have any concrete observation points or firing points and no specific records of weapon firing were found.

The Field Artillery East Shrapnel Range extends over a large area along the eastern edge of Parris Island which is primarily covered by marsh/swamps as shown in Figure 10.5. The locations of utilities that may be present at this site are unknown at this time; however, it is unlikely that utilities exist in the marsh areas of the site. The Beaufort River boarders this site on the east and access to this site would be possible from the river.

10.6.1.2 Potential or Known Sources of MEC and MC Contamination

MEC Presence

The sources of potential MEC contamination at the Field Artillery East Shrapnel Range are located in the range fan, the target area/impact area and the firing point. Presumably, munitions use at this range included artillery ammunition for 75mm guns and howitzers, M1897 and M1, respectively. Types of munitions used at this site included shrapnel rounds. Maximum penetration depths for these types of munitions are estimated to be 5 to 10 feet bgs, depending on soil type, specific munitions and angle of impact. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d

http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. Expended shrapnel rounds have little ability to penetrate the ground surface and can often be found on the surface. The area around the firing point could potentially contain complete rounds of ammunition. There may have been instances when complete rounds/residue may have been discarded (i.e., thrown or tossed) around the firing points after exercises. Therefore, if present, the discarded rounds would be expected to be present on or near the surface.

MC Presence

At this site, soil (present only at UXO 05) and sediment may have become contaminated with residual explosives when projectiles experience low-order (incomplete) detonations or failed to detonate (i.e., duds). The impact areas would have received the majority of any dud ammunition and there is potential for complete rounds to exist at the firing line where there may have been instances when projectiles detonated inside field guns. Explosives dispersed as a result of low-order detonations will be on the surface soil. Types of munitions used at this range included HE and shrapnel rounds. Shrapnel rounds which functioned properly would have deposited lead pellets over target areas. The primary types of MC which may be present at the Field Artillery West Main Range are TNT, black powder, and lead (technical data sheet presented in Appendix B4). Antimony and arsenic, if present, would be spatially correlated with the lead because they are associated with the lead in the pellets, but they would be present at much lower concentrations as explained in Section 10.3.1.2. Therefore, lead is a useful indicator of the presence or absence of antimony and arsenic at concentrations of environmental concern. RDX may also be present based on potential usage during 1940. Nitroglycerin from unburned propellants could have been deposited at firing points; however, nitroglycerin is highly soluble and degrades in the environment and would not be expected to be present as usage of this site ended in 1940.

10.6.1.3 Contaminant Migration Pathways and Receptors

Soil (UXO 05 only) and sediment at the Field Artillery East Shrapnel Range could be impacted by MEC and MC contamination. MEC and MC contamination would be concentrated in impact/target areas and at the firing point. MC contamination in soil and sediment present at this site could infiltrate into the subsurface soil and deeper sediment and ultimately leach into the groundwater. The potentially impacted groundwater may migrate, thereby contaminating downgradient subsurface soil and expanding the impact to groundwater. An additional migration pathway would also include storm water run-off that could have transported MC contaminated soil, sediment, and dissolved contaminants further impacting nearby soil

and sediment. Migration of potential MEC at this site is not expected to be significant. MC and MEC contaminant migration and exposure of MEC located just beneath the ground surface to the ground surface, may occur through influences of the rising and falling tides along the waterways throughout this site.

Human receptors would include military and civilian personnel, contractors, maintenance workers, recreational users, and trespassers. Ecological receptors would include common flora and fauna, large mammals (e.g., deer), small mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, and birds. Fish, shellfish, crustaceans, wading birds, ospreys, and pelicans may also be potential receptors in areas where sediment has been impacted. Human receptors (fishermen) could also contact contaminants through the food chain because fishing is permitted at MCRD Parris Island and this range encompasses several waterways. Ecological receptors could also contact MC contaminants through the food chain when ingesting fish and vegetation at these sites.

10.6.2 Problem Statement

It is unknown whether MEC or MC contamination (antimony, arsenic, lead, and explosives) exists at the Field Artillery East Shrapnel Range in the surface soil at the firing point (0- to 1-foot bgs) or sediment (0- to 6-inches and possibly 2 to 3 feet below the sediment/water interface) at the impact/target areas and firing point. Surface soil and sediment must be investigated during the SI to determine whether MEC are present in unacceptable quantities or a condition exists that presents a safety hazard, or whether MC are present in surface soil or sediment at concentrations that indicate the presence of a potential unacceptable risk to human health or the environment, and whether further investigation of the site is required.

10.7 CSM SUMMARY AND PROBLEM DEFINITION FOR AERIAL BOMBING TARGET AT GOLF COURSE (UXO 07)

10.6.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Aerial Bombing Target at Golf Course. Figure 10.6 shows an aerial view of UXO 07.

10.7.1.1 Site Setting and Background

The Aerial Bombing Target at Golf Course was established as a replacement for the Aerial Bombing Target at Page Field in 1942. At both of these targets, miniature practice bombs were used, and there is no evidence that any other types of bombs were used at the Aerial Bombing Target at Golf Course. Miniature practice bombs have been recovered in the area during archaeological excavations. Other areas in and around the target may also have received ricochets or impacts from bombs that may have missed their target. Use of this bombing target is thought to have ceased around the time Page Field was placed on caretaker status in July 1946. The construction of the golf course was completed over the target area in 1948. The area of the target center is located on the green of the present day eighth hole of the golf course. The grade of the original target area was raised to construct the golf course. The photographs below present the area of the site adjacent to the golf course green.

Photographs 10-7.1 and 10-7.2: UXO 07 Aerial Bombing Target at Golf Course (2009)

This site is located on a golf course which is open to the general public as well as military personnel and there are no access controls or restrictions in place to limit access to this area once on the installation.

10.7.1.2 Potential or Known Sources of MEC and MC Contamination

MEC Presence

The types of munitions employed at this site were practice bombs and miniature bombs. Penetration depths for these types of munitions are estimated to be up to between 1 and 2 feet bgs surface; however, the original grade near the area of the center of the target has been raised to construct the golf course. Therefore, the actual depth of potential munitions is unknown. The center of the target is located on a green at the current golf course, and it is assumed that any munitions-related items present in this area would either have been removed during construction of the golf course or would be located under fill that was used to raise the level of the grade in this area to construct the golf course. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep.

MC Presence

Munitions used at this site were practice bombs and miniature bombs with pyrotechnic signal cartridges For practice bombs of this type, the spotting charge signal contains a black powder expelling charge and a red phosphorous pyrotechnic mixture to provide smoke and burn brightly. There is the possibility that MC associated with the practice bombs may also be present at this site. Black powder (mixture of sulfur, charcoal, and potassium nitrate), red phosphorous (often used a component of matchbook strike plates or as an ingredient in rat and cockroach poisons), and fluorescein dye (often used in a dye in microscopy, in forensics to detect latent blood stains, in dye tracing, and as a color additive) are the primary MC associated with the practice bombs used at this site. Sulfur and charcoal do not pose an environmental concern at the concentration levels in the environment that could be associated with the site activities. The other MC are not persistent in the environment and would not be expected to be remaining at this site after approximately 65 years and there are no published toxicity criteria for fluorescein dye. However, if MEC/practice bombs are located at this site during the SI geophysical survey, the MCRD Parris Island Project Team may decide after review of the SI results to address MC during future investigations of this site.

10.7.1.3 Contaminant Migration Pathways and Receptors

The surface and subsurface soil at the Aerial Bombing Target at the Golf Course could be possibly be impacted by MEC. If MEC are present in the subsurface soil at the golf course green or in the surface soil or subsurface soil in areas surrounding the green, migration is not expected to be significant. Penetration depths for these types of practice bombs are expected to be up to 2 feet bgs, and any MEC present in the area of the golf course green would be deeper where the grade has been raised. Erosion is considered to be minimal. Smaller MEC items may become mobile within surface soil and subsurface soil and MEC located just beneath the ground surface may become exposed to the surface, particularly during extended periods of surface runoff. Additionally, future construction, excavation and/or maintenance at the site could act as a release mechanism allowing MEC to migrate.

Human receptors at this site include military and civilian personnel, contractors, maintenance workers, visitors, recreational users, and trespassers that may be exposed to hazards in the surface, and maintenance workers or other personnel who may take part in intrusive activities at this site. Ecological receptors at this site would consist of common flora and fauna, large mammals (e.g., deer), small mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, and birds and those animals that may burrow into impacted subsurface soil.

10.7.2 Problem Statement

It is unknown whether MEC exist on the surface (0 to 1 foot bgs) or in the subsurface soil (greater than 1 foot bgs) at the Aerial Bombing Target at the Golf Course. Surface and subsurface soil must be investigated during the SI to determine the absence or presence of MEC. If MEC are located on the surface or in the subsurface soil, the MCRD Parris Island Project Team may decide after a review of the SI findings to address MC during future investigations at this site. Because only MEC is a concern at this site at this time, UXO 07 will not be addressed further in this UFP-SAP for MC and will be addressed in the UFP-SAP for MEC (presented as Appendix A).

10.8 CSM SUMMARY AND PROBLEM DEFINITION FOR AERIAL BOMBING TARGET AT SOUTHERN TIDAL FLATS (UXO 08)

10.8.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Aerial Bombing Target at Southern Tidal Flats. Figure 10.7 shows an aerial view of UXO 08.

10.8.1.1 Site Setting and Background

Although not identified on any of the reviewed historical site plans obtained during ASR information gathering, a bombing target is known to have existed on the tidal flats directly south of the golf course. The time frame of range use is estimated to have spanned the duration of WWII. The ASR team located two 10-foot tall metal posts which formed the target's center. Rusty sheet metal debris apparently from 100-pound practice bombs were scattered around the target area. This rusty sheet metal debris is considered munitions debris (MD) and not MEC. Debris from 2.25-inch subcaliber aerial rockets (SCAR) or HE bombs were not found at this location, though the Parris Island air station used these items at other locations in the Port Royal sound area [i.e., Formerly Used Defense Sites (FUDS)]. The photographs below reveal some of the metal debris observed at UXO 8, the metal post, and the site as observed during the 2009 site visit.

Photograph 10-8.1: Metal debris observed at UXO 08

Photograph 10-8.2: UXO 08 (2009)

Photograph 10-8.3: UXO 08 (2009)

Photograph 10-8.4: Metal post observed at UXO 08 (2009)

The Broad River is located approximately 400 feet south of the center of the target and access from the river would be possible. There are no buildings associated with this site; the golf course is located directly north of this site.

10.8.1.2 Potential or Known Sources of MEC and MC Contamination

MEC Presence

Munitions used at this site included 100-pound practice bombs, also Mk 15 Practice Bombs, and probably miniature practice bombs as well. The 100 pound practice bomb was a light case munitions which normally broke up on impact; maximum penetrations depths for an intact round range from 3 to 10 feet bgs. Maximum penetration depths for the smaller, miniature practice bombs range from 1 to 2 feet bgs. Metallic munitions-related debris which resulted from past aerial bombing is present on the surface at this site and may also be present in the deeper subsurface and sediment. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. The entire area of the Aerial Bombing Target at the Southern Tidal Flats is a suspect MEC area.

MC Presence

For practice bombs, miniature, the spotting charge signal contains a black powder expelling charge and a red phosphorous pyrotechnic mixture to provide smoke and burn brightly and used an extra-long 10 guage shotgun shell, which emitted a puff of smoke upon impact. The Mk 15 Bomb uses the Mk 7

Spotting Signal and contains one pound of black powder. Metallic munitions-related debris which resulted from past aerial bombing is present on the surface at this site and may be present in the deeper subsurface and sediment and there is the possibility that MC associated with the practice bombs may be present at this site. Black powder (mixture of sulfur, charcoal, and potassium nitrate), red phosphorous (often used a component of matchbook strike plates or as an ingredient in rat and cockroach poisons), and fluorescein dye (often used in a dye in microscopy, in forensics to detect latent blood stains, in dye tracing, and as a color additive) are the primary MC associated with the practice bombs used at this site. Sulfur and charcoal do not pose an environmental concern at the concentration levels in the environment that could be associated with the site activities. The other MC are not persistent in the environment and would not be expected to be remaining at this site after approximately 65 years and there are no published toxicity criteria for fluorescein dye. After surface debris is removed and the MEC investigation is completed, the Project Team will evaluate whether MC needs to be addressed during future investigations at this site.

10.8.1.3 Contaminant Migration Pathways and Receptors

The sediment at the Aerial Bombing Target at the Southern Tidal Flats may have been impacted by MEC. If MEC are present in the deeper subsurface and sediment or in additional areas that have not yet been observed on the surface of the southern tidal flats, migration is not expected to be significant. Visual evidence of surface metal in the area of the targets also indicates that little if any migration has occurred since the target was last used in the 1940s. Erosion is also considered to be minimal. Smaller MEC items (potentially pieces from miniature practice bombs) may become mobile within sediment and MEC located just beneath the ground surface may become exposed to the surface, particularly during extended periods of surface runoff and due to the tidal influences.

Human receptors at this site include military and civilian personnel, contractors, recreational users, and trespassers. Ecological receptors would include common flora and fauna, small mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, and birds. Crustaceans, wading birds, ospreys, and pelicans may also be potential receptors in impacted areas.

10.8.2 Problem Statement

MEC may exist on the surface in the sediment at the Aerial Bombing Target at the Southern Tidal Flats. However, the extent and depth of MEC contamination in sediment at this site is unknown. Sediment must be investigated during the SI to determine if MEC are present in unacceptable quantities or a condition exists that presents a safety hazard. Based on the results of the MEC investigation, the Project Team

may decide to address MC during future investigations at this site. Because only MEC are a concern at this site at this time, UXO 08 will not be addressed further in this UFP-SAP for MC and will be addressed in the UFP-SAP for MEC (presented as Appendix A).

SAP Worksheet #11.1 - Data Quality Objectives for the Rifle Range at Ballast Creek (UXO 02)

11.1.1 IDENTIFY THE GOAL OF THE STUDY

The goal of the MC SI for the Rifle Range at Ballast Creek is to obtain environmental data for use in making the following decision:

1. Determine whether MC metals (antimony, arsenic, copper, lead, and zinc) are present in the sediment surrounding the concrete target foundations and the surface soil upgradient of the concrete target foundations at concentrations that exceed human health or ecological screening criteria. Lead is considered to be a marker for other MC metals associated with the type of munitions used at this site. If lead is determined to be present at concentrations that exceed screening criteria, then conclude that other MC metals are present at potentially unacceptable concentrations and proceed to further study at this site. If lead is not present at concentrations that exceed screening criteria, then conclude other MC metals are not present at unacceptable concentrations and no further investigation of the site for MC metals is required.

11.1.2 IDENTIFY INFORMATION INPUTS

Data and information that will be required to achieve the above goals include the following:

1. Soil and Sediment Parameters: Soil will be shipped to the laboratory and analyzed for pH (SW 846 Method 9045D). Sediment will be shipped to the laboratory and analyzed for TOC (Lloyd Kahn Method). The results of the pH and TOC analysis will be used to help determine leachability and mobility of lead in soil and sediment.

2. Global Positioning System (GPS) Data: In clear areas where vegetation does not interfere with signal reception, GPS data will be gathered to map the MC sample point locations. In areas where tree canopy precludes use of a GPS unit, locations will be established using a tape measure and compass measurements from a known location(s). Additional GPS requirements are included in Worksheet 14.

3. Chemical Data: Chemical data will be used to determine the presence of lead in sediment and surface soil and to characterize the site. Lead is the primary MC constituent of concern, lead concentrations are correlated to other metal concentrations (i.e., unacceptable lead concentrations indicate potentially unacceptable concentrations of at least one other metal, otherwise the other metal

concentrations are acceptable). The list of all chemical analytes evaluated during this SI is presented in Worksheet 15, and laboratory methods are listed in Worksheet 23.

4. PALs: This investigation requires fixed base laboratory chemical data that can be used to determine whether further investigation is necessary. The screening values (PALs), laboratory quantitation limits (QLs), and method detection limits (MDLs) that will be used to evaluate the chemical concentrations detected in site media and to decide whether further site investigation is warranted are listed in Worksheet 15.

11.1.3 DEFINE THE BOUNDARIES OF THE STUDY

UXO 02 lies in the northeastern portion of MCRD Parris Island, south of the main station (developed area), east of Cuba Street, and directly north of Ballast Creek. The concrete target foundations are located in a marshy area of Ballast Creek. The population of interest is sediment and surface soil of UXO 02 that is most likely to be contaminated. An investigation of additional media is beyond the scope of this investigation but may be required in the future based, in part, on the outcome of this investigation. The horizontal site boundary for the MC investigation is shown on Figure 10.2. Decisions concerning presence or absence of unacceptable levels of contamination will be applied to this area but if additional investigation is warranted, the area may be expanded.

The sediment interval of interest is 0 to 6 inches and 2 to 3 feet below the sediment surface and the surface soil interval of interest is 0 to 1 foot bgs, these represent the vertical boundary of this investigation. An investigation of other media including subsurface soil, groundwater, and surface water is beyond the scope of this investigation but may be required based on the outcome of this SI.

11.1.4 DEVELOP THE ANALYTIC APPROACH

The decision rule for this investigation is as follows:

If the fixed base laboratory lead concentration in all samples from the top 6 inches of UXO 02 sediment, the 2 to 3 foot bgs interval of UXO 02 sediment, and the top 1 foot of UXO 02 soil, targeted toward the most contaminated locations and as shown on Figure 10.2 are less than the PAL, then no further investigation of lead, or any other metals associated with the types of munitions used at this site, in sediment or soil is required at this site; otherwise, further characterization of contamination and associated risks from exposure to the contamination will be conducted at this site.

11.1.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

Samples for lead analysis will be collected from the concrete target foundation area and areas upgradient of the concrete target foundations, which is the area most likely to be contaminated with lead at the site. The project team selected locations and numbers of samples which, based on their experience, will support the attainment of the stated project objectives. Biasing the sampling toward areas most likely to have contamination is a major part of this strategy because only one sample must have a lead concentration in excess of a PAL to conclude that further study is necessary. The project team will use the results of the investigation to ensure all proposed samples were collected, that the data meet quality specifications of this SAP, especially adherence to method-specific quality specifications identified in Worksheets 35 and 36. The project team will review the field screening measurements and fixed base laboratory analytical results and ensure that all viewpoints are included in decision making. Worksheet 37 describes the data usability assessment process which goes beyond an evaluation of analytical method-specific quality evaluations to include evaluations of planning assumptions and other factors. This will involve a review of contaminant concentrations and concentration patterns to ensure that contaminants are likely to have been detected if present.

11.1.6 DEVELOP THE PLAN FOR OBTAINING DATA

The proposed SI field data collection program for the Rifle Range at Ballast Creek is described in detail in Worksheet 17 of this UFP-SAP for MC.

SAP Worksheet #11.2 - Data Quality Objectives for Field Artillery West Main Range (UXO 04) and Field Artillery East Shrapnel Range (UXO 05 and 06)

The CSMs, as presented in Worksheets 10.5 and 10.6, are similar for these sites, both are artillery ranges with similar types of munitions use and are therefore, combined in this worksheet.

11.2.1 IDENTIFY THE GOAL OF THE STUDY

The goal of the MC SI for the Field Artillery West Main Range (UXO 04) and the Field Artillery East Shrapnel Range (UXO 05 and UXO 06) are to obtain environmental data for use in making the following decisions:

Determine whether explosives or lead are present in the surface soil or sediment within the study areas at concentrations greater than ecological or human health screening values. If they are, then return to the site for further investigation. If MC concentrations are less than screening values, as appropriate, in surface soil and sediment, then no further investigation of the site for MC is required. If field screening data indicate the presence of potentially unacceptable lead concentrations, then conduct limited delineation of lead contamination, otherwise omit this delineation.

11.2.2 IDENTIFY INFORMATION INPUTS

Data and information that will be required to achieve the above goals include the following:

1. Soil and Sediment Parameters: Soil from each site will be shipped to the laboratory and analyzed for pH (SW 846 Method 9045D). Sediment from each site will be shipped to the laboratory and analyzed for TOC (Lloyd Kahn Method). The results of pH and TOC analysis will be used to help determine leachability and mobility of lead in sediment.

2. GPS Data: In clear areas where vegetation does not interfere with signal reception, GPS data will be gathered to map the MC sample point locations. In areas where tree canopy precludes use of a GPS unit, locations will be established using a tape measure and compass measurements from a known location(s). Additional GPS requirements are included in Worksheet 14.

3. X-Ray Fluorescence (XRF) Field Screening (UXO 04 only): Lead concentrations in surface soil and sediment determined with a Field Portable XRF spectrometer will be used as a tool for locating hot-spots (i.e., >200 mg/kg) of lead contamination. Identification of these hot spots will be useful for making sure that the highest concentration areas are known so they can be sampled and for guiding

initial delineation of contaminants at the UXO 04 Impact Area. This will help to ensure that significant contamination levels, which can be identified during sampling, are not overlooked.

4. Chemical Data: Chemical concentrations will be used to determine the presence of MC metals and explosives in soil and sediment and to characterize the site. The list of all chemical analytes evaluated for this site is included in Worksheet 15, and laboratory methods are listed in Worksheet 23. Sampling of secondary explosives at firing points and impact locations will be conducted using incremental sampling and sample homogenization techniques described in Appendix A Section A.5.0 of USEPA Method 8330B because of the heterogeneous distribution of explosives in the environment.

5. PALs: This investigation requires field measurements and fixed base laboratory chemical data that can be used to determine whether further investigation is necessary. The screening values (PALs), laboratory QLs, and MDLs that will be used to evaluate the chemical concentrations detected in site media and to decide whether further site investigation is warranted are listed in Worksheet 15.

11.2.3 DEFINE THE BOUNDARIES OF THE STUDY

Horizontal Boundaries, UXO 04, 05 and 06

The population of interest are the potentially most contaminated soil (UXO 04 and UXO 05) and sediment (UXO 04 and UXO 06). This includes the suspect target areas (UXOs 04 and 06) and firing points (UXOs 04 and 05) of the former ranges. An investigation of additional media is beyond the scope of this investigation but may be required in the future based, in part, on the outcome of this investigation.

<u>UXO 04 Impact Areas</u>

Within UXO 04 the impact area locations are unknown, but sandy high topographic points near the center of the impact area are expected to be the former target locations where the majority of any dud ammunition, shrapnel, or MEC debris from rounds that hit the targets may be concentrated. The UXO surface survey and geophysical investigation will be used to confirm the locations and the horizontal boundaries of the suspect target areas by identifying concentrated MEC or MEC debris on the surface, in the subsurface, and in the navigable waterways and marshy areas and will guide the MC investigation in those areas (details of the MEC investigation are presented in the UFP-SAP for MEC in Appendix A). IS samples will be collected for explosives with 100-foot by 100-foot decision units which will be located where detector-aided surface survey data and subsurface geophysical data indicate the highest potential for impacts to have occurred. The rationale for IS is explained in Worksheet 17.

UXO 06 Impact Areas

Most of the impact area is located in low-lying wetlands with waterways meandering through the site. A boat-based aquatic geophysical survey combined with a limited detector-aided surface survey of two potentially dry areas within the range, identified from recent aerial photographs of the site, will be conducted. However, accessibility to these areas will need to be determined in the field by the FOL during initial reconnaissance operations. Details of the MEC investigation are presented in the UFP-SAP for MEC in Appendix A. The results of these surveys will guide the MC investigation. MC samples will be collected in locations where the results of the MEC detector-aided surface survey and subsurface geophysical investigations show surface MEC or subsurface anomaly distribution patterns indicative of impact areas. Samples will be collected in the locations with the highest concentration of MEC/material potentially presenting an explosive hazard (MPPEH) and subsurface anomalies.

Firing Points, UXO 04 and 05

Also included in the horizontal investigation boundary are the five firing points which are located in undeveloped areas of UXO 04, possibly two additional firing points located in developed areas of UXO 04, and the single firing point at UXO 05 where there is potential for complete rounds and MC residue from the spent rounds to exist. The potential locations of the UXO 04 firing points are presented in Figure 10.4, while the UXO 05 Firing Point is presented in Figure 10.5. IS samples will be collected for explosives with 100-foot by 100-foot grids which will be located at the firing points. The rationale for IS is explained in Worksheet 17.

Vertical Boundaries for Surveys, Soil and Sediment Sampling at UXO 04, 05 and 06

The vertical boundary for the MC investigation is the 0 to 1 foot bgs interval for discrete surface soil samples and 0 to 6 inches bgs interval for all sediment samples and additionally 2 to 3 feet bgs for discrete sediment samples. The surface soil interval that is of interest for risk screening is the 0 to 1 foot bgs interval; therefore, surface soil data will be collected from this interval. Soil and/or sediment IS samples will be collected from depths not greater than 6 inches bgs. At impact points low-order detonations of explosives would result in the dispersal of particles of explosives near the location of the impact.

Anomaly avoidance will be practiced during the investigations at UXOs 04, 05 and 06. If suspect surface MEC, MEC debris, or subsurface anomalies are detected, site media will be investigated in the area of

these detections, but not at the exact locations. Any alterations to the proposed boundaries will be recorded and documented in an FTMR.

11.2.4 DEVELOP THE ANALYTIC APPROACH

The decision rules for this investigation are as follows:

XRF Field Measurements (UXO 04 Impact Area only):

Lead concentrations in surface soil and/or sediment will be determined in the field using a Field Portable XRF spectrometer. These data will be used to characterize the site and locate impact points.

If the field XRF-measured lead result of a perimeter sample location exceeds 200 (mg/kg), then limited "step-out" sampling for impact point locations will be conducted as follows:

- Step out samples will include XRF measurements of both surface soil (0 to1 foot bgs) and sediment (0 to 6 inches bgs).

- If the XRF measured concentration in the first step-out sample is less than 200 mg/kg, no more step-out samples will be collected. If the first step-out sample exceeds 200 mg/kg, a second step-out sample will be collected. No more than two step-out samples will be collected from the initial grid square with the measured reading above 200 mg/kg. The step-out samples will be collected in a location that is equidistant from the previously collected sample and in a direction that is toward anticipated lower contaminant concentrations.

If no field measured soil or sediment samples exceed the field PAL, then no step out samples will be collected.

Characterization Approach (All Sites):

Individual MC (lead and explosives) concentrations will be determined in surface soil and sediment through fixed-base laboratory analysis. These concentrations will be compared to the PALs listed in Worksheet 15.

If fixed base laboratory lead and explosives concentrations in all sediment samples collected from the top 6 inches or the 2 to 3 foot bgs interval of sediment and all surface soil samples collected from the top one

foot of soil, that are biased toward most likely contaminated locations are less than the PALs, then no further investigation of these MC in sediment or soil is required at this site; otherwise further investigation of the site will continue during an RI.

11.2.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

The surface soil and sediment samples will be collected from areas known to be or most likely to be contaminated, and samples will help to bound the lateral and vertical extent of contamination. The intent is to bound the contamination, if present, within a limited number of step-out rounds and to determine whether further investigation is necessary based on comparison of individual sample results to numerical action levels. The project team selected locations and numbers of samples which, based on their experience, will support the attainment of the stated project objectives. Biasing the sampling toward areas most likely to have contamination is a major part of this strategy because only one sample must have an analyte concentration in excess of a PAL to conclude that further study is necessary. The project team will use the results of the investigation to ensure all proposed samples were collected, that the data meet quality specifications of this SAP, especially adherence to method-specific quality specifications identified in Worksheets 35 and 36. The project team will review the field screening and laboratory analytical results to ensure that all viewpoints are included in decision making. Worksheet 37 describes the data usability assessment process which goes beyond an evaluation of analytical method-specific quality evaluations to include evaluations of planning assumptions and other factors. This will involve an evaluation of contaminant concentrations and concentrations patterns to ensure that contaminants are likely to have been detected if present.

11.2.6 DEVELOP THE PLAN FOR OBTAINING DATA

The proposed SI field data collection program for the Field Artillery West Main Range (UXO 04) and the Field Artillery East Range (UXO 05 and 06) is described in detail in Worksheet 17 of this UFP-SAP for MC.

SAP Worksheet #12 -- Measurement Performance Criteria Table Field Quality Control Sample – All fractions

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Equipment Rinsate Blanks	All Fractions	One per 20 field samples per matrix per sampling equipment	Bias/Contamination	Detections ≤ QL	S&A
Field Duplicate	All Fractions	One per 20 field samples collected (or once per day for XRF field screening, whichever is more frequent)	Precision	Solid samples relative percent difference (RPD) of 50	S
Field Triplicate (IS samples only)	Explosives	One per 20 field samples collected per type of activity (firing point or impact area)	Precision	Solid samples relative percent difference (RPD) of 50	S
Cooler Temperature Blank	All Fractions	One per cooler	Accuracy / Representativeness	4°C +/- 2°C	S&A

SAP Worksheet #13 -- Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Archives Search Report	US Army Corps of Engineers St. Louis District/Archive Search Reprot Marine Corps Recruit Depot Eastern Recruiting Region Parris Island/May 1999	St Louis District	Basis for UFP-SAP, Site Histories, and CSMs	The information is qualitative and no quantitative (site-specific nature and extent of contamination) information is available. The information was used to establish the field work program and identify areas most likely to be contaminated.
Range Identification and Preliminary Range Assessment	US Army Corps of Engineers St. Louis District/Archive Search Report Marine Corps Recruit Depot Eastern Recruiting Region Parris Island/May 1999	St Louis District	Basis for UFP-SAP, Site Histories, and CSMs	The information is qualitative and no quantitative (site-specific nature and extent of contamination) information is available. The information was used to establish the field work program and identify areas most likely to be contaminated.

SAP Worksheet #14 -- Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

The MRP Site Investigation project activities consist of the following tasks:

- Field tasks, including:
  - Mobilization/demobilization and utility clearance
  - Soil and sediment sample collection
  - Quality control sample collection and other QC tasks
  - Field instrument calibration
  - Equipment decontamination
  - IDW removal and disposal
  - GPS locating
  - XRF field screening of lead in soil and sediment
  - Sample core collection
- Analytical tasks
- Data management
- Assessment and oversight
- Data review
- Project report

These tasks are summarized below. The SOPs and field documents referenced below and in other worksheets are included in Appendix C.

Field Tasks

- **Mobilization/Demobilization:** Mobilization/demobilization activities include: field equipment procurement and transport to the work site, subcontractor procurement and coordination, utility awareness and clearance, location and setup of areas for decontamination and waste storage, acquisition of vehicles, and establishment of an on-site staging area.

  Equipment requirements will be finalized by the FOL following the acceptance of the UFP-SAP. The FOL will review the scope of work and assemble equipment (e.g., vehicles, sampling, personal protection, and decontamination equipment) to implement and complete the field investigations.

This list will be reviewed by the TtNUS TOM. The FOL will be responsible for receiving and unpacking the equipment and ensuring that all equipment is operable and calibrated.

The FOL will be responsible for tracking equipment used in the field. The FOL will be responsible for coordinating associated field activities with the analytical laboratory POC, Katahdin Analytical Services (select metals, explosives, pH, and TOC analysis) and GPL Laboratories (IS sample preparation which will include the grinding portion of Method 8330B for explosives analysis). The TtNUS Project Chemist will be responsible for coordinating the analytical services and the acquisition and delivery of sample containers to the site.

Prior to commencing any work at MCRD Parris Island, the Comprehensive Work Approval Process (CWAP) will be followed. The CWAP will identify constraints in the work area, such as the locations of eagle's nests, archeological sites, wetlands, etc., that may affect work at the site and other requirements that must be met prior to commencing work (such as locating underground utilities) at each of the investigative areas.

Prior to mobilization, the FOL will review the roles and responsibilities of each field team member and review the requirements of the various field activities. A series of meetings will be conducted to review the sampling and analytical requirements. Upon mobilization, the FOL will ensure that all field personnel have read and understand this UFP-SAP and the associated HASP, and ensure that all non-health and safety-related equipment is available and operational, while the SSO will ensure that all health and safety-related equipment is available and operational. The SSO or designee will be responsible for reviewing the HASP with the field team members and subcontractors. Daily safety meetings will be held each morning by TtNUS to briefly address the days planned activities.

Upon completion of all site investigation activities, the FOL and field crew will demobilize from the site and transport field equipment back to the TtNUS Pittsburgh office or third party vendor, as necessary. All sample location pin flags will be removed from the sites, work areas will be thoroughly checked, and trash will be bagged and disposed of in trash dumpster outside the field office.

- **Soil and Sediment Sample Collection Tasks:** Surface soil samples will be collected in accordance with SOP-05 (Soil Coring and Sampling Using Hand Auger Techniques), and SOP-07 (Borehole and Soil Sample Logging). Sediment samples will be collected in accordance with SOP-06 (Sediment Sampling) and SOP-11 (Large Water Body Sediment Sampling). IS sampling will be conducted in accordance with SOP-12 (IS Sampling). The sample numbering scheme will be in accordance with SOP-02 (Sample Identification Nomenclature). Methods for recording data are included in each of

the above SOPs and in SOP-03 (Sample Custody and Documentation of Field Activities). Sample labeling will be in accordance with SOP-01 (Sample Labeling), and selection of sample containers, sample preservation, packaging, and shipping will be in accordance with SOP-08 (Sample Preservation, Packaging, and Shipping).

The numbers and types of samples to be collected at each site along with associated analytical programs are presented in Worksheets 18.1 through 18.4.

- **Quality Control Tasks:** Equipment rinsate blanks, field duplicates, field triplicates, matrix spikes, and matrix spike duplicates will be collected as explained in Worksheet 20.

  Initial and continuing calibrations, tuning, reagent blanks, surrogates, duplicates, laboratory control samples, and all other applicable QC for all analytical methods is presented in Worksheets 25 and 28.

- **Field Instrument Calibration:** These procedures are described in Worksheet 22.

- **Equipment Decontamination**: All reusable sampling equipment (e.g., stainless steel trowels and hand augers, etc.) will be decontaminated prior to sampling and between samples, according to the sequence established in SOP-04 (Decontamination of Field Sampling Equipment).

- **Investigation-Derived Waste Tasks:** It is anticipated that small quantities of waste materials will be generated during the field investigation, only surface soil and sediment samples are proposed for collection. Disposable trowels and personal protective equipment (PPE) will be properly bagged and disposed of in MCRD Parris Island facility dumpsters. Excess soil and sediment from samples will be returned to the site from which they were collected. Decontamination water will be collected and disposed of following SOP-09 which provides information on the handling of investigation-derived waste.

- **GPS:** A hand-held GPS unit capable of sub-meter accuracy (i.e., Trimble GeoXM or Trimble GeoHX) will be used to locate all sampling points according to MRP SOP 05. The GPS coordinate system will be set up so all data points are collected in North American Datum of 1983 (NAD83) South Carolina State Plane coordinates in US survey feet.

- **XRF Field Screening:** On-site field XRF analysis for lead will be conducted. Analysis will be performed according to SOP-10 (Field Portable X-Ray Fluorescence Analysis of Soil and Sediment). A minimum of 6 samples, up to a maximum of 12 of the samples collected from each site where XRF

field screening is being conducted will be sent to the fixed-base laboratory for confirmation analysis, at the FOL's discretion.

- **Sample Core Collection:** Two to three sample cores will be collected at the parade deck in order to determine construction materials and depth of grade. Sample cores will be collected in locations in order to minimize disturbance and damage to the parade deck. Exact locations will be chosen in the field, by the FOL, based on site conditions at the parade deck. The core holes will be filled and concrete/asphalt patched once sampling is complete.

Analytical Tasks - Chemical analysis for explosives, select metals, pH, and TOC will be performed by the Katahdin Analytical Services. GPL Laboratories will prepare explosives samples via SW-846 8330B Appendix A (grinding portion of method) and Katahdin Analytical Services will extract and analyze all samples. Katahdin Analytical Services is a Naval Facilities Engineering Service Center (NFESC) and South Carolina approved laboratory. Katahdin and GPL Laboratories have also obtained DoD Environmental Laboratory Approval Program (ELAP) accreditation. Copies of these certifications can be found in Appendix D. Analyses will be performed in accordance with the analytical methods identified in Worksheet 30. The subcontracted laboratories will meet the PALs specified in Worksheet 15. The subcontracted laboratories will perform the chemical analyses following laboratory-specific SOPs (Worksheets 19 and 23) developed based on the methods listed in Worksheets 19 and 30. Copies of the laboratories SOPs are included in Appendix D are included on the attached compact disk (CD).

Data Management

- Project documentation and records
  - Field sample collection and field measurement records are described in Worksheets 27 and 29.
  - Laboratory data package deliverables are described in the analytical specifications.
  - Data assessment documents and records are listed in Worksheet 29.
- Data recording formats are described in Worksheet 27.

Data Handling and Management - After the field investigation is completed, the field sampling log sheets will be organized by date and media and filed in the project files. The field logbooks for this project will be used only for these sites, and will also be categorized and maintained in the project files after the completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity. The data handling procedures to be followed by the laboratories will meet the requirements of the technical specification. The electronic data

results will be automatically downloaded into the TtNUS database in accordance with proprietary TtNUS processes.

Data Tracking and Control. The TtNUS TOM (or designee) is responsible for the overall tracking and control of data generated for the project.

- **Data Tracking**. Data is tracked from its generation to its archiving in the TtNUS project-specific files. The TtNUS Project Chemist (or designee) is responsible for tracking the samples collected and shipped to the subcontracted laboratory. Upon receipt of the data packages from the analytical laboratory, the Project Chemist will oversee the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by the analytical laboratory(ies).

- **Data Storage, Archiving, and Retrieval**. The data packages received from the subcontracted laboratory are tracked in the data validation logbook. After the data are validated, the data packages are entered into the TtNUS CLEAN file system and archived in secure files. The field records including field logbooks, sample logs, chain-of-custody records, and field calibration logs will be submitted by the FOL to be entered into the CLEAN file system prior to archiving in secure project files. The project files are audited for accuracy and completeness. At the completion of the Navy contract the records will be stored by TtNUS and eventually handed over to NAVFAC.

- **Data Security**. The TtNUS project files are restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The TtNUS Data Manager maintains the electronic data files. Access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

Assessment and Oversight – Refer to Worksheet 32 for assessment findings and corrective actions and Worksheet 33 for QA management reports.

Data Review

- Data verification is described in Worksheet 34.
- Data validation is described in Worksheets 35 and 36.
- Usability assessment is described in Worksheet 37.

Project Report - Draft and Final versions of project reports will be prepared and submitted to the Navy, USEPA, and SCDHEC for review. Additionally, for any MEC MRP site in which, upon completion of the SI fieldwork, a recommendation of No Further Investigation is made, per direction from SCDHEC, LUC will be added to the No Further Investigation recommendation. LUCs are to be included to facilitate documentation of former range use for future land use planning. The reports will include the following sections:

- Executive Summary – includes a brief description of the work conducted and the findings.

- Introduction and Background – includes a description of the history of operations and activities at the site and a summary of any previous investigations and removal actions.

- Description of Field Investigations – includes a summary of the work performed in the approved SAP and any field modifications as documented by the FOL. This section will include maps showing the sampling locations and tables summarizing the data collected.

- Data quality – includes a summary of quantitative analytical performance indicators such as completeness, precision, bias and sensitivity, as well as qualitative indicators such as representativeness and comparability. Includes a reconciliation of project data with the DQOs and an identification of deviations from this SAP.

  A data usability assessment will be used to identify significant deviations in analytical performance that could affect the ability to meet project objectives. The elements of this review are presented in Worksheet #37.

- Nature and Extent of Contamination – includes the contamination previously (if applicable) found in each medium sampled in relation to the conceptual model of the site. This section will note the removals previously conducted (if applicable), the contamination addressed and any additional contaminants found during this field effort. Detected contaminant concentrations will be tabulated for each medium and depicted on maps.

- Contaminant Fate and Transport – includes a description of the contaminants detected and their behavior in the soil, bedrock, and sediment, particularly with emphasis on the future migration of these contaminants to any possible exposure areas.

- Summary and Conclusions – includes a summary of the findings, a conclusion assessing whether delineation of contamination is adequate, and a recommendation for further investigations if needed.

TtNUS will respond to comments received on the draft report. TtNUS will submit the draft report before any additional sampling begins. The final version of the report will submitted in hardcopy and electronic format to the project stakeholders.

SAP Worksheet #15 – Reference Limits and Evaluation Table

Matrix: Soil
Analytical Group: Select Metals (UXO 4, UXO 5)

Analyte	Chemical Abstract Service (CAS) Number	PAL[1] (mg/kg)	PAL Reference[2]	Project Quantitation Limit Goal (PQLG) (mg/kg)	Katahdin Analytical Services	
					QL(mg/kg)	MDL (mg/kg)
Lead	7439-92-1	11	Eco SSL	3.7	0.50	0.14

Matrix: Soil
Analytical Group: Explosives (UXO 4, UXO 5)

Analyte	CAS Number	PAL[1] (mg/kg)	PAL Reference[2]	PQLG (mg/kg)	Katahdin Analytical Services	
					QL(mg/kg)	MDL (mg/kg)
1,3,5-Trinitrobenzene	99-35-4	2200	R-RSL	730	0.1	0.0067
1,3-Dinitrobenzene	99-65-0	6.1	R-RSL	2	0.1	0.0062
2,4-Dinitrotoluene	121-14-2	1.6	R-RSL	0.520	0.1	0.015
2,6-Dinitrotoluene	606-20-2	61	R-RSL	20	0.1	0.027
Nitrobenzene	98-95-3	4.4	R-RSL	1.5	0.1	0.022
2,4,6-Trinitrotoluene	118-96-7	1.2	USACE	0.4	0.1	0.0067
2-Amino-4,6-Dinitrotoluene	35572-78-2	150	R-RSL	50	0.1	0.021
2-Nitrotoluene	88-72-2	2.9	R-RSL	1	0.1	0.012
3-Nitrotoluene	99-08-1	1200	R-RSL	400	0.1	0.0079
4-Amino-2,6-Dinitrotoluene	19406-51-0	150	R-RSL	50	0.1	0.017

Analyte	CAS Number	PAL[1] (mg/kg)	PAL Reference[2]	PQLG (mg/kg)	Katahdin Analytical Services	
					QL(mg/kg)	MDL (mg/kg)
4-Nitrotoluene	99-99-0	30	R-RSL	10	0.1	0.027
HMX	2691-41-0	3800	R-RSL	1300	0.1	0.0086
Tetryl	479-45-8	240	R-RSL	80	0.1	0.0054
RDX	1221-82-4	5.5	R-RSL	2	0.1	0.0068

Matrix: Sediment
Analytical Group: Select Metals (UXO 2, UXO 4, UXO 6)

Analyte	CAS Number	PAL [1] (mg/kg)	PAL Reference[2]	PQLG (mg/kg)	Katahdin Analytical Services	
					QL (mg/kg)	MDL (mg/kg)
Lead	7439-92-1	30.2	Reg 4 SDSL	10.1	0.50	0.14

Matrix: Sediment
Analytical Group: Explosives (UXO 4, UXO 6)

Analyte	CAS Number	PAL[1] (mg/kg)	PAL Reference[2]	PQLG (mg/kg)	Katahdin Analytical Services	
					QL (mg/kg)	MDL (mg/kg)
1,3,5-Trinitrobenzene	**99-35-4**	**0.002**	**USACE**	**0.0007**	**0.1**	**0.0067**
1,3-Dinitrobenzene	**99-65-0**	**0.007**	**USACE**	**0.002**	**0.1**	**0.0062**
2,4-Dinitrotoluene	**121-14-2**	**0.0416**	**Reg 3 FW**	**0.01**	**0.1**	**0.015**
2,6-Dinitrotoluene	**606-20-2**	**0.0416**	**Reg 3 FW**	**0.01**	**0.1**	**0.027**

Analyte	CAS Number	PAL[1] (mg/kg)	PAL Reference[2]	PQLG (mg/kg)	Katahdin Analytical Services	
					QL (mg/kg)	MDL (mg/kg)
Nitrobenzene	**98-95-3**	**0.021**	**NOAA AET**	**0.007**	**0.1**	**0.022**
2,4,6-Trinitrotoluene	**118-96-7**	**0.092**	**Reg 3 FW**	**0.03**	**0.1**	**0.0067**
2-Amino-4,6-Dinitrotoluene	35572-78-2	150	R-RSL	50	0.1	0.021
2-Nitrotoluene	88-72-2	2.9	R-RSL	1	0.1	0.012
3-Nitrotoluene	99-08-1	4.06	Reg 3 FW	1	0.1	0.0079
4-Amino-2,6-Dinitrotoluene	19406-51-0	150	R-RSL	50	0.1	0.017
4-Nitrotoluene	99-99-0	4.06	Reg 3 FW	1	0.1	0.027
HMX	**2691-41-0**	**0.005**	**USACE**	**0.002**	**0.1**	**0.0086**
Tetryl	479-45-8	240	R-RSL	80	0.1	0.0054
RDX	**1221-82-4**	**0.013**	**Reg 3 FW**	**0.004**	**0.1**	**0.0068**

Matrix: Soil

Analytical Group: lead [Field Data Collected via field Portable XRF Analyzer (UXO 04**)]**

Analyte	CAS Number	PAL[3] (mg/kg)	PAL Reference	PQLG (mg/kg)	MDL[4] (mg/kg)
Lead	7439-92-1	200	R-RSL	60	20

Notes: Bold rows indicate that the PAL is between the QL and the MDL. Bold and shaded rows indicate that the PAL is less than both the laboratory QL and the MDL. All results will be reported to detection limits and any limitations on data use that result from

having QLss greater than PALs will be described in the project report. Particular scrutiny will be applied to these situations when determining whether project objectives have been obtained.

At the time of data evaluation, screening criteria will be reviewed and updated as necessary.

R-RSL: Residential-Regional Screening Level
Eco-SSL: USEPA Ecological Soil Screening Level
USACE (Talmage et al.): United States Army Corps of Engineers
Reg 4 SDSL: Region 4 Sediment Screening Level
Reg 3 FW: Region 3 Freshwater Screening Level
NOAA AET: National Oceanic and Atmospheric Administration Marine Apparent Effects Threshold

Footnotes:

1. PALs are the lesser of the USEPA Residential Regional Screening Level (May, 2009) or the Ecological Screening Levels.
2. All human health and ecological screening criteria evaluated, and complete screening criteria references are provided in Appendix B2.
3. PALs were determined by dividing the R-RSL for lead by 2 to provide a conservative margin of error
4. "XRF Technologies for Measuring soil and Sediment" – USEPA/540/R-06/002. February 2006.

SAP Worksheet #16 -- Project Schedule/Timeline Table

(UFP-QAPP Manual Section 2.8.2)

Activity	Organization	Dates (MM/YY)	
		Anticipated Date(s) of Initiation	Anticipated Date of Completion
Prepare Rough Draft SI Work Plan and Appendices	TtNUS	01/09	06/09
Submit Rough Draft SI Work Plan and Appendices	TtNUS	--	06/09
Navy Review	Navy	06/09	07/09
Receive Comments/Comment Resolution	TtNUS	07/09	07/09
Prepare Draft SI Work Plan and Appendices	TtNUS	08/09	09/09
Submit Draft SI Work Plan and Appendices	TtNUS	--	09/09
Navy and Regulator Review	Navy, USEPA, and SCDHEC	09/09	10/09
Receive Comments/Comment Resolution	TtNUS	11/09	11/09
Prepare Final SI Work Plan and Appendices	TtNUS	11/09	12/09
Submit Final SI Work Plan and Appendices	TtNUS	--	01/10
Field Investigation	TtNUS	01/10	02/10
Laboratory Analysis	Katahdin and GPL	02/10	03/10
Data Validation	TtNUS	03/10	03/10
Database Entry	TtNUS	02/10	03/10
Prepare Rough Draft SI Report	TtNUS	01/10	03/10

Activity	Organization	Dates (MM/YY)	
		Anticipated Date(s) of Initiation	Anticipated Date of Completion
Submit Rough Draft SI Report and Appendices	TtNUS	--	03/10
Navy Review	Navy	03/10	004/10
Receive Comments/Comment Resolution	TtNUS	04/10	05/10
Prepare Draft SI Report	TtNUS	05/10	05/10
Submit Draft SI Report	TtNUS	--	07/10
Navy and Regulator Review	Navy, USEPA, and SCDHEC	07/10	08/10
Receive Comments/Comment Resolution	TtNUS	08/10	09/10
Prepare Final SI Report	TtNUS	09/10	09/10
Submit Final SI Report	TtNUS	--	09/10

SAP Worksheet #17 – Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

This section describes sampling locations, methods, and rationales for the sampling activities to be conducted in support of the field investigations at UXO 02, UXO 04, UXO 05, and UXO 06, which are proposed for MC sampling at MCRD Parris Island as well as sample core collection at UXO 03. All referenced field MC SOPs are presented in Appendix C. Discrete surface soil samples will be collected via hand auger in accordance with SOP-05 and SOP-07 at a depth of 0 to 1 foot bgs. Discrete sediment samples will be collected via stainless steel or disposable trowel in areas accessible by foot in accordance with SOP-06 at a depth of 0 to 6 inches and 2 to 3 feet bgs. Sediment samples will be collected via petite ponar dredge from a boat in accordance with SOP-11 from a depth of 0 to 6 inches below the sediment surface water interface. IS samples for explosives analysis will be collected in accordance with SOP-12. IS will be used at the firing points and some impact areas at UXO 4 and UXO 5. At firing points and most impact areas, residues from energetic compounds initially are deposited on the surface. Chunks of explosives gradually leach into the soil and continued releases at the surface (e.g., from bullets) ensures that surface soil will be more contaminated than subsurface soil. Disturbance also has not occurred to surface soil at locations where samples are expected to be collected; therefore, IS samples will be collected at depths no greater than 6 inches bgs.

The sampling objective is primarily to determine if past operations have resulted in unacceptable MC concentrations in soil or sediment at each respective site but also to begin delineation of contamination in these media at select sites. As shown in Worksheets 18.1 through 18.4, samples will be analyzed for explosives and select metals (lead) in soil and sediment. For samples undergoing field XRF analysis, any bullets, bullet fragments, or lead shot observed in a sample will be removed prior to analysis so as not to bias the lead results. All field visual observations will be recorded on sample log sheets. If MEC is observed during sampling or near any work area, work will be halted. The presence of MEC will be communicated in accordance with Worksheet 6. If obvious soil or sediment staining is observed during sampling, the staining will be described in the sampling log, and additional soil or sediment samples may be collected at the discretion of the FOL to determine the nature and possibly the extent of associated site-related contamination.

All soil and sediment sample locations will be marked with a brightly colored pin flag indicating the sample location. Additional brightly colored flagging may be tied to an adjacent tree or shrub to further identify a sample location. Coordinates will be determined by a sub-meter accuracy GPS at each individual sample locations and/or compass/tape measure from a known location, which will allow for future studies or guide

in any removal action. Pre-determined Geographic Information System (GIS) grade sample coordinates may be utilized in locating proposed sample locations. All sample location markers will be removed prior to the final demobilization.

Sampling activities will be conducted at the following sites:

- UXO 02 – Rifle Range at Ballast Creek
- UXO 03 – Aerial Bombing Target at Parade Deck (only sample cores will be collected)
- UXO 04 – Field Artillery West Main Range
- UXO 05 – Field Artillery East Shrapnel Range (firing point)
- UXO 06 – Field Artillery East Shrapnel Range (impact areas)

Soil and Sediment Sampling Strategy

The chosen sampling strategy employs a design to target those areas most likely to be contaminated based on the CSMs presented in Worksheet 10, plus nearby areas that will help to bound the contamination. The data collected under this conservative strategy are expected to represent concentrations greater than those to which human or ecological receptors would actually be exposed. The strategy, therefore, ensures that a potential unacceptable human health or ecological risk is not overlooked. For XRF and IS sampling, the sampler will attempt to ensure good spatial coverage of the targeted contamination areas when sampling locations to validate the sampling design and CSMs presented in Worksheet 10; for XRF sampling areas outside of those expected to be contaminated will also be sampled. If the CSMs are correct, these additional locations will exhibit lesser, and perhaps even non-detectable, concentrations of MC that are found in the targeted contamination areas. Additional sampling strategies can be found in the discussion for each individual site.

The total numbers of soil and sediment analyses for each analyte group are tabulated in Worksheets 18.1 through 18.4 and Worksheet 20. Soil QA/QC samples will be collected at the frequencies listed in Worksheet 20. Worksheet 19 presents a summary of the sample analyses, container types and volumes, preservation requirements, and holding times for the samples to be collected.

At all sample locations, the sample material will be placed in a Ziploc plastic baggie or other container as appropriate, which will be marked with the sample location ID, depth, date, and time. The samples will then be thoroughly mixed within the container. The homogenized samples from the UXO sites will then be transferred into the appropriate sample container and placed on ice. Samples collected at UXO 04 for XRF field screening will be transferred back to the field office where a portion of every sample will be

processed and undergo XRF screening in accordance with SOP-10. Unused portions of a collected sample not used for analysis will be returned to the sample location from which it was collected.

Incremental Sampling

IS is a sample collection and processing methodology which has specific elements designed to control data variability due to heterogeneity in contaminant distribution. The objective of this type of sampling is to obtain a single composite sample that contains all analytes in exactly the same proportion as the entire sampled area. This type of sample ensures that significant contamination has a better chance of being detected then with a small number of discrete samples but it also can dilute contaminant concentrations to be less than detectable levels. Average exposure to contaminants is mimicked by the averaging that occurs when combining multiple increments for analysis. The IS sampling method provides reasonably unbiased and reproducible estimates of the mean concentration of analytes in a specifically defined volume of soil (i.e., a specific population). The samples will be collected in accordance with SOP-12 (Incremental Sampling).

This sampling technique will assist in estimating concentrations which can be used to assess whether potential MC:

- Are present within the sampled area at an average concentration greater than the analytical MDL or reporting limit;
- May pose an unacceptable risk to human health, or ecological receptors;
- May contribute to significant contaminant concentrations to groundwater;
- Concentrations exceed ambient concentrations unrelated to munitions activities.

XRF Analysis

Samples collected from the impact areas at UXO 04 will undergo screening in the field utilizing XRF in accordance with SOP-10 (Appendix C). Additional “step-out” sample locations may be added at the discretion of the FOL if XRF field screening results are greater than the field action level of 200 mg/kg for lead. Based on experience, lead concentrations less than this field screening action level of 200 mg/kg are not likely to exceed the action level of 400 mg/kg.

Prior to collection of the XRF samples, a site walkover will be conducted to assess whether any lead shot are visible on the surface or in the very near surface soil at various areas throughout the sites. The FOL

will use his/her inspection of the site to determine which areas are most likely to be contaminated and will sample those locations accordingly.

Rifle Range at Ballast Creek (UXO 02)

Proposed sample locations for the Rifle Range at Ballast Creek (UXO 02) are presented on Figure 17.1. Samples will be collected in areas most likely to contain contamination, if present. Twenty sediment grab samples (10 collected from 0 to 6 inches bgs and 10 collected from 2 to 3 feet bgs) are proposed for collection from the area surrounding the concrete target foundations, via disposable trowel or hand auger. Samples will be collected from along the slope of the bank "behind" the concrete target foundations, "in front" of the concrete target foundations, and from areas beside and between the concrete target foundations as shown on Figure 17.1. Samples will be collected at low tide at this site because access may not possible at high tide. Five surface soil grab samples (0 to 1 foot bgs) are proposed for collection from areas upgradient of the concrete target foundations, via hand auger. Samples will be collected from areas where rounds may have fallen short and missed the targets as shown on Figure 17.1. The sediment and surface soil samples will be submitted to the fixed-base laboratory for lead analysis as presented in Worksheet 18.1. Lead would be the primary MC associated with small arms. Additionally, one surface soil sample will b analyzed for pH and one sediment sample will be analyzed for TOC for characterization purposes.

Aerial Bombing Target at Parade Deck (UXO 03)

Figure 10.3 presents a site location/site layout map for UXO 03. Two to three sample cores will be collected at the parade deck in order to determine construction materials and depth of fill. Sample cores will be advanced thru the parade deck until native soil is reached. The number of sample cores and core locations will be chosen in the field at the discretion of the FOL. Locations will be chosen based on site conditions and in order to minimize disturbance and damage to the parade deck. Core holes will be filled and the concrete/asphalt patched once sampling is complete.

Field Artillery West Main Range (UXO 04)

Proposed firing point sample locations and impact areas locations for the Field Artillery West Main Range are presented on Figure 17.2. All sampling locations are subject to change based on the results of the MEC SI. This range had a concrete observation point and a total of nine firing points, including three concrete points according to the ASR. Former impact area target locations are unknown, but the impact area as it is referred to in the ASR is very large (greater than 1000 acres of marsh and flat land). Sandy high topographic points near the center of the impact area are suspected to be the most likely areas for

the former impact area targets. These higher areas would have allowed visual observation, kept targets out of tidal wash, and provided access to targets for periodic maintenance. Additionally, because significant areas of marsh surround the suspect impact areas, and firing misses might have landed in the marsh, these areas are also suspect.

At each of the accessible firing points located in undeveloped areas (5 total), and possibly two firing points located in developed areas, one decision unit will be established and an IS sample will be collected, for explosives analysis within each decision unit. Each decision unit will be 100-foot by 100-foot, 7 squares by 7 squares. Based on the locations of the firing points as presented in the ASR, five firing points (A, B, C, E, and R) are located in accessible undeveloped portions of UXO 04 and will be investigated. Two firing points (H and L) are located in active ranges, active ranges will be excluded from this investigation. Two firing points (D and F) are located in developed areas, if these firing points are accessible and have not been disturbed/graded/covered by buildings, etc, the firing points will investigated. This determination will be made by the FOL based on site conditions at the time of sampling. In addition to the IS samples for explosives, one discrete soil grab sample will be collected at each of these five firing points for lead analysis to determine if lead from lead primer is present.

Figure 17.2 of Appendix A (MEC SAP) presents the areas where UXO detector-aided surface and subsurface geophysical surveys will be conducted during the MEC portion of the SI. Eight decision units (in addition to those established at the firing points discussed above) will be established in these survey areas, exact locations to be based on the results of the MEC SI. Forty-nine sample increments will be collected for each IS sample from within IS decision units.

Based on the results of the aquatic geophysical survey, if anomalies indicative of buried munitions are located in the waterways within UXO 04, four sediment grab samples will be collected via petite ponar dredge form a boat for analysis of explosives and lead. This determination will be based on whether observed geophysical anomaly distribution patterns are indicative of potential impact areas.

The FOL will select up to 60 surface soil (0 to 1 foot bgs) and/or sediment grab samples (0 to 6 inches bgs) for collection from areas of higher elevation within the expected impact areas which are undeveloped, unpaved, and accessible by foot (locations to be determined in the field and to be guided by the results of the MEC SI). Soil grab samples will be collected via hand auger whereas sediment grab samples will be collected with a disposable trowel. Sample locations will be set up in grid pattern in each area to receive XRF field screening in order to cover areas suspected to contain lead pellets from shrapnel. Shrapnel rounds are expected to disperse pellets over an area of approximately 105-feet by 50-feet. Therefore, 4 grids, 105-feet by 50-feet, will be set up with 15 evenly spaced samples collected

from within each grid for XRF analysis. Exact grid locations will be determined by the FOL based on the results of the MEC investigation. If a sample location has an average XRF lead concentration greater than the field screening value of 200 mg/kg, and the sample location is not bounded by another sample exhibiting an XRF lead concentration below 200 mg/kg, than additional "step-out" samples both horizontally and vertically will be collected to provide information regarding hot spots, to the extent practical. Horizontal expansion will not be conducted into creeks or other waterways, and vertical expansion may not be conducted depending on the depth to water at a given location. Based on the results of the XRF screening, a minimum of six and a maximum of 12 surface soil or sediment samples (to be determined by the FOL) will be submitted to the fixed-base laboratory and analyzed for lead as presented in Worksheet 18.2. Additionally, one surface soil sample will be analyzed for pH and two sediment samples will be analyzed for TOC for characterization purposes.

Field Artillery East Shrapnel Range (UXO 05)

The proposed sample location at UXO 05 is presented on Figure 17.3. The Field Artillery East Shrapnel Range had a single firing point at Ballast Creek with a southerly direction of fire. Therefore, one decision unit (100-foot by 100-foot, 7 squares by 7 squares) will be established at the firing point and one IS sample will be collected from this decision unit for explosives analysis. Forty-nine sample increments will be collected for each IS sample from within this decision unit, explosives will be analyzed in this IS sample. Additionally, the FOL will select 2 discrete soil or sediment sample locations and will collect samples from within this area for lead analysis to determine if lead from lead primer is present. If discrete sediment samples are collected, two depth intervals will be collected from each location, 0 to 6 inches and 2 to 3 feet bgs.

Field Artillery East Shrapnel Range (UXO 06)

The focus of this SI will be the impact end of the range as it is defined in the CSM in Worksheet 10 and ASR. Most of the impact area is located in low-lying wetlands with waterways meandering through the site. The area is subject to tidal surges, has very limited accessibility by foot, and cannot be easily accessed; therefore, sediment samples are planned for collection within navigable waterways. These samples will be collected in locations where the results of the MEC investigation show anomaly distribution patterns indicative of potential impact locations. Sediment samples will be collected via petite ponar from a boat. Up to 13 sediment samples are planned for collection; Figure 17.3 shows the general location of the waterways where the MEC investigation will be conducted and where sediment samples will be collected. The exact number of samples to be collected will be determined in the field by the FOL and will be based on accessibility and the results of the MEC investigation. If anomalies are not identified

in the water during the MEC investigation, MC samples will still be collected from within the waterways surveyed. Samples will be approximately evenly spaced along the waterways that were surveyed, up to 13 sediment samples will be collected from within the waterways. All samples will be analyzed for explosives and lead. Additionally, one surface soil sample will be analyzed for pH and two sediment samples will be analyzed for TOC for characterization purposes

Additionally, two potentially dry areas within the impact end of the range fan, as shown on Figure 17.3, were selected for UXO detector-aided surface surveying during the MEC SI. Based on the results of these surveys (if conducted), an additional three sediment samples may be collected via disposable trowel in these areas. Discrete sediment samples will be collected from two depth intervals at each location, 0 to 6 inches bgs and 2 to 3 feet bgs. These samples will be collected in locations which the detector-aided surface survey shows locations most likely to have been impact points. These samples will be analyzed for explosives and lead.

SAP Worksheet #18.1 – Rifle Range at Ballast Creek (UXO 02) Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES
		SW-846 6010B[3] (Lead Only)
Sediment Near Concrete Target Foundations		
X02SD01	X02SD01G0006	1
X02SD01	X02SD01G2436	1
X02SD02	X02SD02G0006	1
X02SD02	X02SD02G2436	1
X02SD03	X02SD03G0006	1
X02SD03	X02SD03G2436	1
X02SD04	X02SD04G0006	1
X02SD04	X02SD04G2436	1
X02SD05	X02SD05G0006	1
X02SD05	X02SD05G2436	1
X02SD06	X02SD06G0006	1
X02SD06	X02SD06G2436	1
X02SD07	X02SD07G0006	1
X02SD07	X02SD07G2436	1
X02SD08	X02SD08G0006	1
X02SD08	X02SD08G2436	1
X02SD09	X02SD09G0006	1
X02SD09	X02SD09G2436	1
X02SD10	X02SD10G0006	1
X02SD10	X02SD10G2436	1
Soil Upgradient of Concrete Target Foundations		
X02SB01	X02SS01G0001	1
X02SB02	X02SS02G0001	1
X02SB03	X02SS03G0001	1
X02SB04	X02SS04G0001	1
X02SB05	X02SS05G0001	1
Total Sediment and Soil Samples – UXO 2		**25**

1 X = UXO Site; SD = Sediment; SB = Soil Boring
2 SD = Sediment; SS = Surface Soil; G = Grab sample. Last four digits of sample ID indicate depth below ground surface in inches for discrete/grab sediment and depth below ground surface in feet for discrete/grab surface soil samples.
3 Analysis to be performed by Katahdin Analytical Services.

Notes:

Soil and sediment samples will be collected in accordance with SOPs -05, -06, -07, -11 and -12 (Appendix C). Field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of 1 per 20 samples per medium per analyte for fixed-base laboratory analysis. Therefore, field QC samples may not be collected at every site.

One surface soil sample collected (location to be determined in the field) will also be submitted to the fixed-base laboratory for pH analysis. One sediment sample collected (location to be determined in the field) will also be submitted to the fixed-base laboratory for TOC analysis.

SAP Worksheet #18.2 – Field Artillery West Main Range (UXO 04) Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES		
		Field XRF (Lead Only)	SW-846 6010B[3] (Lead Only)	SW-846 8330B[3] (Explosives)
Soil at the Firing Points				
X04SB01	X04SS01C0006	NA	NA	1
X04SB02	X04SS02C0006	NA	NA	1
X04SB03	X04SS03C0006	NA	NA	1
X04SB04	X04SS04C0006	NA	NA	1
X04SB05	X04SS05C0006	NA	NA	1
X04SB78	X04SS78C0006	NA	NA	1
X04SB79	X04SS79C0006	NA	NA	1
X04SB01	X04SS01G0001	NA	1	NA
X04SB02	X04SS02G0001	NA	1	NA
X04SB03	X04SS03G0001	NA	1	NA
X04SB04	X04SS04G0001	NA	1	NA
X04SB05	X04SS05G0001	NA	1	NA
X04SB78	X04SS78G0001	NA	1	NA
X04SB79	X04SS79G0001	NA	1	NA
Soil and/or Sediment at the UXO/Geophysical Survey Areas				
X04SB06 or X04SD06	X04SS06C0006 or X04SD06C0006	NA	NA	1
X04SB07 or X04SD07	X04SS07C0006 or X04SD07C0006	NA	NA	1
X04SB08 or X04SD08	X04SS08C0006 or X04SD08C0006	NA	NA	1
X04SB09 or X04SD09	X04SS09C0006 or X04SD09C0006	NA	NA	1
X04SB10 or X04SD10	X04SS10C0006 or X04SD10C0006	NA	NA	1
X04SB11 or X04SD11	X04SS11C0006 or X04SD11C0006	NA	NA	1
X04SB12 or X04SD12	X04SS12C0006 or X04SD12C0006	NA	NA	1

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES		
		Field XRF (Lead Only)	SW-846 6010B[3] (Lead Only)	SW-846 8330B[3] (Explosives)
X04SB13 or X04SD13	X04SS13C0006 or X04SD13C0006	NA	NA	1
Sediment Samples from Waterways				
X04SD14	X04SD14G0006	NA	1	1
X04SD15	X04SD15G0006	NA	1	1
X04SD16	X04SD16G0006	NA	1	1
X04SD17	X04SD17G0006	NA	1	1
Soil and/or Sediment Samples from XRF Screening Areas				
X04SB18 or X04SD18	X04SS18G0001 or X04SD18G0006	1	TBD[4]	NA
X04SB19 or X04SD19	X04SS19G0001 or X04SD19G0006	1	TBD[4]	NA
X04SB20 or X04SD20	X04SS20G0001 or X04SD20G0006	1	TBD[4]	NA
X04SB21 or X04SD21	X04SS21G0001 or X04SD21G0006	1	TBD[4]	NA
X04SB22 or X04SD22	X04SS22G0001 or X04SD22G0006	1	TBD[4]	NA
X04SB23 or X04SD23	X04SS23G0001 or X04SD23G0006	1	TBD[4]	NA
X04SB24 or X04SD24	X04SS24G0001 or X04SD24G0006	1	TBD[4]	NA
X04SB25 or X04SD25	X04SS25G0001 or X04SD25G0006	1	TBD[4]	NA
X04SB26 or X04SD26	X04SS26G0001 or X04SD26G0006	1	TBD[4]	NA
X04SB27 or X04SD27	X04SS27G0001 or X04SD27G0006	1	TBD[4]	NA
X04SB28 or X04SD28	X04SS28G0001 or X04SD28G0006	1	TBD[4]	NA
X04SB29 or X04SD29	X04SS29G0001 or X04SD29G0006	1	TBD[4]	NA

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES		
		Field XRF (Lead Only)	SW-846 6010B[3] (Lead Only)	SW-846 8330B[3] (Explosives)
X04SB30 or X04SD30	X04SS30G0001 or X04SD30G0006	1	TBD[4]	NA
X04SB31 or X04SD31	X04SS31G0001 or X04SD31G0006	1	TBD[4]	NA
X04SB32 or X04SD32	X04SS32G0001 or X04SD32G0006	1	TBD[4]	NA
X04SB33 or X04SD33	X04SS33G0001 or X04SD33G0006	1	TBD[4]	NA
X04SB34 or X04SD34	X04SS34G0001 or X04SD34G0006	1	TBD[4]	NA
X04SB35 or X04SD35	X04SS35G0001 or X04SD35G0006	1	TBD[4]	NA
X04SB36 or X04SD36	X04SS36G0001 or X04SD36G0006	1	TBD[4]	NA
X04SB37 or X04SD37	X04SS37G0001 or X04SD37G0006	1	TBD[4]	NA
X04SB38 or X04SD38	X04SS38G0001 or X04SD38G0006	1	TBD[4]	NA
X04SB39 or X04SD39	X04SS39G0001 or X04SD39G0006	1	TBD[4]	NA
X04SB40 or X04SD40	X04SS40G0001 or X04SD40G0006	1	TBD[4]	NA
X04SB41 or X04SD41	X04SS41G0001 or X04SD41G0006	1	TBD[4]	NA
X04SB42 or X04SD42	X04SS42G0001 or X04SD42G0006	1	TBD[4]	NA
X04SB43 or X04SD43	X04SS43G0001 or X04SD43G0006	1	TBD[4]	NA
X04SB44 or X04SD44	X04SS44G0001 or X04SD44G0006	1	TBD[4]	NA

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES		
		Field XRF (Lead Only)	SW-846 6010B[3] (Lead Only)	SW-846 8330B[3] (Explosives)
X04SB45 or X04SD45	X04SS45G0001 or X04SD45G0006	1	TBD[4]	NA
X04SB46 or X04SD46	X04SS46G0001 or X04SD46G0006	1	TBD[4]	NA
X04SB47 or X04SD47	X04SS47G0001 or X04SD47G0006	1	TBD[4]	NA
X04SB48 or X04SD48	X04SS48G0001 or X04SD48G0006	1	TBD[4]	NA
X04SB49 or X04SD49	X04SS49G0001 or X04SD49G0006	1	TBD[4]	NA
X04SB50 or X04SD50	X04SS50G0001 or X04SD50G0006	1	TBD[4]	NA
X04SB51 or X04SD51	X04SS51G0001 or X04SD51G0006	1	TBD[4]	NA
X04SB52 or X04SD52	X04SS52G0001 or X04SD52G0006	1	TBD[4]	NA
X04SB53 or X04SD53	X04SS53G0001 or X04SD53G0006	1	TBD[4]	NA
X04SB54 or X04SD54	X04SS54G0001 or X04SD54G0006	1	TBD[4]	NA
X04SB55 or X04SD55	X04SS55G0001 or X04SD55G0006	1	TBD[4]	NA
X04SB56 or X04SD56	X04SS56G0001 or X04SD56G0006	1	TBD[4]	NA
X04SB57 or X04SD57	X04SS57G0001 or X04SD57G0006	1	TBD[4]	NA
X04SB58 or X04SD58	X04SS58G0001 or X04SD58G0006	1	TBD[4]	NA
X04SB59 or X04SD59	X04SS59G0001 or X04SD59G0006	1	TBD[4]	NA

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES		
		Field XRF (Lead Only)	SW-846 6010B[3] (Lead Only)	SW-846 8330B[3] (Explosives)
X04SB60 or X04SD60	X04SS60G0001 or X04SD60G0006	1	TBD[4]	NA
X04SB61 or X04SD61	X04SS61G0001 or X04SD61G0006	1	TBD[4]	NA
X04SB62 or X04SD62	X04SS62G0001 or X04SD62G0006	1	TBD[4]	NA
X04SB63 or X04SD63	X04SS63G0001 or X04SD63G0006	1	TBD[4]	NA
X04SB64 or X04SD64	X04SS64G0001 or X04SD64G0006	1	TBD[4]	NA
X04SB65 or X04SD65	X04SS65G0001 or X04SD65G0006	1	TBD[4]	NA
X04SB66 or X04SD66	X04SS66G0001 or X04SD66G0006	1	TBD[4]	NA
X04SB67 or X04SD67	X04SS67G0001 or X04SD67G0006	1	TBD[4]	NA
X04SB68 or X04SD68	X04SS68G0001 or X04SD68G0006	1	TBD[4]	NA
X04SB69 or X04SD69	X04SS69G0001 or X04SD69G0006	1	TBD[4]	NA
X04SB70 or X04SD70	X04SS70G0001 or X04SD70G0006	1	TBD[4]	NA
X04SB71 or X04SD71	X04SS71G0001 or X04SD71G0006	1	TBD[4]	NA
X04SB72 or X04SD72	X04SS72G0001 or X04SD72G0006	1	TBD[4]	NA
X04SB73 or X04SD73	X04SS73G0001 or X04SD73G0006	1	TBD[4]	NA
X04SB74 or X04SD74	X04SS74G0001 or X04SD74G0006	1	TBD[4]	NA

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES		
		Field XRF (Lead Only)	SW-846 6010B[3] (Lead Only)	SW-846 8330B[3] (Explosives)
X04SB75 or X04SD75	X04SS75G0001 or X04SD75G0006	1	TBD[4]	NA
X04SB76 or X04SD76	X04SS76G0001 or X04SD76G0006	1	TBD[4]	NA
X04SB77 or X04SD77	X04SS77G0001 or X04SD77G0006	1	TBD[4]	NA
Total Soil and/or Sediment Samples – UXO 4		**60**	**Min 17 – Max 23**	**19**

1 X = UXO Site ; SB = Soil Boring; SS = Surface Soil; SD = Sediment
2 SS = Surface soil; SD = Sediment C = Composite Sample; G = Grab sample. Last four digits of sample ID indicate depth below ground surface in feet for discrete/grab surface soil samples and depth below ground surface in inches for IS/composite surface soil and sediment.
3 Analysis to be performed by Katahdin Laboratories. For composite IS samples for explosive analysis, GPL Laboratories will be conducting the grinding portion of sample preparation prior to analysis.
4 Dependent on field XRF screenings, a minimum of 6 (maximum of 12) soil and/or sediment samples will be selected for fixed-base laboratory analysis (lead only).

Notes:

Soil and sediment samples will be collected in accordance with SOPs -05, -06, -07, -11 and -12 (Appendix C). Field duplicate and MS/MSD samples will be collected at a frequency of 1 per 20 samples per medium per analyte for fixed-base laboratory analysis. Field triplicate samples (IS samples only) will be collected at a frequency of 1 per 20 samples per type of activity (firing point and impact area) for fixed-base laboratory analysis. Therefore, field QC samples may not be collected at every site.

One surface soil sample collected (location to be determined in the field) will also be submitted to the fixed-base laboratory for pH analysis. Two sediment samples collected (locations to be determined in the field) will also be submitted to the fixed-base laboratory for TOC analysis.

SAP Worksheet #18.3 – Field Artillery East Shrapnel Range (UXO 05) Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES	
		SW-846 8330B[3] (Explosives)	SW-846 6010B[3] (Lead Only)
Soil and/or Sediment Samples at Firing Point			
X05SB01	X05SS01C0006	1	NA
X05SB02 or X05SD02	X05SS02G0001 or X05SD02G0006 and X05SD02G2436	NA	TBD[4]
X05SB03 or X05SD03	X05SS03G0001 or X05SD03G0006 and X05SD03G2436	NA	TBD[4]
Total Soil and/or Sediment Samples - UXO 5		**1**	**Min 2 – Max 4**

1 X = UXO Site ; SB = Soil Boring; SS = Surface Soil; SD = Sediment
2 SS = Surface soil; SD = Sediment C = Composite Sample; G = Grab sample. Last four digits of sample ID indicate depth below ground surface in feet for discrete/grab surface soil samples and depth below ground surface in inches for IS/composite surface soil and sediment.
3 Analysis to be performed by Katahdin Laboratories. For composite IS samples for explosive analysis, GPL Laboratories will be conducting the grinding portion of sample preparation prior to analysis.
4 Total number of samples to be collected is dependent on field conditions and locations of samples. If a discrete soil sample is collected, one sample will be collected per location at a depth of 0 to 1 foot bgs. If a discrete sediment sample is collected, two samples will be collected per location at depths of 0 to 6 inches bgs and 2 to 3 feet bgs.

Notes:

Soil and sediment samples will be collected in accordance with SOPs -05, -06, -07, -11 and -12 (Appendix C). Field duplicate and MS/MSD samples will be collected at a frequency of 1 per 20 samples per medium per analyte for fixed-base laboratory analysis. Field triplicate samples (IS samples only) will be collected at a frequency of 1 per 20 samples per type of activity (firing point and impact area) for fixed-base laboratory analysis. Therefore, field QC samples may not be collected at every site.

SAP Worksheet #18.4 – Field Artillery East Shrapnel Range (UXO 06) Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sample Location[1]	Sample ID[2]	NUMBER OF SAMPLES	
		SW-846 6010B[3] (Lead Only)	SW-846 8330B[3] (Explosives)
Sediment from the Waterways			
X06SD01	X06SD01G0006	1	1
X06SD02	X06SD02G0006	1	1
X06SD03	X06SD03G0006	1	1
X06SD04	X06SD04G0006	1	1
X06SD05	X06SD05G0006	1	1
X06SD06	X06SD06G0006	1	1
X06SD07	X06SD07G0006	1	1
X06SD08	X06SD08G0006	1	1
X06SD09	X06SD09G0006	1	1
X06SD10	X06SD10G0006	1	1
X06SD11	X06SD11G0006	1	1
X06SD12	X06SD12G0006	1	1
X06SD13	X06SD13G0006	1	1
Sediment Samples from within Dry Areas			
X06SD14	X06SD14G0006	1	1
X06SD14	X06SD14G2436	1	1
X06SD15	X06SD15G0006	1	1
X06SD15	X06SD15G2436	1	1
X06SD16	X06SD16G0006	1	1
X06SD16	X06SD16G24366	1	1
Total Soil and/or Sediment Samples – UXO 6		**19**	**19**

1 X = UXO Site ; SD = Sediment
2 SD = Sediment; G = Grab sample. Last four digits of sample ID indicate depth below ground surface in inches for sediment.
3 Analysis to be performed by Katahdin Laboratories.

Notes:

Sediment samples will be collected in accordance with SOP-06 and SOP-11 (Appendix C). Field duplicate and MS/MSD samples will be collected at a frequency of 1 per 20 samples per medium per analyte for fixed-base laboratory analysis. Field triplicate samples (IS samples only) will be collected at a frequency of 1 per 20 samples per type of activity (firing point and impact area) for fixed-base laboratory analysis. Therefore, field QC samples may not be collected at every site.

Two sediment samples collected (locations to be determined in the field) will also be submitted to the fixed-base laboratory for TOC analysis.

SAP Worksheet #19 -- Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Sample Volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (1) (preparation/ analysis)
Water	Metals	SW-846 3005A/6010C, CA-604/CA-608/CA-627	500-milliliter plastic	50 milliliters	Nitric acid to a pH<2; Cool to 4 °C	180 days to analysis
Solid	Metals	SW-846 3050B/6010B, CA-605/CA-608/CA-627	4-ounce glass	1 to2 grams	Cool to 4 °C	180 days to analysis
Water	Explosives	SW-846 8330B, CA-402	Two 1-liter amber glass	1,000 milliliters	Cool to 4 °C	7 days to extraction 40 days to analysis
Solid	Explosives	SW-846 8330B, CA-402	4-ounce glass	2 grams	Cool to 4 °C	14 days to extraction 40 days to analysis
Solid	Explosives (sample preparation, grinding only)	SW-846 8330B Appendix A SOP: G.22	Plastic bag or other container	1 to 4 kilogram	Cool to 4 °C	Within 14 days to extraction holding time
Solid	pH (Corrosivity)	SW-846 9045D, CA-709	One 2-oz. soil jar	20 grams	Cool to 4 (± 2) °C	28 days
Solid	TOC	Lloyd Kahn CA-741	4-ounce glass	0.2 grams	Cool to 4 °C	14 Days

1 Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

SAP Worksheet #20 -- Field Quality Control Sample Summary Table – Analytical Samples

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Concentration Level	Field Samples	Field Duplicates(1)	MS/MSDs(1)	Rinsate Blanks(2)	Total Samples to Lab
Solid	Lead	Low to Moderate	63 (and up to 71[3])	6	6	7	82
Solid	Explosives	Low to Moderate	23	2	2	2	29
Solid	Explosives (IS)	Low to Moderate	16	4[4]	2	3	25
Solid	TOC	Low	5	0	0	0	5
Solid	pH	Low	3	0	0	0	3

MS/MSD = Matrix spike/matrix spike duplicate

1 Field duplicates and MS/MSD samples will be collected at a frequency of 1 per 20 samples per medium and per analyte.
2 Rinsate blanks will be collected at a frequency of one per piece of non-dedicated equipment.

3 Total number to be determined in the field and will be based on results XRF screening and matrix (soil or sediment) of samples collected at UXO 05.

4 Field triplicate samples will be collected for IS samples only, samples will be collected at a frequency of 1 per 20 samples per type of activity (firing point or impact area).

Note: Field sample identifications are provided in Worksheets 18.1 through 18.4. QC sample identifications will be in accordance with SOP-02 (Sample Identification Nomenclature - Appendix C).

SAP Worksheet #21 -- Project Sampling SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-01	Sample Labeling	TtNUS	NA	N	Contained in Appendix C
SOP-02	Sample Identification Nomenclature	TtNUS	NA	N	Contained in Appendix C
SOP-03	Sample Custody and Documentation of Field Activities	TtNUS	Field logbook, sample log sheets, boring logs	N	Contained in Appendix C
SOP-04	Decontamination of Field Sampling Equipment	TtNUS	Decontamination equipment, scrub brushes, 5-gallon buckets, spray bottles, phosphate free detergent, deionized (DI) water	N	Contained in Appendix C
SOP-05	Soil Coring and Sampling Using Hand Auger Techniques	TtNUS	Stainless steel auger bucket, extension rods, and T-handle	N	Contained in Appendix C
SOP-06	Sediment Sampling	TtNUS	Stainless steel or disposable trowels	N	Contained in Appendix C
SOP-07	Borehole and Soil Sample Logging	TtNUS	NA	N	Contained in Appendix C
SOP-08	Sample Preservation, Packaging, and Shipping	TtNUS	NA	N	Contained in Appendix C
SOP-09	Management of Investigation-Derived Waste	TtNUS	NA	N	Contained in Appendix C
SOP-10	Field Portable X-Ray Fluorescence Analysis of Soil and Sediment	TtNUS	Portable XRF analyzer and accessories	N	Contained in Appendix C

Reference Number	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-11	Large Water Body Sediment Sampling	TtNUS	Stainless steel trowel, large Ziploc-type baggies, petite ponar dredge with rope, wide-bodied, flat-bottomed boat powered by an outboard motor	N	Contained in Appendix C
SOP-12	IS Sampling	TtNUS	CRREL Coring devise or equivalent	N	Contained in Appendix C
MRP SOP 02	MEC Management and Accountability	TtNUS	Metal Detector	Y (project specific contact information added)	Contained in Appendix C
MRP SOP 05	GPS	TtNUS	GPS unit	N	Contained in Appendix C

SAP Worksheet #22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
GPS	Positioning	Beginning and end of each day used	Accuracy: sub-meter horizontal dilution of precision (HDOP)<3, number of satellites at least six	Wait for better signal, replace unit, or choose alternate location technique	FOL	MRP SOP 05	None
XRF	Standardization Clip	Prior to daily use and after a shutdown of the unit or battery change	Instrument will either accept or reject the standardization.	If rejected, re-standardize. If still unacceptable, contact manufacturer for further instruction which may include replacement. of the unit	XRF Technician	SOP-10	None
	Instrument Blank verification (silicon dioxide) to ensure there is no contamination on the analyzer window or other component that is being "seen" by the instrument	Prior to daily use and after a shutdown of the unit or battery change	Zero (to ensure there is no contamination on the analyzer window or other component that is being "seen" by the instrument)	If lead concentrations are observed, reanalyze to confirm. Contact manufacturer for possible replacement	XRF Technician	SOP-10	None

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
	Calibration verification	Prior to daily use and after a shutdown of the unit or battery change	20% or less for the NIST standards shipped with the instrument. Typically includes three standards - high (5,532 ppm), medium (1,162 ppm), and low (18 ppm) for lead	Reanalyze the standard. Contact manufacturer for possible replacement	XRF Technician	SOP-10	None

NIST -= National Institute of Standards and Technology

ppm = parts per million

SOPs are located in Appendix C.

SAP Worksheet #23 -- Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (1) (Y/N)
Katahdin CA-101	Equipment Maintenance, 07/08, Revision 7.	NA	Various	Various	Katahdin Analytical Services, Inc.	N
Katahdin CA-402	Determination Of Nitroaromatics And Nitramines By HPLC Method 8330, 07/08, Revision 3.	Definitive	Water and Soil/ GC/HPLC	HPLC/UV	Katahdin Analytical Services, Inc.	N
Katahdin CA-604	Acid Digestion of Aqueous Samples by EPA Method 3010 for ICP Analysis of Total or Dissolved Metals, 05/09, Revision 4.	Definitive	Metals Digestion	NA/ sample preparation	Katahdin Analytical Services, Inc.	N
Katahdin CA-605	Acid Digestion of Solid Samples by USEPA Method 3050 for Metals by ICP-AES and GFAA, 03/08, Revision 3.	Definitive	Metals Digestion	NA/ sample preparation	Katahdin Analytical Services, Inc.	N
Katahdin CA-608	Trace Metals Analysis By ICP-AES Using EPA Method 6010, 02/09, Revision 8.	Definitive	Soil and Water Metals	ICP-AES	Katahdin Analytical Services, Inc.	N
CA-709	pH Concentration Measurements In Soil Matrices - SW 846 Method 9045, 08/09, Revision 7.	Definitive	Soil - pH	pH Meter	Katahdin	N
Katahdin CA-741	Determination of Total Organic Carbon in Solids using the EPA Region II Lloyd Kahn Method, 06/08, Revision 2.	Definitive	Soil Wet Chemistry	TOC Analyzer	Katahdin Analytical Services, Inc.	N
Katahdin SD-902	Sample Receipt and Internal Control, SOP No. SD-902, 05/09, Revision 8.	NA	Various	NA	Katahdin Analytical Services	N
Katahdin SD-903	Sample Disposal, SOP No. SD-903, 05/09, Revision 4.	NA	Various	NA	Katahdin Analytical Services	N
GPL Laboratories G.22	General Laboratory MIS Sub-Sampling Procedures, SOP No. G.22, 01/09, Revision 5.	NA	Soil Preparation (grinding)	NA	GPL Laboratories	N

SAP Worksheet #24 -- Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
Inductively Coupled Plasma	Initial Calibration (IC)	At the beginning of each day or if QC is out of criteria.	One point calibration per manufacturer's guidelines	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Analyst/Supervisor	Katahdin Analytical Services SOP CA-608
	Initial Calibration Blank (ICB)	Before beginning a sample sequence.	No analytes detected > 2 x MDL.	Correct the problem, then reprepare and reanalyze.	Analyst/Supervisor	
	Continuing Calibration Verification (CCV)	At the beginning and end of each run sequence and every 10 samples.	90-110% of True Values	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst/Supervisor	
	Continuing Calibration Blank (CCB)	After every 10 samples and at the end of the sequence.	No analytes detected > 2x MDL.	Correct the problem, then reprepare and reanalyze calibration blank and previous 10 samples.	Analyst/Supervisor	
Inductively Coupled Plasma - Mass Spectrophotometer	Tune	Daily prior to calibration	Mass calibration within 0.1 amu of true value, Resolution < 0.9 amu at 10% peak height	Perform necessary equipment maintenance	Analyst, Supervisor	Katahdin Analytical Services SOP CA-627

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
	IC	Daily prior to sample analysis.	4 point calibration plus blank – correlation coefficient ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	
	Initial Calibration Verification (Second Source)	Before beginning a sample run.	Recovery within ± 10% of true value.	Do not use results for failing elements, unless ICV >110% and sample result < PQL/reporting limit.	Analyst/Supervisor	
	Calibration Blank	Before beginning a sample sequence.	No analytes detected > 2x MDL.	Correct the problem, then re-prepare and reanalyze.	Analyst/Supervisor	
	Continuing calibration	At the beginning and end of each run sequence and every 10 samples	90-110% of True Values	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	
	Low-level Calibration Check Standard	At beginning and end of run	80%-120% for D.O.D. projects of true value	Do not use results for failing elements, unless PQL rec.> upper limit and sample result < PQL/reporting limit.	Analyst/Supervisor	
High Performance Liquid Chromatography/ Ultraviolet Detector (SW846 8330B)	IC - A minimum 5-point calibration is required.	Instrument receipt, major instrument change, when CV does not meet criteria.	5 point calibration – correlation coefficient (r) ≥ 0.995 or $(r)^2$ ≥ 0.990	Repeat IC and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/Supervisor	Katahdin Analytical Services SOP CA-402
	Initial Calibration Verification (ICV)	Once after IC.	70 to 130% recovery.	Identify source of problem, correct, repeat calibration, rerun samples.	Analyst/ Supervisor	
	CCV	After every 10 samples; If calibration curve previously analyzed, analyze daily before samples.	< 20% Difference	(1) Evaluate the samples: If the %D > +20% and sample results are < QL, narrate. If %D > ± 20% only on one channel, narrate. If %D > ± 20% and is likely a result of matrix interference, narrate. Otherwise, reanalyze all samples back to last acceptable CV.	Analyst/Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
pH Meter (Corrosivity)	Initial calibration - Two point calibration with pH buffers	Daily.	N/A.	N/A.	Analyst, Department Manager	CA-709
	CCV	At beginning of run, after every 10 field samples and at end of run.	90% - 110%R of the true value.	Recalibrate and reanalyze samples back to last acceptable CCV.	Analyst, Department Manager	
TOC Analyzer / Lloyd Kahn	IC	initially, when the daily CCV does not pass, but, no longer than every 3 months.	Correlation coefficient >/= 0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	Katahdin Analytical Services SOP CA-741
	CCV	every 10 samples and at the end of the run	80-120% of true value for 415.1 75-125% of true value for Lloyd Kahn	If the CCV fails high, report samples that are <PQL. Recalibrate and/or reanalyze samples back to last acceptable CCV recovery.	Analyst, Supervisor	

SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Inductively Coupled Plasma Spectrometer	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, and replace peristaltic pump tubing as needed. Other maintenance specified in lab Equipment Maintenance SOP.	Metals	Torch, nebulizer chamber, pump, pump tubing.	Prior to IC and as necessary.	Acceptable Calibration or Calibration Verification	Correct the problem and repeat Calibration or Calibration Verification	Analyst/Supervisor	Katahdin SOP CA-608
High Performance Liquid Chromatography / Ultraviolet Detector	Check and sonicate pump valves as needed. Backflush column as needed. Replace analytical column or guard column as needed. Sonicate and replace solvent with every use. Replace the UV lamp as needed. Check and replace seal-pak as needed	Explosives	Column flow, pressure	Prior to initial calibration and/or as necessary.	Acceptable Calibration or Calibration Verification	Correct the problem and repeat Calibration or Calibration Verification	Analyst/Supervisor	Katahdin SOP CA-402

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
pH Meter	Clean, drain, and refill reference electrode as needed.	pH	Reference electrode for white crystals, Inspect electrode for damage.	Before use.	pH 7 ± 0.05 pH units.	Recalibrate and/or perform necessary equipment maintenance.	Analyst / Supervisor	CA-709
TOC Analyzer	Check level of dilution water, drain vessel water, humidifier water, autosampler rinse water and phosphoric acid vessel and fill as needed. Replace oxygen cylinder.	QC standards	Tubing, sample boat, syringe, humidifier, rinse Reservoir, phosphoric acid vessel, oxygen pressure	Prior to initial calibration and as necessary	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst/Supervisor	Katahdin Analytical Services SOP CA-741

SAP Worksheet #26 -- Sample Handling System

(UFP-QAPP Manual Appendix A)

SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FOL/TtNUS
Sample Packaging (Personnel/Organization): TBD/TtNUS
Coordination of Shipment (Personnel/Organization): TBD/TtNUS
Type of Shipment/Carrier: Federal Express
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodians/Katahdin Analytical Services and GPL Laboratories
Sample Custody and Storage (Personnel/Organization): Sample Custodians/ Katahdin Analytical Services and GPL Laboratories
Sample Preparation (Personnel/Organization): Extraction Lab, Metals Preparation Lab, Katahdin Analytical Services/IS Prep Lab, GPL Laboratories
Sample Determinative Analysis (Personnel/Organization): High Performance Liquid Chromatography Lab, Metals Lab/ Katahdin Analytical Services
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 60 days from receipt of samples.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 3 months from sample digestion/extraction
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodians/ Katahdin Analytical Services and GPL Laboratories

SAP Worksheet #27 – Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

SAMPLE CUSTODY REQUIREMENTS

Field Chain of Custody

To ensure the integrity of a sample from collection through analysis, an accurate, written record that traces the possession and handling of the sample is necessary. This documentation is referred to as the chain of custody (COC) form. COC begins at the time of sample collection. A sample is under custody if any of the following conditions apply:

- It is in the owner's actual possession
- It is in the owner's view, after being in his/her physical possession,
- It was in the owner's possession and was locked or sealed it up to prevent tampering,
- It is in a secure area.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part COC form is used with each page of the form signed and dated by the recipient of a sample or portion of sample. The person releasing the sample and the person receiving the sample each will retain a copy of the COC form each time a sample transfer occurs.

Preservation of the integrity of the samples collected during the SI will be the responsibility of identified persons from the time the samples are collected until the samples, or their derived data, are incorporated into the final report. Sample custody is described in Worksheet 27.

The FOL is responsible for the care and custody of the samples collected until they are delivered to the laboratory or are entrusted to a carrier. When transferring samples, the individuals relinquishing and receiving them will sign, date, and note the time on the COC form. This form documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common carrier). Field COC requirements are provided in SOP-03. Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the laboratory SOPs included in Appendix D.

Laboratory Chain of Custody – Katahdin Analytical Services and GPL Laboratories

The laboratory sample custody procedures (receipt of samples, archiving, and disposal) documented in Katahdin Analytical Services and GPL Laboratories SOPs will be followed. Coolers will be received and checked for proper temperature. A sample cooler receipt form will be filled out to note conditions and any discrepancies. The COC will be checked against the sample containers for correctness. Samples will be logged into the laboratory information management system (LIMS) and given a unique log number which can be tracked through processing. The client will be notified of any problems.

SAP Worksheet #28 -- Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

Matrix	Water
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-846 3010A, 6010B / Katahdin SOP CA-604, CA-608

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples.	Contaminants in the method blank must be less than the QL.	If blank value > QL report sample results if < QL or > 10 x the blank value; otherwise redigest. If blank value is less than negative QL, report sample results if > 10x the absolute value of the blank result, otherwise redigest.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Contaminants in the method blank must be less than ½ the QL.
Laboratory Control Sample (LCS)	One per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias/ Contamination	Recovery must be within ± 20% of the true value
Laboratory Control Sample Duplicate (LCSD)	One per preparation batch of twenty or fewer samples of similar matrix.	The RPD should be within ≤20% for duplicate samples	Narrate any results that are outside control limits	Analyst, Laboratory Supervisor, and Data Validator	Precision	The RPD should be within ≤20% for duplicate samples.
MS	One per digestion batch of 20 or fewer samples.	Recovery should be ± 25% of the true value if sample < 4x spike added.	Flag results for affected analytes for all associated samples with "N".	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Recovery should be ± 25% of the true value if sample < 4x spike added.
ICP Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with "E".	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.

Matrix	Soil
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-846 3050B, 6010B / Katahdin SOP CA-605, CA-608

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples.	Contaminants in the method blank must be less than ½ the QL.	If blank value > QL report sample results if < QL or > 10 x the blank value; otherwise redigest. If blank value is less than negative QL, report sample results if > 10x the absolute value of the blank result, otherwise redigest.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Contaminants in the method blank must be less than ½ the QL.
LCS	One per digestion batch of 20 or fewer samples.	Recovery must be within vendor supplied limits.	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias/ Contamination	Recovery must be within ± 20% of the true value, unless vendor-supplied or statistical limits have been established.
Duplicate Sample	One per digestion batch of 20 or fewer samples.	The relative percent difference should be within ≤20% for duplicate samples.	Narrate any results that are outside control limits	Analyst, Laboratory Supervisor, and Data Validator	Precision	The relative percent difference should be within ≤20% for duplicate samples.
MS	One per digestion batch of 20 or fewer samples.	Recovery should be ± 25% of the true value, if sample < 4x spike added.	Flag results for affected analytes for all associated samples with ”N”,	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Recovery should be ± 25% of the true value, if sample < 4x spike added.
ICP Serial Dilution	One per digestion batch.	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.

Matrix	Soil
Analytical Group	Explosive
Analytical Method/ SOP Reference	8330B / Katahdin SOP CA-402

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	Contaminants in the method blank must be less than ½ the QL.	Investigate source of contamination. Evaluate the samples and associated QC: ie. the blank results are above the QL, report sample results which are <QL or > 10X the blank concentration. Otherwise, re-prepare a blank and the remaining samples.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Contaminants in the method blank must be less than ½ the QL.
Surrogate	1per sample	1,2-dinitrobenzene = 30%-150%	If surrogate is outside high and sample is <QL no CA taken. If surrogate is outside low the affected samples are re-extracted and reanalyzed,	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	1,2-dinitrobenzene = 30%-150%

Matrix	Soil
Analytical Group	Explosive
Analytical Method/ SOP Reference	8330B / Katahdin SOP CA-402

LCS	One per batch of 20 or less	%Recovery = 30% - 120%	If an MS/MSD was performed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the LCS recovery is high but the sample results are < QL, narrate. Otherwise, re-prepare a blank and the remaining samples.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy/ Bias	%Recovery = 30% - 120%
MS/MSD	One per Sample Delivery Group (SDG) or every 20 samples.	%Recovery = 30% - 150% RPD ≤50%	Evaluate the samples and associated QC: ie. If the LCS results are acceptable, narrate. If both the LCS and MS/MSD are unacceptable, re-prepare the samples and QC.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy/ Bias	%Recovery = 30% - 150% RPD ≤50%

Matrix	Water
Analytical Group	Explosive
Analytical Method/ SOP Reference	8330B / Katahdin SOP CA-402

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	Contaminants in the method blank must be less than ½ the QL.	Investigate source of contamination. Evaluate the samples and associated QC: ie. the blank results are above the QL, report sample results which are <QL or > 10X the blank concentration. Otherwise, re-prepare a blank and the remaining samples.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Contaminants in the method blank must be less than ½ the QL.
Surrogate	1per sample	1,2-dinitrobenzene = 30%-150%	If surrogate is outside high and sample is <QL no CA taken. If surrogate is outside low the affected samples are re-extracted and reanalyzed.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	1,2-dinitrobenzene = 30%-150%
LCS	One per batch of 20 or less	%Recovery = 30% - 120%	If an MS/MSD was performed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the LCS recovery is high but the sample results are < QL, narrate. Otherwise, re-prepare a blank and the remaining samples.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy/ Bias	%Recovery = 30% - 120%

Matrix	Water
Analytical Group	Explosive
Analytical Method/ SOP Reference	8330B / Katahdin SOP CA-402

MS/MSD	One per SDG or every 20 samples.	%Recovery = 30% - 120% RPD ≤30%	Evaluate the samples and associated QC: ie. If the LCS results are acceptable, narrate. If both the LCS and MS/MSD are unacceptable, re-prepare the samples and QC.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy/ Bias	%Recovery = 30% - 120% RPD ≤30%

Matrix	Soil
Analytical Group	pH
Analytical Method/ SOP Reference	SW-846 9045D/ Katahdin SOP CA-709

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	One per 20 or fewer samples of similar matrix.	%R must be within 90-110% of the true value.	Correct problem, recalibrate, and reanalyze samples.	Analyst, Department Manager, QA Officer	Accuracy / Bias	90-110 %R.
Sample duplicate	One sample duplicate per every 10 field samples.	%RPD < 20.	1) Investigate problem and reanalyze sample in duplicate (2) If RPD is still unacceptable, report original result with notation or narration.	Analyst, Department Manager, QA Officer	Precision	RPD < 20%, if result >10x MDL; else, <±QL.

Matrix	Soil
Analytical Group	TOC
Analytical Method/ SOP Reference	Lloyd Kahn, / CA-741

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per 20 samples	No analyte > PQL	Investigate source of contamination. Report all sample results > 10 x the blank result and flag results with "B". Reprepare and analyze method blank and all other samples processed with the contaminated blank.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > PQL
Laboratory Quadruplicate	One sample quadruplicate per 20 samples.	RSD < 30%	If lab QC in criteria and matrix interference suspected, flag data. Otherwise, reanalyze.	Analyst, Supervisor, QA Manager	Precision	RSD < 30%
MS	One per 10 samples	75-125 % recovery	If LCS in criteria and matrix interference suspected, flag data. Otherwise, reanalyze.	Analyst, Supervisor, QA Manager	Accuracy/Bias	75-125 % recovery
LCS	One per 20 samples	80-120%	Investigate source of problem. If the LCS fails high, report samples that are < PQL. Reprepare a blank the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias	80-120%

SAP Worksheet #29 -- Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
Sample Collection Documents and Records Project Personnel Sign-off Record Field logbook (and sampling notes) Field sample forms (e.g., boring logs, sample log sheets, drilling logs, etc.) COC records Sample shipment airbills Equipment calibration logs Photographs FTMR forms SAP Field sampling SOPs	TtNUS project file (may include hard-copy as well as electronic information), results will be discussed in subject document.

Document	Where Maintained
Laboratory Documents and Records Sample receipt/log-in forms Sample storage records Sample preparation logs Standard traceability logs Equipment calibration logs Sample analysis run logs Equipment maintenance, testing, and inspection logs FTMR forms Reported field sample results Reported results for standards, QC checks, and QC samples Data completeness checklists Sample storage and disposal records Telephone logs Extraction/clean-up records Raw data	TtNUS project file (may include hard-copy as well as electronic information), long-term data package storage at third-party professional document storage firm (BRM), results will be discussed in subject document.
Data Assessment Documents and Records Field sampling audit checklist (if an audit is conducted) Analytical audit checklist (if an audit is conducted) Data validation memoranda	TtNUS project file (may include hard-copy as well as electronic information), results will be discussed in subject document.
Other Documents HASP All versions of SAP All versions of reports (e.g., SI, RI, FS, etc.)	TtNUS project file (may include hard-copy as well as electronic information)

SAP Worksheet #30 -- Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical Method	Data Package Turnaround Time	Laboratory/Organization (name and address, contact person and telephone number)	Backup Laboratory/Organization (name and address, contact person and telephone number)
Soil, Sediment, and Aqueous (QC) samples	Metals	See Worksheet #18	SW-846 6010B SOP: CA-604, CA-605, CA-608, CA-627	21 calendar days	PM: Kate Zaleski Katahdin Analytical Services, Inc. 600 Technology Way Scarborough, Maine 04074 Ms. Kate Zaleski 207.874.2400 x17 kzaleski@katahdinlab.com	NA
	Explosives	See Worksheet #18	SW-846 8330B SOP: CA-402	21 calendar days		
	pH (soil only)	See Worksheet #18	SW-846 9045C SOP: CA-709	21 calendar days		
	TOC (sediment only)	See Worksheet #18	Lloyd Kahn Method SOP: CA-741	21 calendar days		
Soil and Sediment	Explosives (sample preparation, grinding only)	See Worksheet #18	SW-846 8330B Appendix A SOP: G.22	extraction within 14 calendar days	PM: David Howell GPL Laboratories 7210 Corporate Ct. Frederick, MD 21703 301.694.5310 howell@gplab.com	NA

SAP Worksheet #31 -- Planned Project Assessments Table

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing CA** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of CA** (title and organizational affiliation)
Field Supervision	Daily during sampling events	Internal	TtNUS	TtNUS FOL	TtNUS FOL	TtNUS FOL and Field Crew	TtNUS TOM, QAM, and FOL
Project Supervision	Every sampling	Internal	TtNUS	TtNUS TOM	TtNUS FOL	TtNUS TOM and FOL	TtNUS TOM and FOL
Field Sampling System Audit	One per contract year	Internal	TtNUS	TBD	TtNUS TOM and FOL	TtNUS Auditor and TOM	CLEAN QAM
Laboratory System Audit [1]	Every 18 months	External	DoD ELAP	DoD ELAP	Laboratory QAM or Laboratory Manager Katahdin Analytical Services and GPL Laboratories	Laboratory QAM or Laboratory Manager Katahdin Analytical Services and GPL Laboratories	DoD ELAP and TtNUS

1 Katahdin Analytical Services has successfully completed the laboratory evaluation process required as part of the NFESC QA program and as described in the DoD Quality Service Manual (QSM) and has obtained DoD ELAP accreditation. GPL Laboratories has also obtained DoD ELAP accreditation. GPL Laboratories will be preparing (grinding) explosives samples via SW-846 8330B Appendix A and Katahdin will extract and analyze all samples. The NFESC and DoD ELAP certification documentation is included in Appendix D.

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Field Supervision	Site logbook and sample collection logs	Mark Sladic, TOM, TtNUS Stanley Conti, FOL, TtNUS	Immediately	Entry in site logbook	Mark Sladic, TOM, TtNUS Stanley Conti, FOL, TtNUS	24 hours
Project Supervision	Written report	Debra Humbert Program Manager, TtNUS; Mark Perry, Deputy Program Manager, TtNUS	Monthly	Written memo	Debra Humbert Program Manager, TtNUS; Mark Perry, Deputy Program Manager, TtNUS	Within one week of notification
Field Sampling System Audit	Audit checklist and written audit finding summary	Mark Sladic, TOM, TtNUS Stanley Conti, FOL, TtNUS Debra Humbert, Program Manager , TtNUS ; Mark Perry, Deputy Program Manager, TtNUS	Dependent on the finding, if major a stop work may be issued immediately; however, if minor, within 1 week of audit	Written memo	Kelly Carper , CLEAN QAM, TtNUS Designee, Field Auditor, TtNUS Debra Humbert, Program Manager TtNUS; Mark Perry, Deputy Program Manager, TtNUS	Within 48 hours of notification
Laboratory System Audit	Written audit report	Laboratory Manager or Laboratory QAM Katahdin Analytical Services and GPL Laboratories	Not specified by DoD ELAP	Letter	DoD ELAP	Specified by DoD ELAP

SAP Worksheet #33 -- QA Management Reports Table

(UFP QAPP Manual Section 4.2)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Data validation report	Per SDG	Completion of data validation	DVM and Staff Chemists, TtNUS	TOM and project file, TtNUS
Major analysis problem identification (internal memo)	When persistent analysis problems are detected	On the same day	CLEAN QAM, TtNUS	TOM, CLEAN QAM, Program Manager, and project file, TtNUS
Project monthly progress report	Monthly for duration of project	Monthly	TOM, TtNUS	Project file, Navy
Field progress report	Daily, oral, during the course of sampling	Every day that field sampling is occurring	FOL, TtNUS	TOM, TtNUS
Laboratory QA report	When significant plan deviations result from unanticipated circumstances	On the same day	Katahdin Analytical Services and GPL Laboratories	Project file, TtNUS
Audit report	In conjunction with audits	After completion of audits (within 3 weeks)	Auditor(s)	TOM, QAM, TtNUS, and audited entity

SAP Worksheet #34 -- Verification (Step I) Process Table

(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Chain-of-custody forms	The TtNUS FOL or designee will review and sign the chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and that the sample information is accurate. The forms will be signed by the sampler and a copy will be retained for the project file, TOM, and data validators.	Internal	Sampler and FOL, TtNUS
SAP sample tables	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	FOL or designee, TtNUS
Sample log sheets	Verify that information recorded on the log sheets is accurate and complete.	Internal	FOL or designee, TtNUS
Sample coordinates	Verify that sample locations are correct and in accordance with the SAP proposed locations.	Internal	FOL or designee, TtNUS
Field QC samples	Check that field QC samples listed in Worksheet #20 were collected as required.	Internal	FOL or designee, TtNUS
Chain-of-custody forms	The laboratory sample custodian will review the sample shipment for completeness, and integrity, and sign accepting the shipment. The data validators will check that the chain-of-custody form was signed/dated by the TtNUS FOL or designee relinquishing the samples and also by the laboratory sample custodian receiving the samples for analyses.	Internal/ External	1 - Laboratory sample custodian 2 -Data validators, TtNUS
Analytical data package	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The laboratory QAM will sign the case narrative for each data package.	Internal	Katahdin Analytical Services and GPL Laboratories
Analytical data package	The data package will be verified for completeness by TtNUS data validators. Missing information will be requested from the laboratory, and validation will be suspended until missing data are received.	External	Data validators TtNUS

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Analytical data package and electronic data deliverables (EDDs)	The electronic data will be verified against the chain-of-custody form and hard copy data package for accuracy and completeness. Laboratory analytical results will be verified and compared to the electronic analytical results for accuracy. Sample results will be evaluated for laboratory contamination and will be qualified for false positives using the laboratory method/preparation blank summaries. Positive results reported between the MDL and the reporting limit will be qualified as estimated. Extraneous laboratory qualifiers will be removed from the validation qualifier.	External	Data validators TtNUS

Verification includes field data verification and laboratory data verification. Verification inputs as per SAP Worksheet 34 will be checked.

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37, page 110 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Field SOPs/Field Logs/Sample Collection Logs	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and Measurement Performance Criteria (MPC) have been achieved. Particular attention will be given to verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented COC from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	Designee, TtNUS
IIa	Analytical SOPs	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Data Validators, TtNUS
IIa	Documentation of Method QC Results	Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the laboratory will contact TtNUS for guidance prior to report preparation.	Data Validators, TtNUS
IIa	Chain-of-custody forms	Ensure that the custody and integrity of the samples were maintained from collection to analysis and that custody records are complete and any deviations are recorded.	Project Chemist or Data Validators, TtNUS
IIa	Holding times	Review that the samples were shipped and store at the required temperature and sample pH values for chemically preserved samples meet the requirements listed in Worksheet #19. Ensure that the analyses were performed within the holding times listed in Worksheet #19	Project Chemist or Data Validators, TtNUS
IIa/IIb	Laboratory Data Results for Accuracy	Ensure that the laboratory QC samples listed in Worksheet #28 were analyzed and that the MPC listed in Worksheet #12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical quality control criteria set up for this project were met.	Project Chemist or Data Validators, TtNUS

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa/IIb	Field and Laboratory Duplicate Analyses for Precision	Check field sampling precision by calculating the RPD for field duplicate samples. Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses, matrix spike/matrix spike duplicates, and LCS/LCSD. Ensure compliance with the methods and project MPC accuracy goals listed in Worksheet 12.	Project Chemist or Data Validators, TtNUS
IIa/IIb	Sample Results for Representativenes s	Check that the laboratory recorded the temperature at sample receipt and the pH of chemically preserved samples to ensure sample integrity from sample collection to analysis	Project Chemist or Data Validators, TtNUS
IIa/IIb	PALs	Discuss the impact on matrix interferences or sample dilutions performed because of the high concentration of one or more contaminant on the other target compounds reported as not-detected. Document this usability issue and inform the TOM.	Project Chemist or Data Validators, TtNUS
IIa/IIb	Data Validation Report	Summarize deviations from methods, procedures, or contracts. Qualify data results based on method or QC deviation and explain all the data qualifications. Print a copy of the project database qualified data depicting data qualifiers and data qualifiers codes that summarize the reason for data qualifications. Determine if the data met the MPC and determine the impact of any deviations on the technical usability of the data.	Project Chemist or Data Validators, TtNUS
IIa, IIb	SAP QC Sample Documentation	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Ensure that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the laboratory shall have contacted the TtNUS TOM.	Designee, TtNUS

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa, IIb	Documentation of Analytical Reports for Completeness	Ensure that the chain-of-custody form generated in the field to delivery of analytical data that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. Validator will verify that elements of the data package required for validations are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed as per Worksheet 36. Check that all data have been transferred correctly and completely to the final Structured Query Language (SQL) database.	Project Chemist or Data Validators, TtNUS
IIa/IIb	PALs	Review and add PALs to the laboratory EDD. Flag samples and notify TtNUS TOM of samples that exceed PALs as listed on Worksheet 15.	Designee, TtNUS
IIb	Project QLs for sensitivity	Ensure that the project QLs listed in Worksheet #15 were achieved.	Project Chemist or Data Validators, TtNUS
IIb	Analytical Data Deviations	Determine the impact of any deviation from sampling or analytical methods and SOPs requirements and matrix interferences effect on the analytical results.	Project Chemist or Data Validators, TtNUS

SAP Worksheet #36 –Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1) (Figure 37, page 110 UFP-QAPP Manual)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria [1]	Data Validator (title and organizational affiliation)
IIa and IIb	Solid and aqueous quality control samples	Metals	Limited validation, with 10% full validation, will be performed on all fixed-based analytical results (no data validation of XRF lead results). SW-846 6010B method-specific criteria and those listed in Worksheet numbers 12, 15, 24, and 28. If not included in these worksheets, the logic outlined in USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review EPA-540-R-04-004, October 2004, will be used to apply qualifiers to data.	Data Validators, TtNUS

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria [1]	Data Validator (title and organizational affiliation)
IIa and IIb	Solid and aqueous quality control samples	Explosives	Limited validation, with 10% full validation, will be performed on all the data using SW-846 8330B method-specific criteria and those listed in Worksheet numbers 12, 15, 24, and 28. If not included in these worksheets, the logic outlined in USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review EPA-540/R-08-01, June 2008, will be used to apply qualifiers to data.	Data Validators, TtNUS
IIa and IIb	Solid and aqueous quality control samples	pH and TOC	Limited validation[1] will be performed on all fixed-based analytical results. EPA Region II Lloyd Kahn Method, 06/08, Revision 6 and SW-846 9045 method-specific criteria and those listed in Worksheet numbers 12, 15, 24, and 28. If not included in these worksheets, the logic outlined in USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review EPA-540-R-04-004, October 2004, will be used to apply qualifiers to data.	Data Validators, TtNUS

1 Limited data validation will be conducted to evaluate false positives. Limited data validation consists of data completeness, holding time compliance, calibrations, field quality control and laboratory generated blanks, field duplicate precision, and detection of limits for the data collected during this investigation. The data packages provided by the analytical laboratory will be expansive enough to allow future complete formal data validation, if necessary.

SAP Worksheet #37 -- Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment
The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the project report. The characteristics will be evaluated for multiple concentration levels if the evaluator determines that this is necessary. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these data characteristics: **Completeness** o For each matrix that was scheduled to be sampled, the FOL acting on behalf of the project team will prepare a table listing planned samples/analyses to collected samples/analyses. If deviations from the scheduled sample collection or analyses are identified the TtNUS TOM and risk assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the TtNUS TOM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions. **Precision** o The Project Chemist acting on behalf of the project team will determine whether precision goals for field duplicates and triplicates and laboratory duplicates were met. This will be accomplished by comparing duplicate and triplicate results to precision goals identified in Worksheets 12 and 28. This will also include a comparison of field and laboratory precision with the expectation that field duplicate and triplicate results will be no less precise than laboratory duplicate results. If the goals are not met, or data have been flagged as estimated (J qualifier), limitations on the use of the data will be described in the project report. **Accuracy** o The Project Chemist acting on behalf of the project team will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing percent recoveries of LCS, laboratory Control sample Duplicate (LCSD), MS, MSD, and surrogate compounds to accuracy goals identified in Worksheet 28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, matrix spike, and laboratory control samples. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report.

Data Usability Assessment

Representativeness

- A project scientist identified by the TtNUS TOM and acting on behalf of the project team will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project scientist indicates that a quantitative analysis is required.

Comparability

- The Project Chemist acting on behalf of the project team will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the Project Chemist indicates that such quantitative analysis is required.

Sensitivity

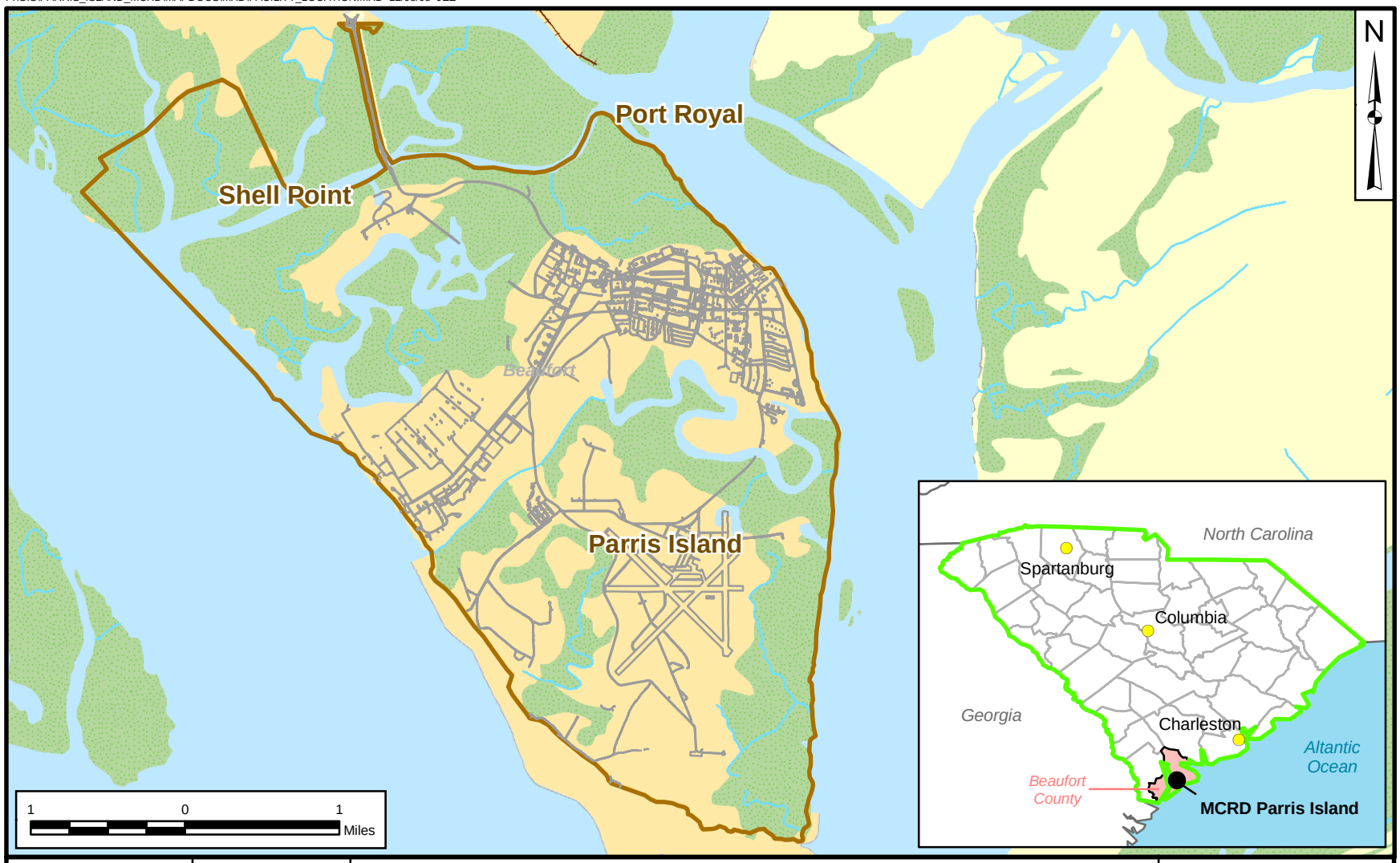
- The Project Chemist acting on behalf of the project team will determine whether project sensitivity goals listed in Worksheet #15 are achieved. The overall sensitivity and QLs from multiple data sets for each matrix and analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described. The Project Chemist will enlist the help of the project risk assessor to evaluate deviations from planned sensitivity goals.

Project Assumptions and Data Outliers

- The TtNUS TOM and designated team members will evaluate whether project assumptions are valid. This will typically be a qualitative evaluation but may be supported by quantitative evaluations. The type of evaluation depends on the assumption being tested. Quantitative assumptions include assumptions related to data distributions (e.g., Normal versus log-normal) and estimates of data variability. Statistical tests for outliers will be conducted using standard statistical techniques appropriate for this task. Potential outliers will be removed if a review of the associated indicates that the results have an assignable cause the renders them inconsistent with the rest of the data. During this evaluation, the team will consider whether outliers could be indications of unanticipated site conditions. Consideration will be given to whether outliers represent an unanticipated site condition.

Data Usability Assessment
Describe the evaluative procedures used to assess overall measurement error associated with the project: After completion of the data validation, the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described above, a series of inspections and statistical analyses will be performed to estimate these characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples exhibiting non-detected results, number of samples exhibiting positive results, and the proportion of samples with detected and non-detected results. The project team members identified by the TOM will assess whether the data collectively support the attainment of project objectives. They will consider whether any missing or rejected data have compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated by other data. Although rejected data will generally not be used, there may be reason to use them in a weight of evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales. For statistical comparisons and mathematical manipulations, non-detected values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate samples will be used to represent the concentration at a particular sampled location.
Identify the personnel responsible for performing the usability assessment: The TtNUS TOM, Project Chemist, FOL, and Project Scientist will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Navy RPM, MCRD Parris Island POC, SCDHEC, and USEPA. If deficiencies affecting the attainment of project objectives are identified, the review will take place either in a face to face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation will support the non-compliance estimated or rejected data results. The project report will identify and describe the data usability limitations and suggest re-sampling or other corrective actions, if necessary.

P:\GIS\PARRIS_ISLAND_MCRD\MAPDOCS\MXD\FACILITY_LOCATION.MXD 12/08/08 JEE

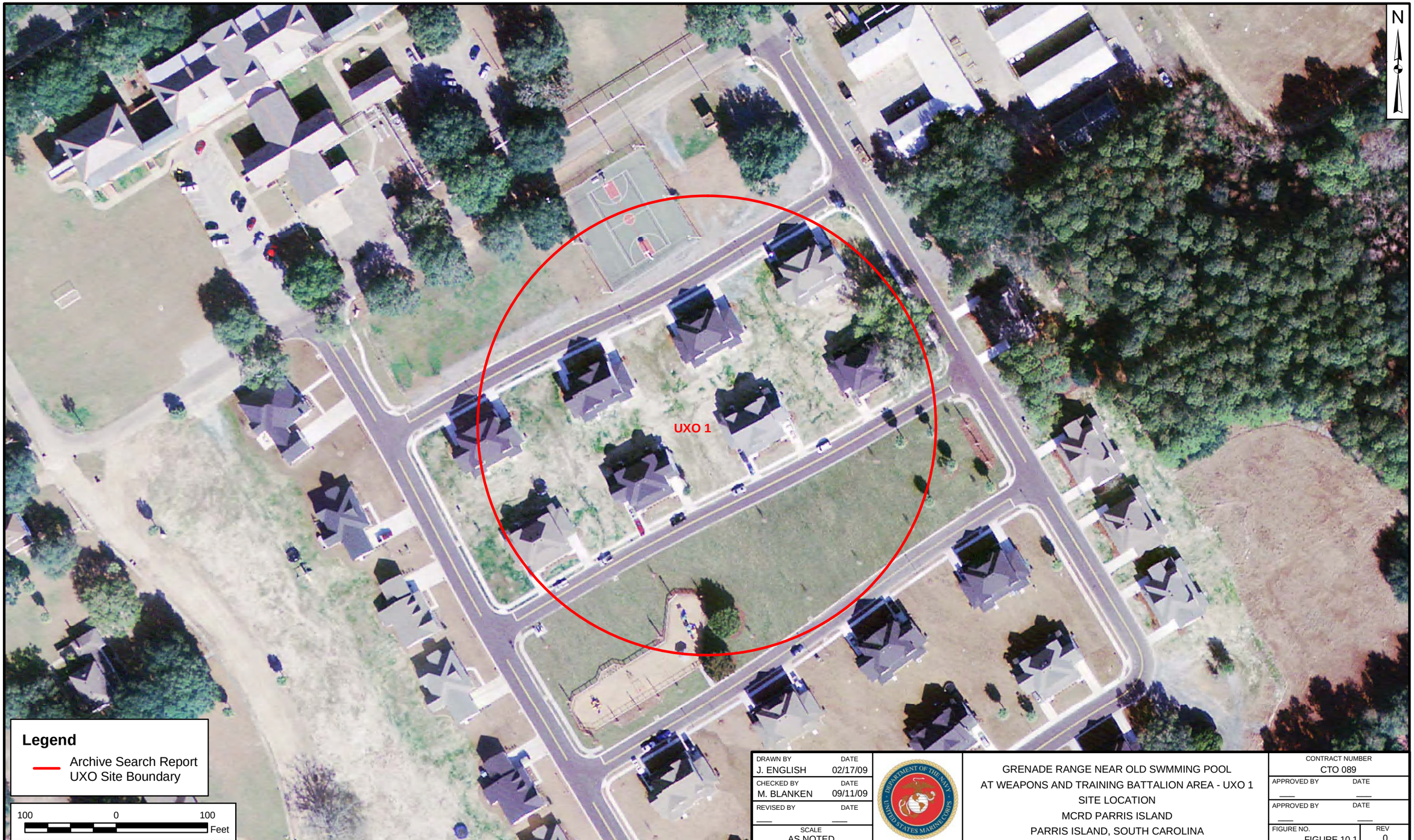


DRAWN BY J. ENGLISH	DATE 12/08/08	FACILITY LOCATION MAP MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 0089
CHECKED BY M. BLANKEN	DATE 12/08/08		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE ES-1 / REV 0

P:\GIS\PARRISISLAND_MCRD\MAPDOCS\MXD\UXOS_BV_ALT.MXD 09/11/09 JEE

DRAWN BY T. WHEATON	DATE 08/24/09	UXO 1, 2, 3, 4, 5, 6, 7, & 8 LOCATION MAP MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE ES-2 / REV 0

P:\GIS\PARRISISLAND_MCRD\MAPDOCS\MXD\UXO1_REVISED_LOCATION.MXD 09/11/09 JEE



DRAWN BY J. ENGLISH	DATE 02/17/09	GRENADE RANGE NEAR OLD SWMMING POOL AT WEAPONS AND TRAINING BATTALION AREA - UXO 1 SITE LOCATION MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 10.1 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO2_RIFLE_RANGE_BALLAST_CREEK_SITE_LOCATION.MXD 01/20/10 TW

DRAWN BY J. ENGLISH	DATE 09/09/09	RIFLE RANGE AT BALLAST CREEK - UXO 2 SITE LOCATION MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 01/20/10		APPROVED BY ___ DATE ___
COST/SCHED AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 10.2 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO3_PARADE_DECK_MC.MXD 09/11/09 JEE

DRAWN BY	DATE
J. ENGLISH	12/08/08
CHECKED BY	DATE
M. BLANKEN	09/11/09
COST/SCHED AREA	
SCALE AS NOTED	

AERIAL BOMBING TARGET AT PARADE DECK - UXO 3

SITE LOCATION

MCRD PARRIS ISLAND

PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	
CTO 089	
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO.	REV
FIGURE 10.3	0

P:\GIS\PARRIS_ISLAND_MCRD\MAPDOCS\MXD\UXO4_WEST_MAIN_RANGE_CENTER_SITE_LOC.MXD 10/29/09 KM

DRAWN BY J. ENGLISH	DATE 09/09/09	FIELD ARTILLERY WEST MAIN RANGE - UXO 4	CONTRACT NUMBER CTO 0089
CHECKED BY M. BLANKEN	DATE 10/29/09	SITE LOCATION	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___	MCRD PARRIS ISLAND	APPROVED BY ___ DATE ___
SCALE AS NOTED	NAVFAC	PARRIS ISLAND, SOUTH CAROLINA	FIGURE NO. FIGURE 10.4 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MAPDOCS\MXD\UXO6_EAST_SHRAPNEL_RANGE_SITE_LOCATION.MXD 09/11/09 JEE

DRAWN BY J. ENGLISH	DATE 09/09/09	FIELD ARTILLERY EAST SHARPNEL RANGE - UXO 5 / UXO 6	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09	SITE LOCATION	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___	MCRD PARRIS ISLAND	APPROVED BY ___ DATE ___
SCALE AS NOTED		PARRIS ISLAND, SOUTH CAROLINA	FIGURE NO. FIGURE 10.5 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO7_AERIAL_BOMBING_GOLF_COURSE_MC.MXD 09/09/09 JEE

DRAWN BY J. ENGLISH	DATE 12/08/08		AERIAL BOMBING TARGET AT GOLF COURSE - UXO 7	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/09/09		SITE LOCATION	APPROVED BY ___ DATE ___
COST/SCHED AREA			MCRD PARRIS ISLAND	APPROVED BY ___ DATE ___
SCALE AS NOTED			PARRIS ISLAND, SOUTH CAROLINA	FIGURE NO. FIGURE 10.6 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO8_BOMBING_TARGET_TIDAL_FLATS_MC.MXD 09/11/09 JEE

DRAWN BY J. ENGLISH	DATE 12/08/08	AERIAL BOMBING TARGET AT SOUTHERN TIDAL FLATS - UXO 8 SITE LOCATION MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09		APPROVED BY ___ DATE ___
COST/SCHED AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 10.7 / REV 0

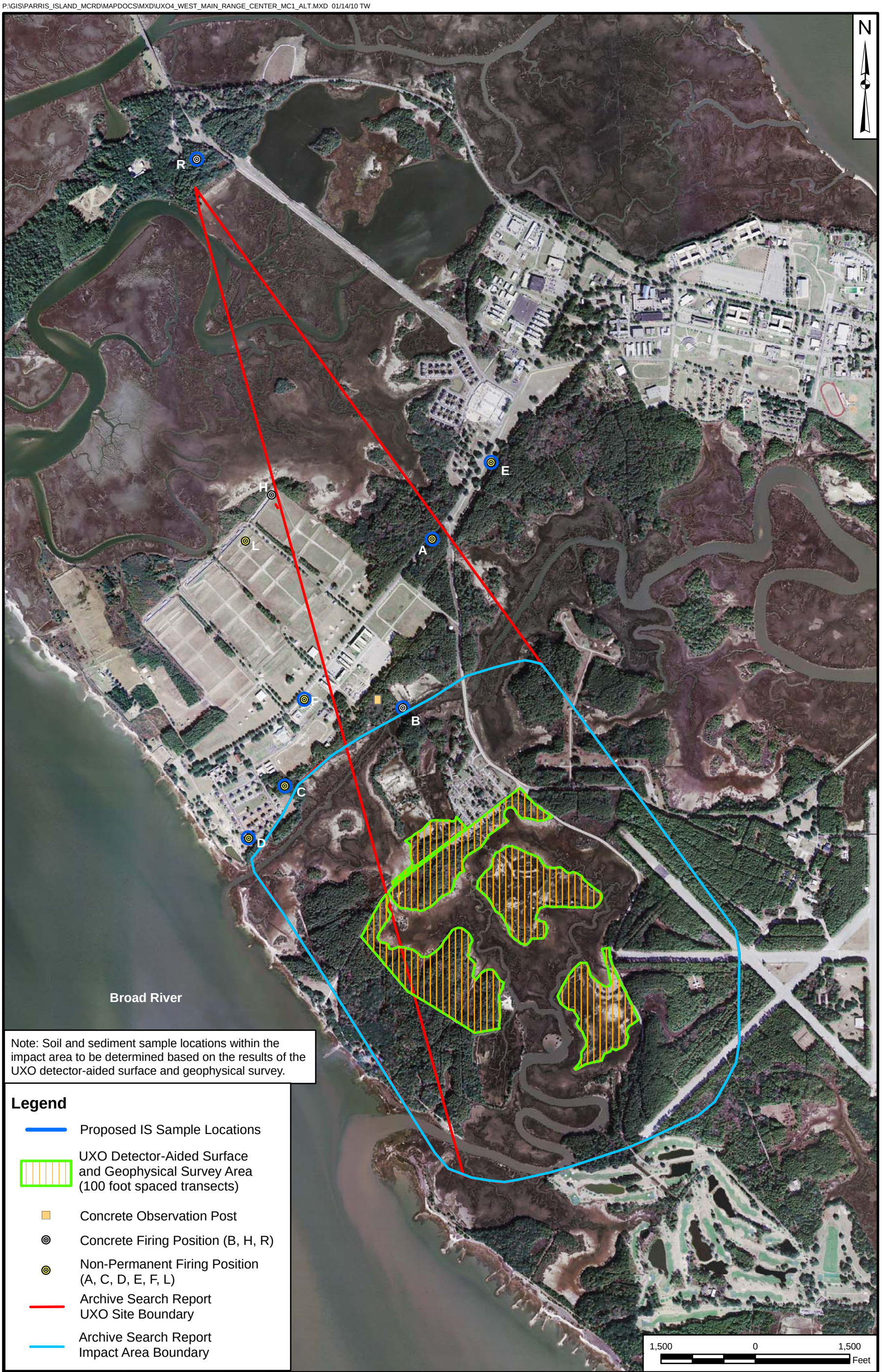
P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO2_RIFLE_RANGE_BALLAST_CREEK_ALT2.MXD 01/20/10 TW

DRAWN BY	DATE
T. WHEATON	08/24/09
CHECKED BY	DATE
M. BLANKEN	01/20/10
COST/SCHED AREA	
SCALE AS NOTED	

RIFLE RANGE AT BALLAST CREEK - UXO 2
MC INVESTIGATION AREA
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER CTO 089	
APPROVED BY ___	DATE ___
APPROVED BY ___	DATE ___
FIGURE NO. FIGURE 17.1	REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MAPDOCS\MXD\UXO4_WEST_MAIN_RANGE_CENTER_MC1_ALT.MXD 01/14/10 TW



Note: Soil and sediment sample locations within the impact area to be determined based on the results of the UXO detector-aided surface and geophysical survey.

Legend

- Proposed IS Sample Locations
- UXO Detector-Aided Surface and Geophysical Survey Area (100 foot spaced transects)
- Concrete Observation Post
- Concrete Firing Position (B, H, R)
- Non-Permanent Firing Position (A, C, D, E, F, L)
- Archive Search Report UXO Site Boundary
- Archive Search Report Impact Area Boundary

DRAWN BY J. ENGLISH	DATE 09/09/09	FIELD ARTILLERY WEST MAIN RANGE - UXO 4	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 01/14/10	MC INVESTIGATION AREA	APPROVED BY ___ DATE ___
REVISED BY T. WHEATON	DATE 01/14/10	MCRD PARRIS ISLAND	APPROVED BY ___ DATE ___
SCALE AS NOTED	NAVFAC	PARRIS ISLAND, SOUTH CAROLINA	FIGURE NO. FIGURE 17.2 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO6_EAST_SHRAPNEL_RANGE_MC_ALT3.MXD 09/30/09 TW

DRAWN BY	DATE
T. WHEATON	09/30/09
CHECKED BY	DATE
M. BLANKEN	09/30/09
COST/SCHED AREA	
SCALE AS NOTED	

FIELD ARTILLERY EAST SHRAPNEL RANGE - UXO 5 / UXO 6

MC INVESTIGATION AREA

MCRD PARRIS ISLAND

PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	
CTO 089	
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO. FIGURE 17.3	REV 0

APPENDIX A

UFP SAP FOR MEC

UFP SAP FOR MEC

PROVIDED IN VOLUME II

APPENDIX B

PROJECT SUPPORT INFORMATION

B1

FACILITY BACKGROUND CONCENTRATIONS

APPENDIX H

BACKGROUND SAMPLE DESCRIPTION, LOCATIONS, AND SUPPORTIVE COLLECTION DATA (FROM RFI/RI FOR SWMU 3)

TABLE 4-1

SUMMARY OF DETECTED BACKGROUND CONCENTRATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA

Parameter	Surface Soil	Sediment	Surface Water Filtered	Surface Water Unfiltered
Organics	**(µg/kg)**	**(µg/kg)**	**(µg/l)**	**(µg/l)**
4-Methyl-2-pentanone	7.3	26		
2-Butanone		22		
Acetone	267			
Chloromethane				0.68
Carbon Disulfide		9.2		
Toluene	5.7	9.7		
Xylenes				1
Bis(2-Ethylhexyl)phthalate		421		45
Fluorene	646			
Indeno(1,2,3-cd)pyrene		518		2.6
Beta-BHC		7.1		
Inorganics	**(mg/kg)**	**(mg/kg)**	**(µg/l)**	**(µg/l)**
Aluminum	7270	24200		3100
Arsenic	1.4	12	4.3	5.1
Barium	24	28	256	38
Beryllium	0.095	0.98		
Cadmium		0.28		
Calcium	766	4000	650000	637000
Chromium	6.2	35.2	20	22.5
Cobalt	0.36	2.6		
Copper	1.5	10	13	7
Iron	3920	21500	48	2090
Lead	12.5	21	11	
Magnesium	515	6400	1900000	1900000
Manganese	129	186	18	53
Mercury	0.11	0.09		
Nickel	1.8	6		
Potassium	313	3200	890000	830000
Selenium	0.29			
Sodium	241	19000	15900000	16000000
Thallium	0.098	0.41		
Vanadium	9.5	50	15	18
Zinc	9.7	45	66	11

Background concentration is calculated as 2 times the average background concentration.

For chemicals in which at least one detection was noted, the average was calculated using 1/2 the detection limit for non detected chemicals.

Blank: Indicates that the chemical was not detected in any sample, and therefore an average could not be calculated.

Chemicals not detected in the background data set were not presented in this table. They include antimony, silver, and most organic compounds.

4.0 NATURE AND EXTENT OF CONTAMINATION

This section presents the analytical results of the 1998 and 1999 field investigation sampling conducted at Site/SWMU 3 (Site 3). Site 3 is the Causeway Landfill. This landfill was the major disposal area for trash and other waste materials discarded in dumpsters located around the base from 1960 to 1972. Approximately 75 percent of the solid waste originated from the Depot. This solid waste reportedly included empty pesticide containers, oily rags, spent adsorbent, petroleum, and chlorinated solvent sludge, perchloroethylene still bottoms, mercury amalgram and beryllium waste, PCB-contaminated oil, and metal shavings.

In 1988, eight surface water and sediment samples were collected and analyzed for priority pollutants. The 1988 sample results were reported in the 1990 Verification Report and were also included in the current Work Plan for Site 3 (B&R Environmental, 1998b). Exceedances of screening criteria were noted for several metals. These results are discussed and compared to the 1998 surface water and sediment results (see Sections 4.1.3 and 4.1.4). In 1992, biota samples were collected from the area. Detected concentrations were at concentrations less than U.S. Food and Drug Administration (USFDA) action levels. Additional discussion is presented in Section 4.5.

Samples were collected from Site 3 in the spring and summer of 1998. Additional sediment samples were collected in August 1999 to better delineate results obtained during the 1998 testing. A summary of the analytical program is provided in Tables 3-1 and 3-2. Sample locations are shown on Figures 3-1, 3-2, and 3-3. During the field investigation sampling, 16 surface soil samples, four filtered and non-filtered groundwater samples, 20 filtered and non-filtered surface water samples, and 20 sediment samples were collected and analyzed. In 1999, 12 additional sediment samples were collected. A complete set of analytical results is presented in Appendix C.

Analytical results were also compared to human health and ecological criteria on a preliminary basis. Data presented in Section 4.0 figures exceeds background plus Human Health RBCs or ecological screening values. A detailed discussion pertaining to the comparison of analytical results to EPA human health and ecological criteria is provided in the human health and ecological risk assessments presented in Sections 6.0 and 7.0, respectively. Inorganic background levels are based on samples collected from areas that are remote from the investigative sites and other waste management activities at Parris Island. For each background area, sample locations were visually located in the field to confirm the absence of waste management activities and represent a range of undisturbed soil and sediment types. The two locations selected for background samples consist of Pickney Island and an undeveloped area on the southern portion of Parris Island. See Appendix A for sample locations. Six background samples were collected for all media of concern, except groundwater. Positive detections were noted for most

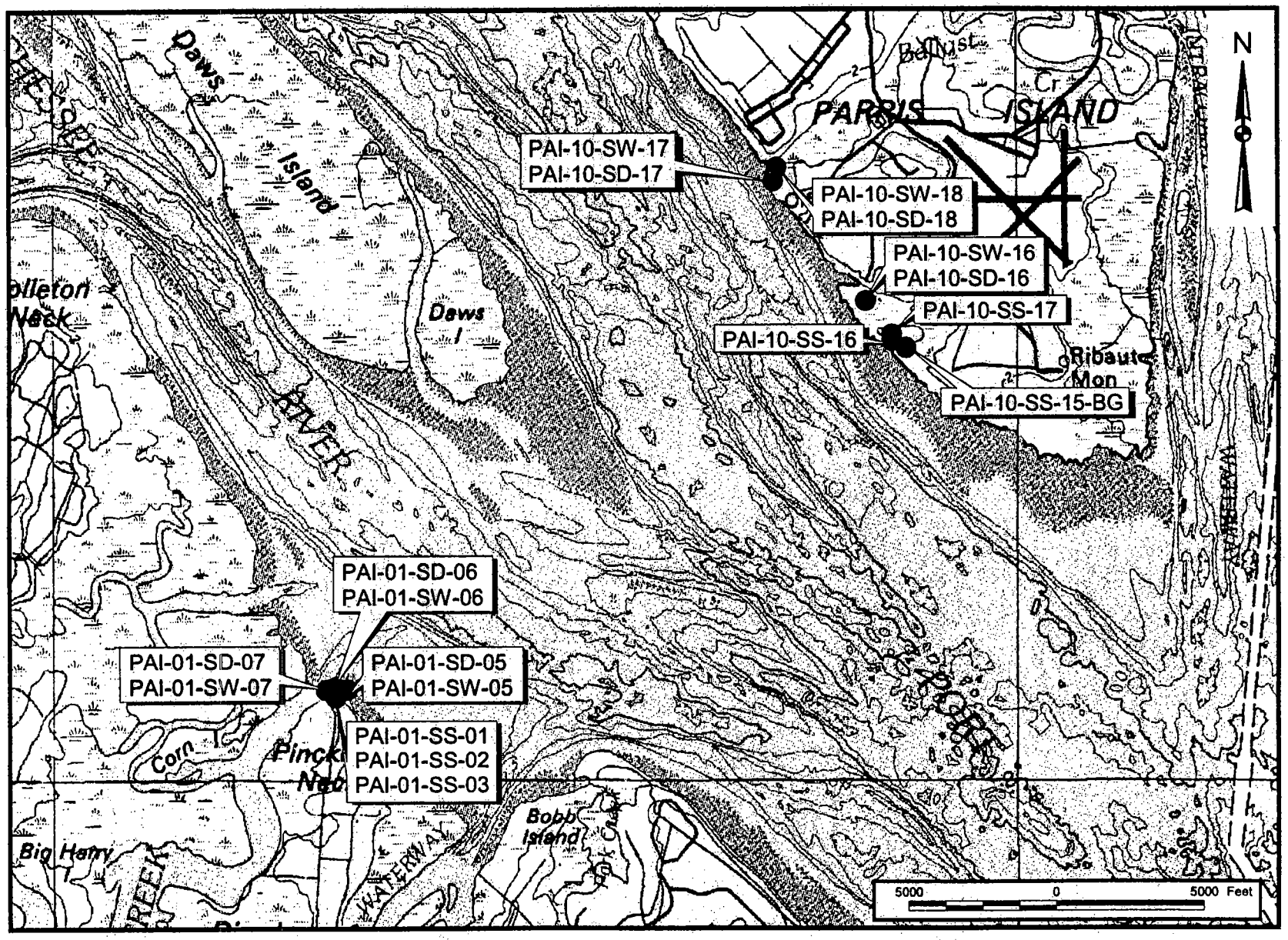
A-12

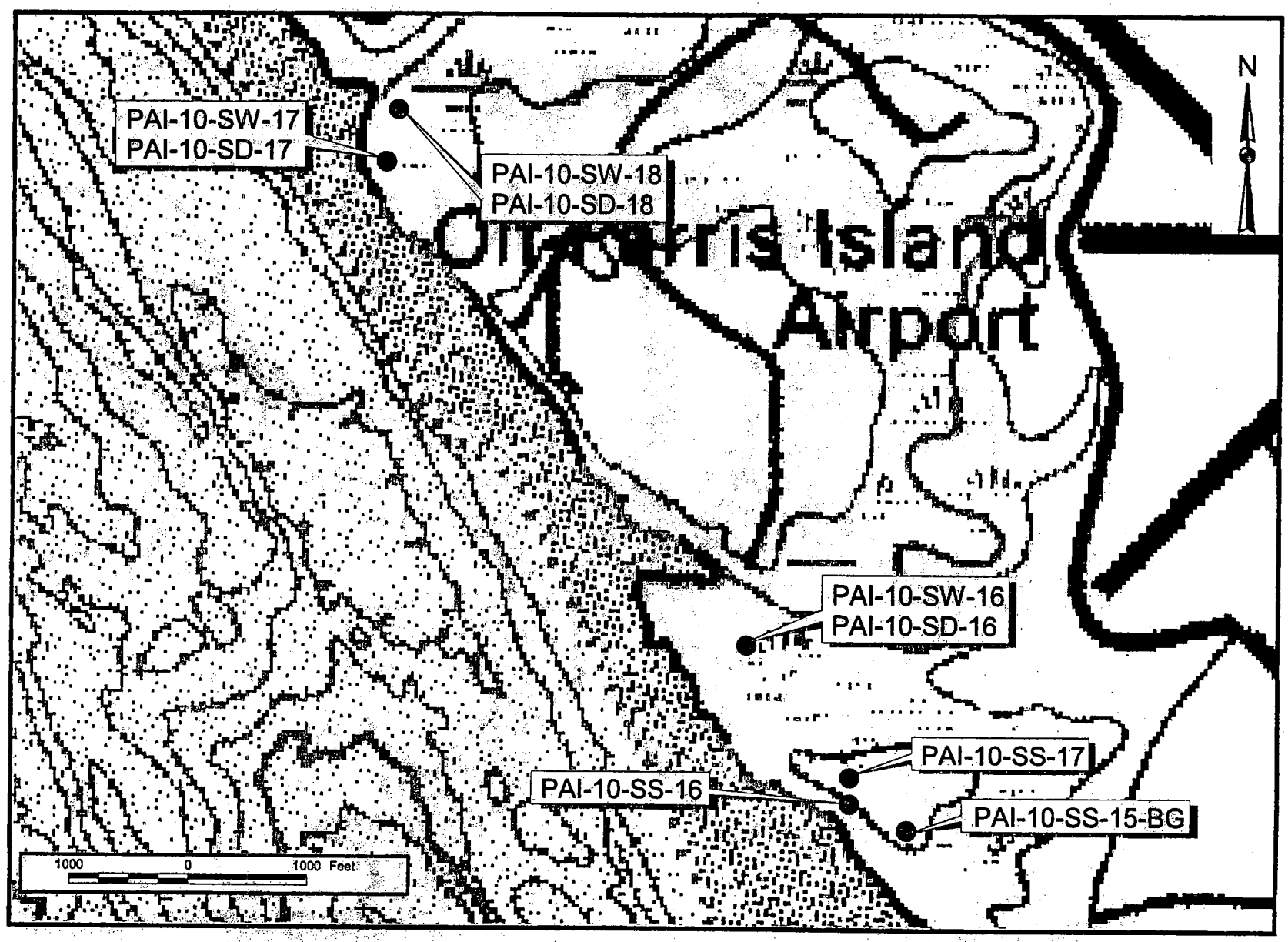
BACKGROUND SAMPLE DESCRIPTION, LOCATIONS, AND SUPPORTING COLLECTION DATA

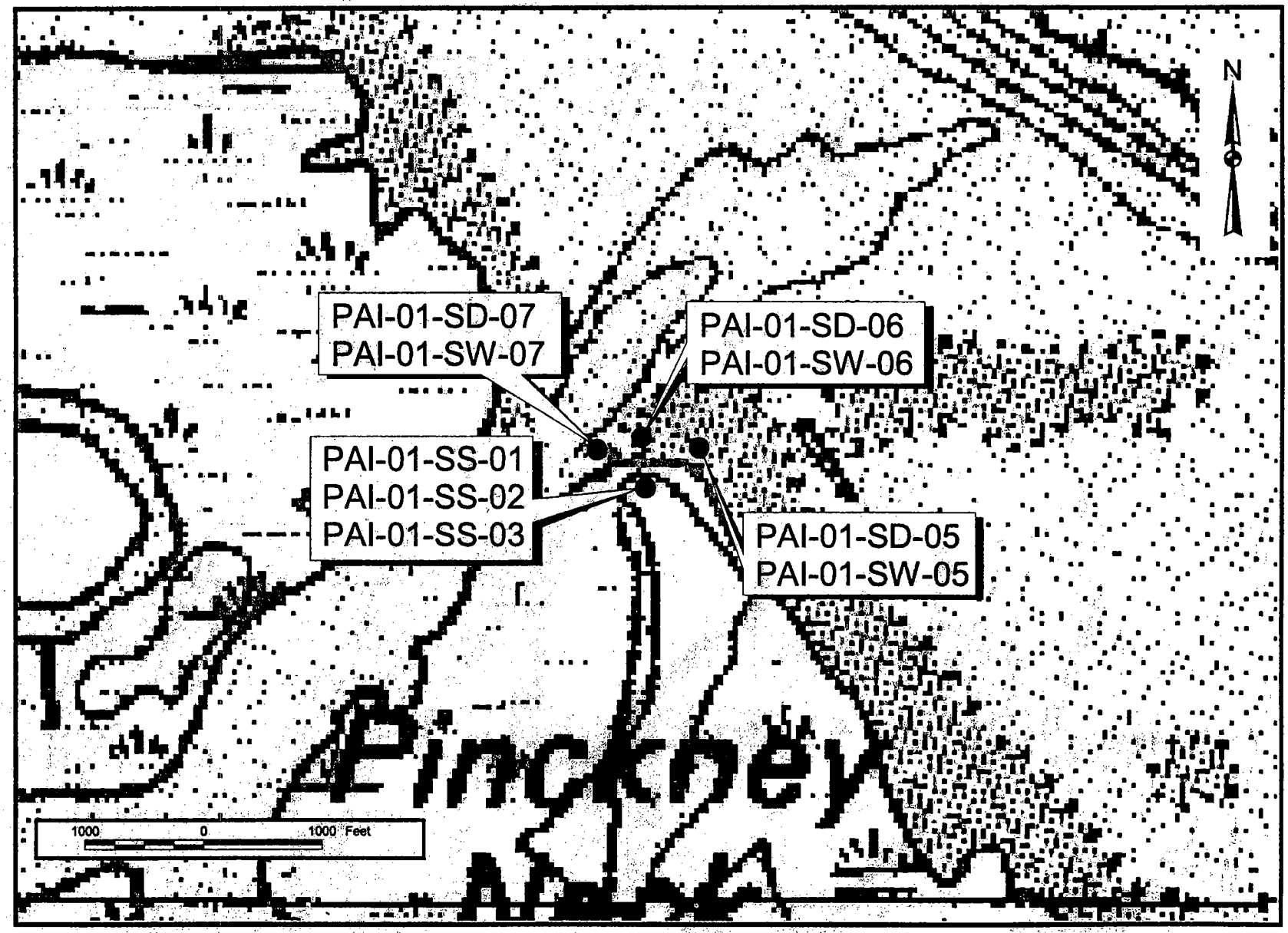
BACKGROUND SAMPLE DESCRIPTION
PARRIS AND PINCKNEY ISLANDS
MCRD PARRIS ISLAND, SOUTH CAROLINA

Sample Location	Sample Description
Surface Water	
PAI-01-SW-05*	Saline surface water sample collected on the northern edge of Pinckney Island at a submerged low tide elevation point.
PAI-01-SW-06*	Saline surface water sample collected in an intertidal area approximately 50 ft west of PAI-01-SW-05.
PAI-01-SW-07*	Saline surface water sample collected from flowing water at a point southwest of PAI-01-SW-05 and PAI-01-SW-06 over a high tide tidal flat in the marsh area.
PAI-10-SW-16	Saline surface water sample collected from a tidal stream adjacent to the Broad River, along the southwestern edge of Parris Island.
PAI-10-SW-17	Saline surface water sample collected from a tidal stream adjacent to the Broad River, along the southwestern edge of Parris Island.
PAI-10-SW-18	Saline surface water sample collected from a tidal stream adjacent to the Broad River, along the southwestern edge of Parris Island.
Sediment	
PAI-01-SD-05*	Sediment sample collected from the northern edge of Pinckney Island at a submerged low tide elevation point. Sample consisted of fine/medium grain sand.
PAI-01-SD-06*	Fine, medium grain sand sample collected in an intertidal area approximately 50 ft west of PAI-01-SD-05.
PAI-01-SD-07*	Collected from flowing water at a point west of PAI-01-SD-05 and PAI-01-SD-06, over a high tide tidal flat in the marsh area. Sample consisted of fine/medium grain sand.
PAI-10-SD-16	Silty clay sediment sample collected on the southwestern edge of Parris Island, near the Broad River
PAI-10-SD-17	Sediment sample with clay mud consistency collected approximately 500 ft south of the Ballast Creek on the southwestern edge of Parris Island.
PAI-10-SD-18	Sediment sample with clay mud consistency collected approximately 500 ft northeast of location PAI-10-SD-17.
Surface Soil	
PAI-01-SS-01*	Soil sample with fine/medium grain sand collected on the northern edge of Pinckney Island.
PAI-01-SS-02*	Located east of PAI-01-SS-01, consisting of fine/medium grain sand.
PAI-01-SS-03*	Fine/medium grain sand sample located southeast of PAI-01-SS-01.
PAI-10-SS-15	Silty, fine sand sample collected in a forest area on the southwestern edge of Parris Island.
PAI-10-SS-16	Collected in a forest area on the southwestern edge of Parris Island, approximately 600 ft northwest of PAI-01-SS-15. Surface soil sample consisted of silty fine sand.
PAI-10-SS-17	Silty, fine sand sample collected in a forest area on the southwestern edge of Parris Island, approximately 250 ft north of PAI-10-SS-16.

* Sample locations selected with input from the United States Fish and Wildlife Service. Additional description of samples and locations are provided on sample log sheets.

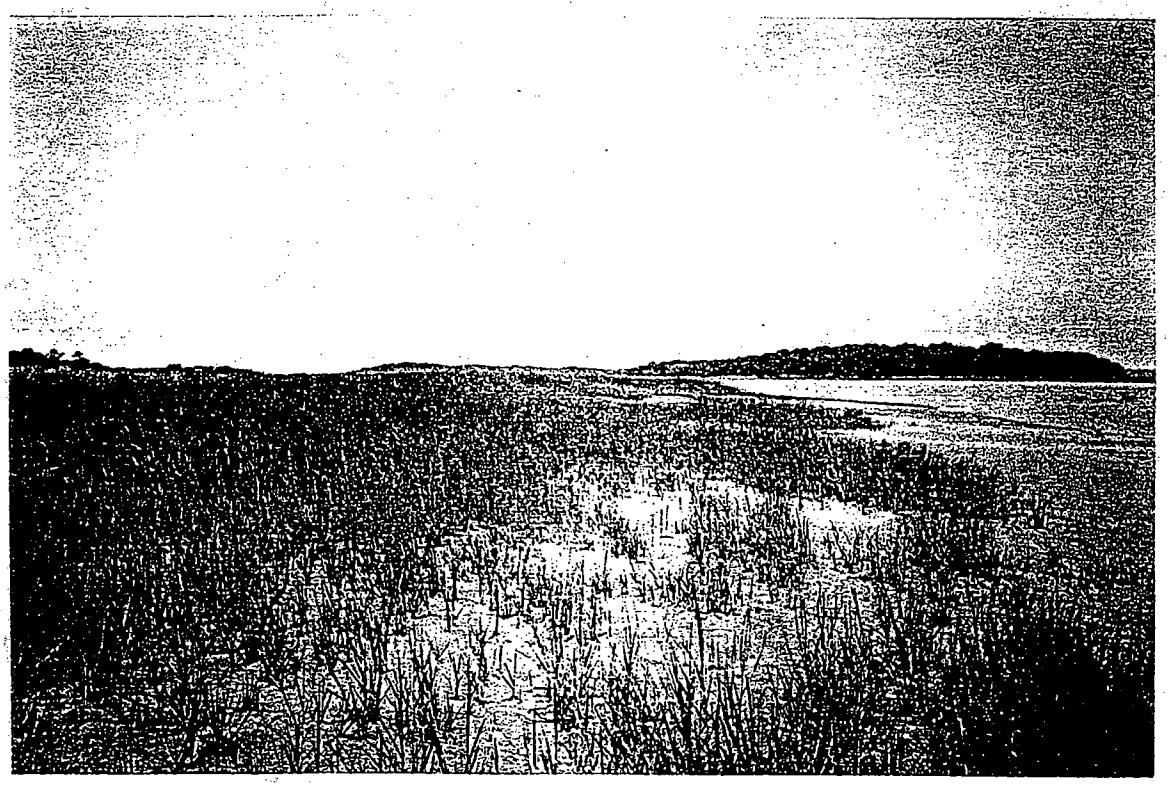

PAI-10-SW-17
PAI-10-SD-17
PAI-10-SW-18
PAI-10-SD-18
PAI-10-SW-16
PAI-10-SD-16
PAI-10-SS-17
PAI-10-SS-16
PAI-10-SS-15-BG
PAI-01-SD-06
PAI-01-SW-06
PAI-01-SD-07
PAI-01-SW-07
PAI-01-SD-05
PAI-01-SW-05
PAI-01-SS-01
PAI-01-SS-02
PAI-01-SS-03
PARRIS
ISLAND
Daws
Island
Daws
I
RIVER
Corn
Bobb
Island
Big Henry
Ribaut
Mon
N
5000
0
5000 Feet


PAI-10-SW-17
PAI-10-SD-17
PAI-10-SW-18
PAI-10-SD-18
Parris Island
Airport
N
PAI-10-SW-16
PAI-10-SD-16
PAI-10-SS-17
PAI-10-SS-16
PAI-10-SS-15-BG
1000
0
1000 Feet


N
PAI-01-SD-07
PAI-01-SW-07
PAI-01-SD-06
PAI-01-SW-06
PAI-01-SS-01
PAI-01-SS-02
PAI-01-SS-03
PAI-01-SD-05
PAI-01-SW-05
Pinckbey
1000 0 1000 Feet

PHOTOS - BACKGROUND SAMPLE LOCATIONS

SURFACE SOIL LOCATION IMMEDIATELY ADJACENT TO THE NORTHERN SHORE OF PINCKNEY ISLAND.



SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS IN INTERTIDAL ZONE OF PINCKNEY ISLAND.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

Sample ID No.: PAI 01 SW-05
Sample Location: Pinckney Is.
Sampled By: RJM / JFL
C.O.C. No.: 01300

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: – TIDAL STREAM
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 052998								
Time: 1240								
Depth:								
Method: Grab		7.7	39	28	8	10.3	2.5	

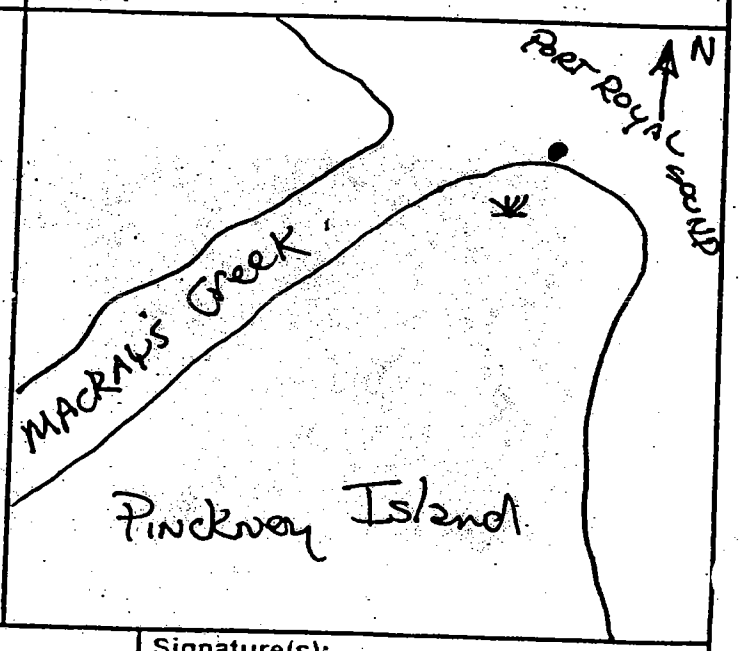
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements (ml)	Collected
VOCs	HCL	40	3
SVOCs		1000 amber	2
Pest./PCBs		1000 Amber	2
Total Metals, Hardness	HNO3	1000 plastic	1
Dissolved (Filtered) Metals	HNO3	1000 plastic	1
Cyanide	NAOH	250 plastic	1
~~Hex Chromium~~		~~1000 plastic~~	~~1~~
TOC	H2SO4	1000 plastic	1
pH		1000 plastic	1

OBSERVATIONS / NOTES:

Sample area chosen by Diane Duncan SC Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

Sample ID No.: PAI01 SW06
Sample Location: PINCKNEY Is.
Sampled By: RCM/JFL
C.O.C. No.: 01306

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: – TIDAL STREAM
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 052798								
Time: 1330								
Depth:								
Method: Grab		7.7	38	29	36	9.1	2.5	

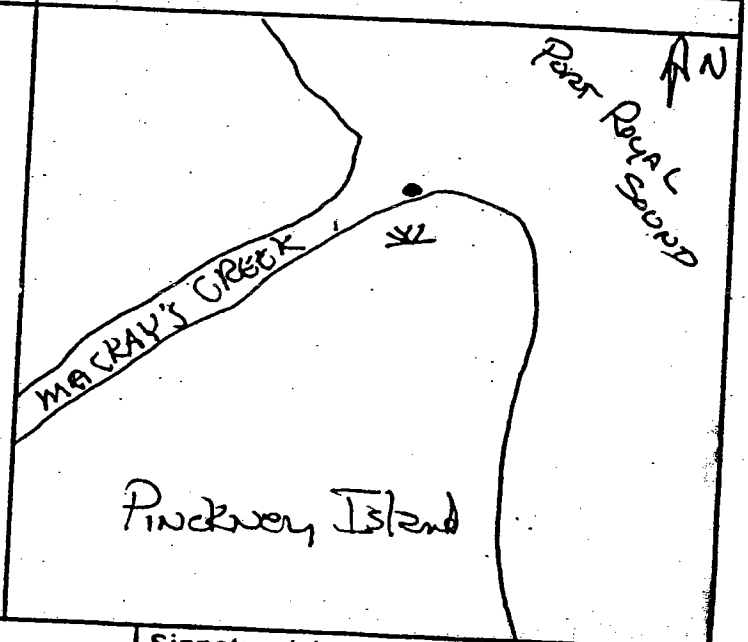
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements (ml)	Collected
VOCs	HCL	40	3
SVOCs		1000 amber	2
Pest./PCBs		1000 Amber	2
Total Metals, Hardness	HNO3	1000 plastic	1
Dissolved (Filtered) Metals	HNO3	1000 plastic	1
Cyanide	NAOH	250 plastic	1
~~Hex Chromium~~		~~1000 plastic~~	~~1~~
TOC	H2SO4	1000 plastic	1
pH		1000 plastic	1

OBSERVATIONS / NOTES:

Sample area Chosen by
Diane Duncan SC
Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

Sample ID No.: PAI 01 SW 07
Sample Location: Pinckney Is.
Sampled By: KLM/JFL
C.O.C. No.: 01364

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: – TIDAL STREAM
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

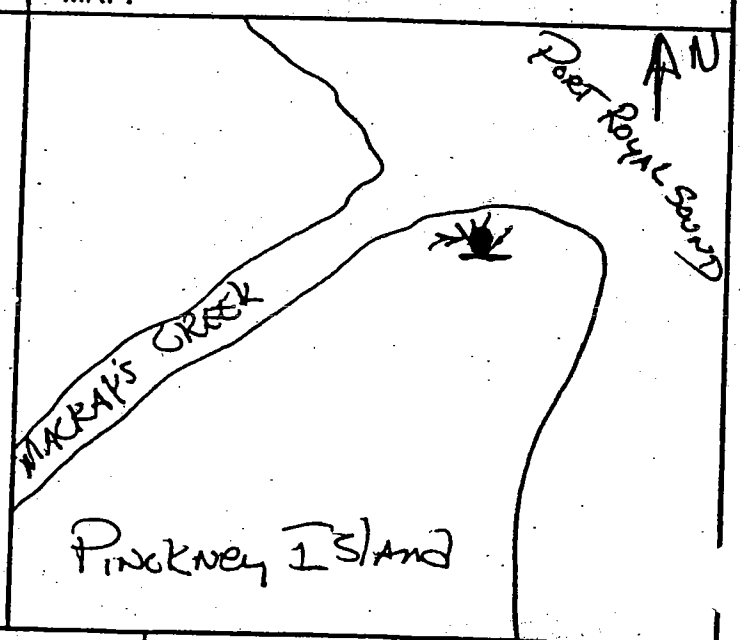
Date: / Time: / Depth: / Method: Grab	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
		6.8	38.0	31	18	11.4	2.4	

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements (ml)	Collected
VOCs	HCL	40	3
SVOCs		1000 amber	2
Pest./PCBs		1000 Amber	2
Total Metals, Hardness	HNO_3	1000 plastic	1
Dissolved (Filtered) Metals	HNO_3	1000 plastic	1
Cyanide	NAOH	250 plastic	1
~~Hex Chromium~~		~~1000 plastic~~	~~1~~
TOC	H_2SO_4	1000 plastic	1
pH		1000 plastic	1

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7803

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: – TIDAL Stream
[] QA Sample Type:

Sample ID No.: PAI-10-SW-16-01
Sample Location: PAI-10-SW16
Sampled By: Skip Barton
C.O.C. No.: 2280

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

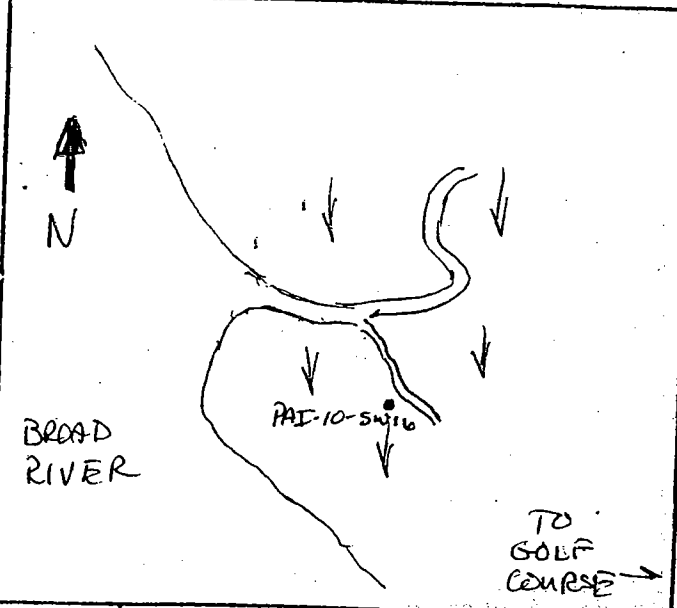
	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 091098 Time: 1242 Depth: surface Method: Grab	cloudy	6.72	44.3	27.4	7	3.25	2.87	secci disk 0.75ft.

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements (ml)	Collected
VOCs	HCL	40 VOAs	~~3~~ 4
SVOCs		1000 amber	2
Pest./PCBs		1000 Amber	2
Total Metals/Hardness	HNO3	1000 plastic	1
Dissolved (Filtered) Metals	HNO3	1000 plastic	1
Cyanide	NAOH	250 plastic	1
Hex Chromium		1000 plastic	1
TOC	H2SO4	1000 plastic	1
pH		1000 plastic	1

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Skip Barton

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7803

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: – TIDAL STREAM
[] QA Sample Type:

Sample ID No.: PAI-10-SW-17-01
Sample Location: PAI-10-SW17
Sampled By: Shy Barton
C.O.C. No.: 2250

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

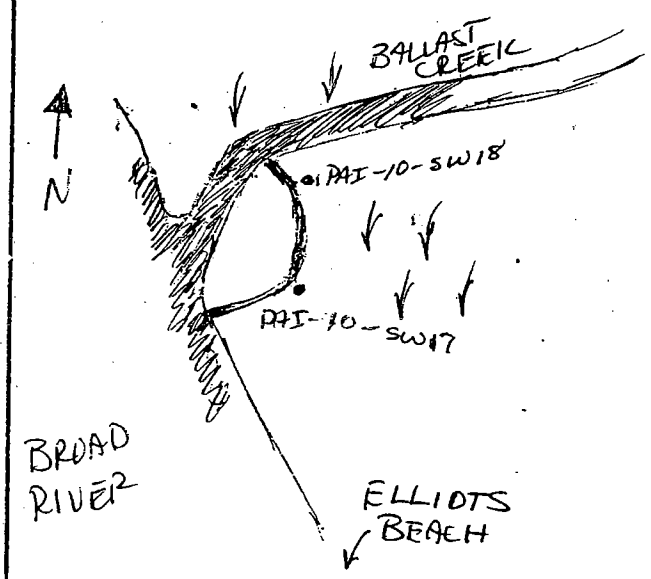
	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 09 10 98 Time: 1421 Depth: Surface Method: Grab	Clear	7.65	44.7	28.7	-9	4.64	2.91	secci disk 1.25 ft

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements (ml)	Collected
VOCs	HCL	40 VOAs	4
SVOCs		1000 amber	2
Pest./PCBs		1000 Amber	2
Total Metals	HNO3	1000 plastic	1
Dissolved (Filtered) Metals	HNO3	1000 plastic	1
Cyanide	NAOH	250 plastic	1
~~Hex Chromium~~		~~1000 plastic~~	~~1~~
TOC	H2SO4	1000 plastic	1
~~pH~~		~~1000 plastic~~	~~1~~

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Shy Barton

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7803

Sample ID No.: PAI-10-SW-18-01
Sample Location: PAI-10-SW18
Sampled By: Shyl Barton
C.O.C. No.: 2250

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: – TIDAL STREAM
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

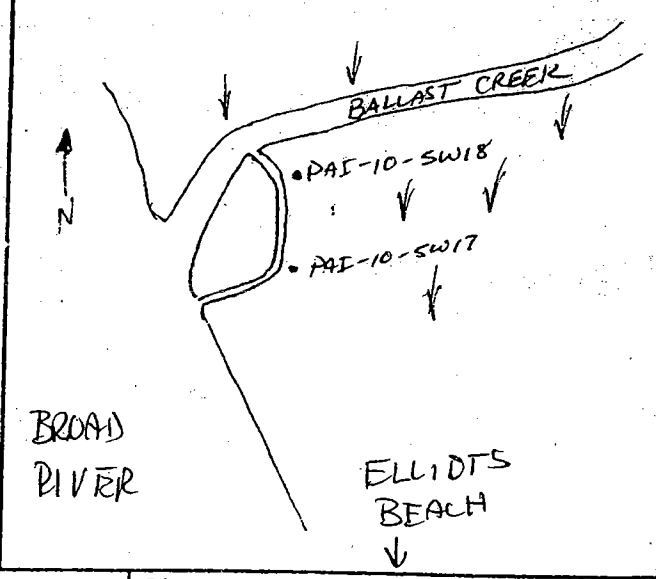
	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date:								
Time:								
Depth:								
Method: Grab	Cloudy	7.51	44.5	28.4	23	3.79	2.91	secci disk 0.25 ft.

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements (ml)	Collected
VOCs	HCL	40	~~3~~ 4
SVOCs		1000 Amber	2
Pest./PCBs		1000 Amber	2
Total Metals	HNO_3	1000 plastic	1
Dissolved (Filtered) Metals	HNO_3	1000 plastic	1
Cyanide	NaOH	250 plastic	1
~~Hex Chromium~~		~~1000 plastic~~	~~1~~
TOC	H_2SO_4	1000 plastic	1
~~pH~~		~~1000 plastic~~	~~1~~

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Shyl Barton

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: PAI 01 SD05
Sample Location: Pinckney Is.
Sampled By: RLM / JPM
C.O.C. No.: 01307

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 052798 Time: 1240 Method: Grab Monitor Reading (ppm):	0-6"	lt. br. - blk.	fn. - med. gr. sd.

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

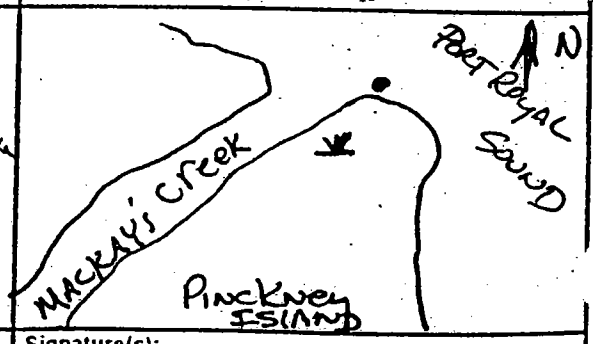
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.A	5 ENCORE SAMPLES	✓	
TCL SVOC.A	16oz	✓	
TAL METALS (TOTAL)	16oz	✓	
CYANIDE	16oz	✓	
TCL PESTICIDES / PCBS	16oz	✓	
TOC	16 oz	✓	
pH	16oz	✓	
~~HEXAVALENT CHROMIUM~~	16oz		

OBSERVATIONS / NOTES:

Sample Area Chosen by Diane Duncan of SC Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: PAI 01 SD06
Sample Location: Pinckney Is.
Sampled By: RJM/JFL
C.O.C. No.: 01307

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time: 1330	0-6"	Hbr.-blk.	fn.-med. gr. sd.
Method: Grab			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

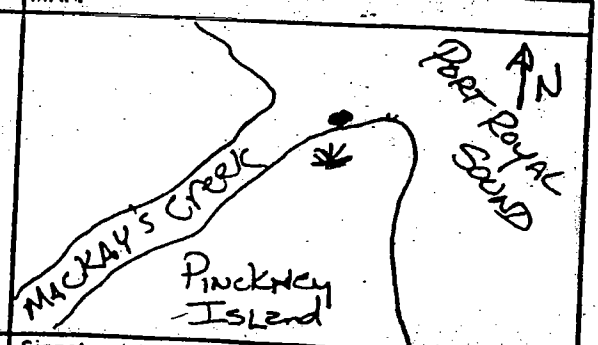
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOCs	5 ENCORE Samples	✓	
TCL SVOCs	16oz	✓	
TAL METALS (TOTAL)	16oz	✓	
CYANIDE	16oz	✓	
TCL PESTICIDES / PCBs	16oz	✓	
TOC	16oz	✓	
pH	16oz	✓	
~~HEXAVALENT CHROMIUM~~	~~16oz~~		

OBSERVATIONS / NOTES:

Sample Area Chosen by Diane Duncan SC Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: PAI 01 SD07
Sample Location: Pinckney Isl.
Sampled By: RLM/JCL
C.O.C. No.: 01307

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 052798 Time: 1400 Method: Grab Monitor Reading (ppm):	0-6"	br.-blk.	fn.-med. gr. sd.

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

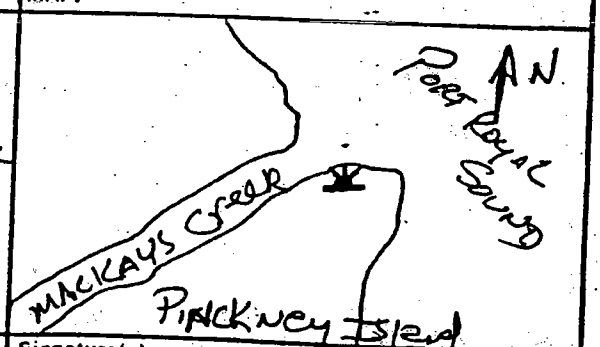
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.A	5 ENCORE SAMPLES	✓	
TCL SVOC.A	1 oz	✓	
TAL METALS (TOTAL)	1 oz	✓	
CYANIDE	1 oz	✓	
TCL PESTICIDES / PCBS	1 oz	✓	
TOC	1 oz	✓	
pH	1 oz	✓	
~~HEXAVALENT CHROMIUM~~	~~1 oz~~		

OBSERVATIONS / NOTES:

Sample Area Chosen by Diane Duncan SC Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: ~~7394~~ 7803

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: PAI-10-SD-16-01
Sample Location: ~~PAI-10-SD-016-01~~ PAI-10-SD16
Sampled By: Skip Barton
C.O.C. No.: 2080

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 090998 Time: 1527 Method: GRAB Monitor Reading (ppm):	0-0.5 ft.	dk. gray	silty clay, v. moist

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

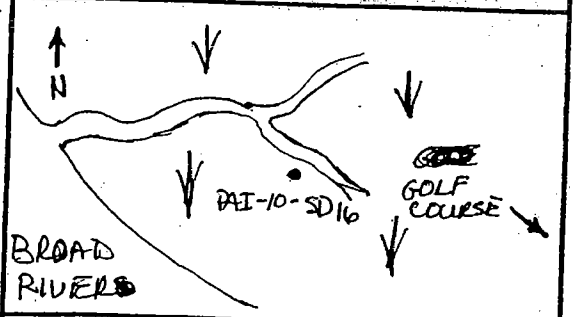
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.s	5 ENCORE SAMPLES	5	
TCL SVOC.s	16 oz	TOTAL OF 3	
TAL METALS (TOTAL)	16 oz	16 OZ JARS	
CYANIDE	16 oz		
TCL PESTICIDES / PCBs	16 oz		
TOC	16 oz		
pH	16 oz		
~~HEXAVALENT CHROMIUM~~	16 oz		

OBSERVATIONS / NOTES:

DUE TO SHIPPING CONSTRAINTS VOC SAMPLES COLLECTED @ 0900 on 091098

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Skip Barton

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD - Jericho Island
Project No.: 7803

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: ~~PAI-10-SD-016-01~~ PAI-10-SD-16-01A
Sample Location: PAI-10-SD16
Sampled By: GG, RD
C.O.C. No.: ~~2543~~ 2212

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/15/98 Time: 1245 Method: Grab Monitor Reading (ppm): NA	0. -0.5 Ft	dark Gray	Silty Clay; v. moist

COMPOSITE SAMPLE DATA:

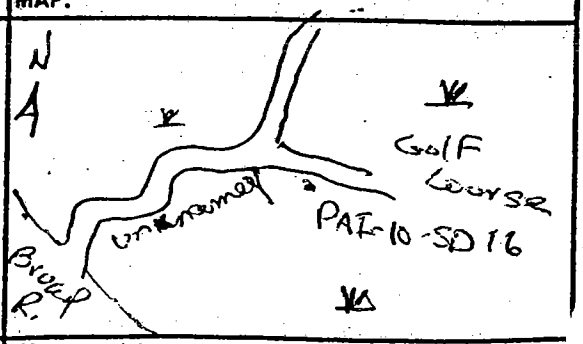
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH - SW846-8310	1	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

A-166

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: ~~7394~~ 7803

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: PAI-10-SD-17-01
Sample Location: ~~PAI-10-SD-017-01~~ PAI-10-SD17
Sampled By: [illegible]
C.O.C. No.: 2280

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 090998	0-0.5 ft.	dk. gray/ black	clay mud, saturated
Time:			
Method: Grab			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

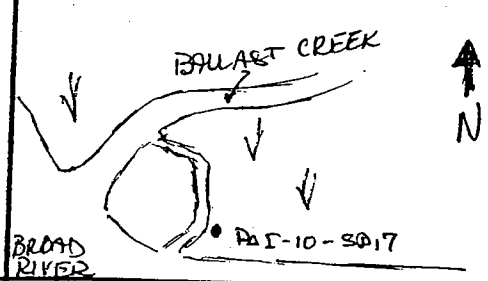
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOCs	5 ENCORE SAMPLES	5	
TCL SVOCs	16oz	Total of 3	
TAL METALS (TOTAL)	16oz	16oz jars	
CYANIDE	16oz		
TCL PESTICIDES / PCBs	16oz		
TOC	16oz		
PH	16oz		
~~HEXAVALENT CHROMIUM~~	~~16oz~~		

OBSERVATIONS / NOTES:

DUE TO SHIPPING CONSTRAINTS VOC SAMPLES WERE COLLECTED @ 1429 ON 09.098

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD - Jericho Island
Project No.: 7803

Sample ID No.: PAI-10-SD-17-01A ~~PAI-10-SD-017-01~~
Sample Location: PAI-10-SD17
Sampled By: GG, RD
C.O.C. No.: 2212

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/15/98 Time: 1200 Method: Grab Monitor Reading (ppm): NA	0-0.5FT	Drk Gray Black	Clay mud, saturated

COMPOSITE SAMPLE DATA:

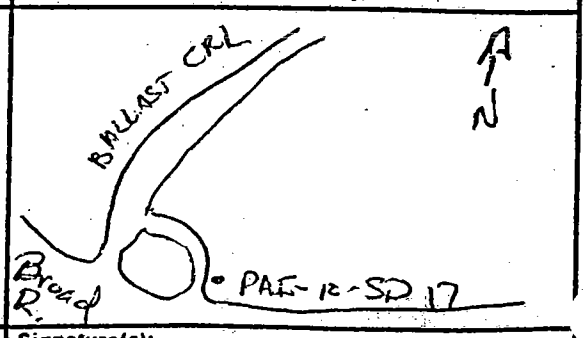
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH - SW 846 - 8310	1 - 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Gary L. Gunter

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: ~~7394~~ 7803

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: PAI-10-SD-18-01 ~~PAI-10-SD-018-01~~ GC
Sample Location: PAI-10-SD18
Sampled By: [signature]
C.O.C. No.: 2280

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 090998	0-0.5 ft	drk. gray	clay mud, saturated
Time:			
Method: Grab			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

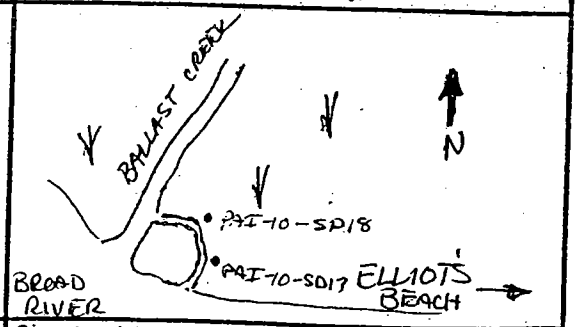
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOCs	5 ENCORE SAMPLES	5	
TCL SVOCs	16oz	Total of 3	
TAL METALS (TOTAL)	16oz	16 oz Jars	
CYANIDE	16oz		
TCL PESTICIDES / PCBs	16oz		
TOC	16 oz		
pH	16oz		
~~HEXAVALENT CHROMIUM~~	~~16oz~~		

OBSERVATIONS / NOTES:

Due to shipping constraints VOC samples were collected @ 1515 on 091098

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [signature]

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD - Jencho Island
Project No.: 7803

Sample ID No.: PAI-10-SD-18-01A ~~PAI-10-SD-018-01~~
Sample Location: PAI-10-SD18
Sampled By: RD, GG
C.O.C. No.: 2212

- [ ] Surface Soil
- [ ] Subsurface Soil
- [x] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/15/98	0-0.5 Ft	dark Gray	Clay mud, Saturated
Time: 1200			
Method: Grab			
Monitor Reading (ppm): NA			

COMPOSITE SAMPLE DATA:

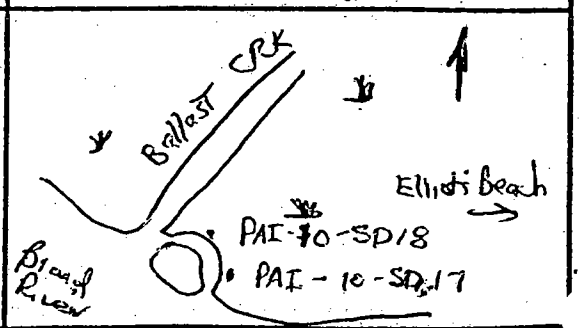
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH SW 846-8310	1 -	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

Sample ID No.: PAI01SS00101
Sample Location: Pinckney Is.
Sampled By: RLM/JFL
C.O.C. No.: 00263

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

Date: 060198
Time: 1015
Method: Grab
Monitor Reading (ppm): —

Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0-1'	H.br.	fn.-med. sd., dry

COMPOSITE SAMPLE DATA:

Date:
Method:
Monitor Readings (Range in ppm):

Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)

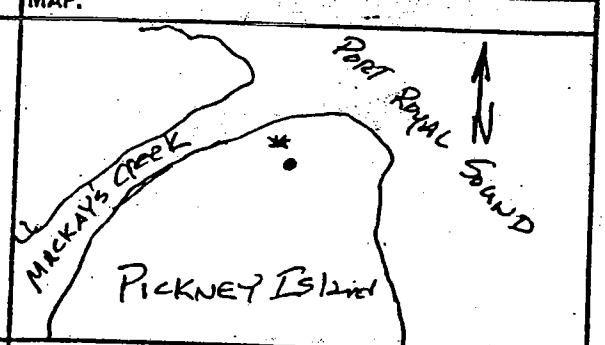
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.A	5 ENCORE SAMPLES	✓	
TCL SVOC.A	16 oz	✓	
TAL METALS (TOTAL)	16 oz	✓	
CYANIDE	16 oz	✓	
TCL PESTICIDES / PCBS	16 oz	✓	
~~TOC~~	~~16 oz~~		
~~pH~~	~~16 oz~~		
~~HEXAVALENT CHROMIUM~~	~~16 oz~~		

OBSERVATIONS / NOTES:

Sampling Area chosen by Duane Duncan - South Carolina Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: PAI01SS00201
Sample Location: ~~Pe~~ Pinckney Is.
Sampled By: RLM/JFL
C.O.C. No.: 00263

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 060198 Time: 1030 Method: Gab Monitor Reading (ppm): —	0-1'	H.br.	fn.-med. sd. dry

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

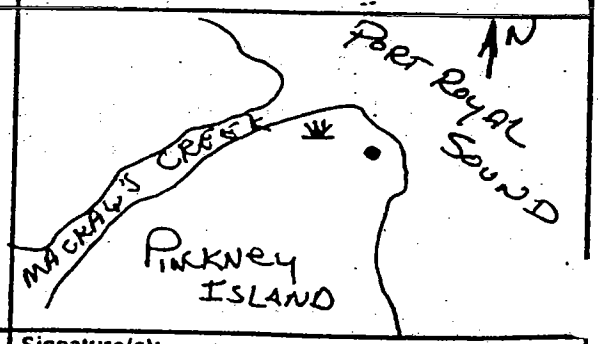
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOCs	5 ENCORE Samples	✓	
TCL SVOCs	16 oz	✓	
TAL METALS (TOTAL)	16 oz	✓	
CYANIDE	16 oz	✓	
TCL PESTICIDES / PCBS	16 oz	✓	
~~TOC~~	~~16 oz~~		
~~pH~~	~~16 oz~~		
~~HEXAVALENT CHROMIUM~~	~~16 oz~~		

OBSERVATIONS / NOTES:

Sampling Area Chosen by Diane Duncan SC Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: 7394

Sample ID No.: PAI015500301
Sample Location: Pinckney Is.
Sampled By: RUM LIAL
C.O.C. No.: 00243

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 060198	0-1'	H. br.	fw.-med. sd. dry
Time: 1055			
Method: Grab			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

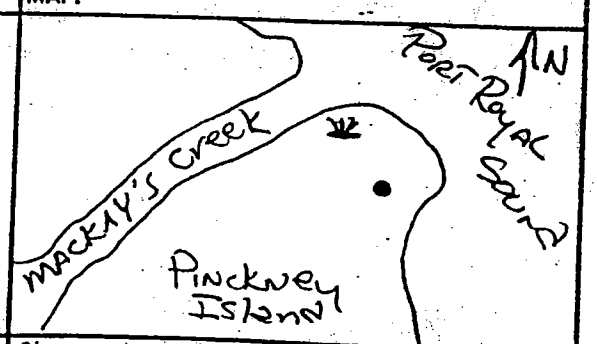
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.s	5 ENCORE SAMPLES	✓	
TCL SVOC.s	16 oz	✓	
TAL METALS (TOTAL)	16 oz	✓	
CYANIDE	16 oz	✓	
TCL PESTICIDES / PCBs	16 oz	✓	
~~TOC~~	~~16 oz~~		
~~pH~~	~~16 oz~~		
~~HEXAVALENT CHROMIUM~~	~~16 oz~~		

OBSERVATIONS / NOTES:

Sample's Area Chosen by Diane Duncan - SC Fish & Wildlife

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: ~~7394~~ 7803

Sample ID No.: ~~PAI-10-SS-015-01~~ PAI-10-SS-15-01
Sample Location: PAI-10-SS15
Sampled By: Shep Barton
C.O.C. No.: 2280

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 090998 Time: 1419 Method: disp. trowel Monitor Reading (ppm):	0-1 ft.	lt. gray	v. silty fine sand, dry, no odor

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

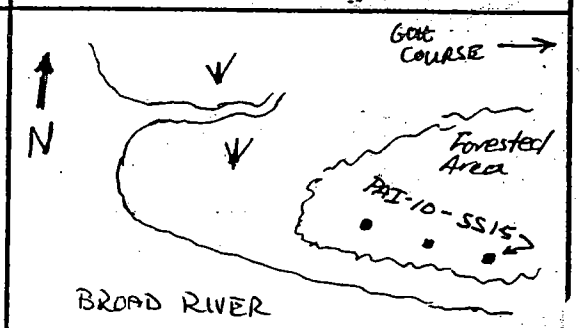
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.A	5 ENCORE SAMPLES	5	
TCL SVOC.A	16 oz	Total of 3	
TAL METALS (TOTAL) INS/SOM	16 oz	16oz jars	
CYANIDE	16 oz		
TCL PESTICIDES / PCBS	16 oz		
TOC	16 oz		
pH	16 oz		
~~HEXAVALENT CHROMIUM~~	~~16 oz~~		

OBSERVATIONS / NOTES:

DUE TO SHIPPING CONSTRAINTS VOC SAMPLES WERE COLLECTED @ ~~1444~~ 0813 ON 090998 SB 9/10/98

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Shep Barton

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: ~~7394~~ 7803

Sample ID No.: PAI-10-SS-16-01 ~~PAI 10-SS-016-01~~
Sample Location: PAI-10-SS16
Sampled By: ~~Shep Barton~~
C.O.C. No.: 2280

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 090998 Time: 1440 Method: disp. trowel Monitor Reading (ppm): -	0-1 ft.	lt. gray	v. silty fine sand, dry, no odor

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

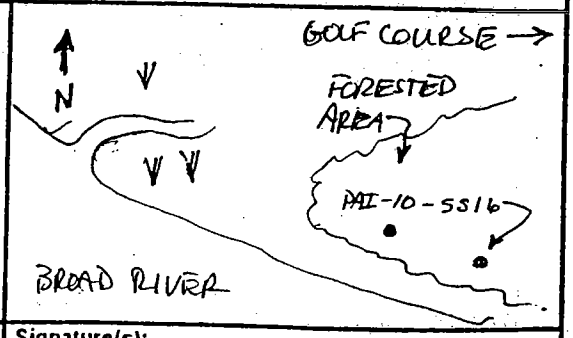
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.A	5 ENCORE SAMPLES	5	
TCL SVOC.A	16 oz	TOTAL OF 3	
TAL METALS (TOTAL)/AVS/SEM	16 oz	16 oz JARS	
CYANIDE	16 oz		
TCL PESTICIDES/PCBS	16 oz		
TOC	16 oz		
pH	16 oz		
~~HEXAVALENT CHROMIUM~~	~~16 oz~~		

OBSERVATIONS / NOTES:

DUE TO SHIPPING CONSTRAINTS VOC SAMPLES WERE COLLECTED @ 0825 ON 091098

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Shep Barton

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD PARRIS ISLAND
Project No.: ~~7394~~ 7803

Sample ID No.: PAI-10-SS-17-01
Sample Location: PAI-10-SS17
Sampled By: Skip Barton
C.O.C. No.: 2280

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 090998 Time: 1455 Method: disp. trowel Monitor Reading (ppm):	0-1 ft.	lt. gray	silty fine sand, dry, no odor

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

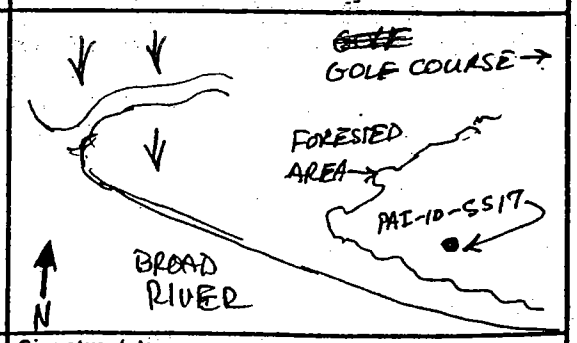
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOC.A	5 ENCORE SAMPLES	5	
TCL SVOC.A	16 oz	TOTAL OF 3	
TAL METALS (TOTAL) AVS/SEM	16 oz	16 OZ JARS	
CYANIDE	16 oz		
TCL PESTICIDES / PCBS	16 oz		
TOC	16 oz		
pH	16 oz		
~~HEXAVALENT CHROMIUM~~	~~16 oz~~		

OBSERVATIONS / NOTES:

DUE TO SHIPPING CONSTRAINTS VOC SAMPLES WERE COLLECTED @ 0835 on 091098

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Skip Barton

CHAIN OF CUSTODY RECORD

00263

PROJECT NO.: 7394

SITE NAME: MCRD Parris Is.

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL VOC Encores (5)	TCL SVOC 16oz.	TAL Metals + CN 16oz.	TCL Pest/PCB 16oz.			REMARKS
	0601 98	10 15		✓	[redacted]	6	✓	✓	✓	✓			
	0601 98	10 30		✓	[redacted]	6	✓	✓	✓	✓			
	0601 98	10 55		✓	[redacted]	6	✓	✓	✓	✓			
	0601 98	11 38	10 25 AM	✓	[redacted]	6	✓	✓	✓	✓			
	0601 98	16 18		✓	[redacted]	6	✓	✓	✓	✓			
	0601 98	15 38		✓	[redacted]	6	✓	✓	✓	✓			
					[redacted]	2	✓						Cooler 1 of 2
					[redacted] Blank	1							Cooler 1 of 2

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[illegible]	060198 1800				
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	
		[illegible]	6/6/98 1145	2.8c (10.4, 11.3, 6.1)	

Order No. 70440 (06931)

A-17

01306

CHAIN OF CUSTODY RECORD

PROJECT NO.: 7394

SITE NAME: Pine Knoll Island

SAMPLERS (SIGNATURE): [illegible] / [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL VOC 40ml	TCL SVOC 1000ml Amber	TAL Metals + Hardness 1000ml plastic	TAL Metals + Hardness Filtered 1000ml plastic	TCL Pest/PCB 1000ml Amber	TOC + H2SO4 1000ml plastic	Cn + NaOH 250ml plastic	pH 1000ml plastic	REMARKS
	0527 98	12 40		✓	[redacted]	12	✓	✓	✓	✓	✓	✓	✓	✓	
	0527 98	13 30		✓	[redacted]	12	✓	✓	✓	✓	✓	✓	✓	✓	
	0527 98	14 00		✓	[redacted]	12	✓	✓	✓	✓	✓	✓	✓	✓	
					[redacted]	2									each cooler
					[redacted]	2	✓								Cooler #1 of 2

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[illegible]	052798 1845				
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	
		[illegible]	5/27/98 HW		

A-178

CHAIN OF CUSTODY RECORD

01307

PROJECT NO.: 7394

SITE NAME: Pinckney Island

SAMPLERS (SIGNATURE): [illegible] Jenny K. Laffey

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL VOC Bacres (5)	TCL SVOC 16oz.	TAL Metals + CN 16oz.	TCL Pest/PCB 16oz.	TOC, PH 16oz.		REMARKS
	0527 98	12 40		✓	[redacted]	6	✓	✓	✓	✓	✓		
	0527 98	13 30		✓	[redacted]	6	✓	✓	✓	✓	✓		
	0527 98	14 00		✓	[redacted]	6	✓	✓	✓	✓	✓		

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[illegible]	052798 1845				
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	
		[illegible]	5/28/98 1420		

Order No. 70440 (0693)

cl 82 -2304 -2360 (12.9.1.6.7.8)(8.4.7.0.6.0). 6.0°c

A-179

CHAIN OF CUSTODY RECORD

9812418

PROJECT NO.: 7803

SITE NAME: Jericho Island

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	PAH Sub 8270						REMARKS
15	12/14/98	1240		X	PAI-10-SD-002-01DA	1	✓						Duplicate
16	12/14/98	1240		X	PAI-10-SD-002-01A	1	✓						MS
17	12/14/98	1240		X	PAI-10-SD-002-01DA	1	✓						MSD
18	12/14/98	1507		X	PAI-10-SD-014-02A	1	✓						
19	12/14/98	1458		X	PAI-10-SD-015-01A	1	✓						
20	12/15/98	1200		X	PAI-10-SD-018-01A	1	✓						
21	12/15/98	1200		X	PAI-10-SD-017-01A	1	✓						
22	12/15/98	1245		X	PAI-10-SD-016-01A	1	✓						

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	12/15/98 1500				
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE): [signature]	DATE / TIME: 12/16/98 8:40	REMARKS: Questions to Dave Brayack OTTI Tech - Pittsburgh 412-921-8375	

Order No. 70440 (0693)

A-180

CHAIN OF STUDY RECORD

98092

02200

PROJECT NO.:	SITE NAME:
7803	MCRD Parris Island, SC

SAMPLERS (SIGNATURE): Shep Barton

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL VOCs	TCL SVOCs	TCL Pes/PCBs	TAL Diss. Metals	TAL Total Metals/Hardness	CN	AVS/SEM	TOC	PH	REMARKS
1)	9/9/98	1419	1	✓	[redacted] BACKGROUND SAMPLE	8	5	✓	✓		✓	✓	✓			VOCs (encores)
2)	↓	1440		✓	[redacted]	8	5	✓	✓		✓	✓	✓			collected on 9/10/98
3)	↓	1455		✓	[redacted]	8	5	✓	✓		✓	✓	✓			
4)	9/9/98	1527		✓	[redacted]	8	5	✓	✓		✓	✓	✓	✓	✓	soils are
5)	↓	1623		✓	[redacted]	8	5	✓	✓		✓	✓	✓	✓	✓	reactive
6)	↓	1641		✓	[redacted]	8	5	✓	✓		✓	✓	✓	✓	✓	↓
~~7)~~	9/10/98	1242		✓	[redacted]	12	4	2	2	1	1	1		1		
	↓	1421		✓	[redacted]	12	4	2	2	1	1	1		1		
	↓	1503		✓	[redacted]	12	4	2	2	1	1	1		1		
					Trip Blanks	2										
					Temp Blanks	4										

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
Shep Barton	9/10/98 2000	Fed Ex			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	
		Jane A Smith	9/11/98 8:50	for soil & sediment samples 16oz jars were collected on 9/9/98, encores on 9/10/98 due to holding time constraints.	

Order No. 70440 (0693)

SAMPLE LOG SHEETS TO SUPPORT
TYPICAL FACILITY PESTICIDE CONCENTRATIONS

SOIL & SEDIMENT SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: MCRD Parris Island
Project No.: 7394

Sample ID No.: PAI-01-SS-016
Sample Location: PAI-01-SS16
Sampled By: GG
C.O.C. No.: 00241

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 4/21/99	0-1.0 Ft	Tan Brn	F Sand Dry
Time: 13:18			
Method: Grab			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

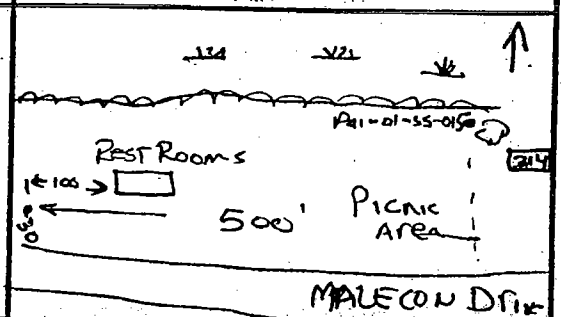
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH, TCL Pest	1-16 oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

A-181B

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: MCRD Parris Island
Project No.: 7394

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: PAI-01-SS-015
Sample Location: PAI-01-SS15
Sampled By: GG
C.O.C. No.: 00241

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 4/21/99 Time: 1301 Method: Grab Monitor Reading (ppm): —	0-1.0 FT	Tan-Brn	F Sand dry

COMPOSITE SAMPLE DATA:

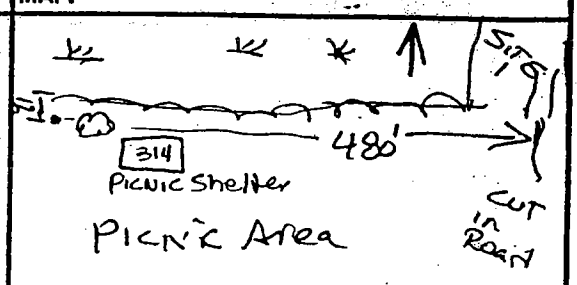
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAHs, TCL Pest	1-16 oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): G Gunter

B2

WORKSHEET 15 REFERENCE LIMITS AND BACKGROUND TABLES

Surface Soil Scsreening Table

Parameter	CAS		Minimum Eco SSL[1]	Region 4 Screening Level[2]	ORNL Benchmarks[3]				Final Screening Level[4]	Source of Final Ecological Screening Level	ORNL Residential Sceening Level	Minimum of Eco and ORNL residential	Reference of Mimimum
					Microorganism	Earthworms	Plants						
ALUMINUM	7429-90-5	MG/KG		50	600		50		50	Reg 4	77000N	50	Reg 4
ANTIMONY	7440-36-0	MG/KG	0.27	3.5			5		0.27	Eco SSL	31N	0.27	Eco SSL
ARSENIC	7440-38-2	MG/KG	18	10	100	60	10		18	Eco SSL	0.39C	18	Residential SSL
BARIUM	7440-39-3	MG/KG	330	165	3000		500		330	Eco SSL	15000N	330	Eco SSL
BERYLLIUM	7440-41-7	MG/KG	21	1.1			10		21	Eco SSL	160N	21	Eco SSL
CADMIUM	7440-43-9	MG/KG	0.36	1.6	20	20	4		0.36	Eco SSL	70N	0.36	Eco SSL
CALCIUM	7440-70-2	MG/KG								NV	NA	NA	NV
CHROMIUM	7440-47-3	MG/KG	26	0.4	10	0.4	1		26	Eco SSL	280C	26	Eco SSL
COBALT	7440-48-4	MG/KG	13	20	1000		20		13	Eco SSL	23N	13	Eco SSL
COPPER	7440-50-8	MG/KG	28	40	100	60	100		28	Eco SSL	3100N	28	Eco SSL
IRON	7439-89-6	MG/KG		200	200				200	Reg 4	55000N	200	Reg 4
LEAD	7439-92-1	MG/KG	11	50	900	500	50		11	Eco SSL	400	11	Eco SSL
MERCURY	7439-97-6	MG/KG		0.1	30	0.1	0.3		0.1	Reg 4	4.3N	0.1	Reg 4
MAGNESIUM	7439-95-4	MG/KG								NV	NA	NA	NV
MANGANESE	7439-96-5	MG/KG	220	100	100		500		220	Eco SSL	NA	220	Eco SSL
NICKEL	7440-02-0	MG/KG	38	30	90	200	30		38	Eco SSL	1500N	38	Eco SSL
POTASSIUM	7440-09-7	MG/KG								NV	NA	NA	NV
SELENIUM	7782-49-2	MG/KG	0.52	0.81	100	70	1		0.52	Eco SSL	390N	0.52	Eco SSL
SILVER	7440-22-4	MG/KG	4.2	2	50		2		4.2	Eco SSL	390N	4.2	Eco SSL
SODIUM	7440-23-5	MG/KG								NV	NA	NA	NV
THALLIUM	7440-28-0	MG/KG		1			1		1	Reg 4	5.1N	1	Reg 4
VANADIUM	7440-62-2	MG/KG	7.8	2	20		2		7.8	Eco SSL	550N	7.8	Eco SSL
ZINC	7440-66-6	MG/KG	46	50	100	100	50		46	Eco SSL	23000N	46	Eco SSL
1,3,5-TRINITROBENZENE	99-35-4	MG/KG								NV	2200N	2200	Residential SSL
1,3-DINITROBENZENE	99-65-0	MG/KG								NV	6.1N	6.1	Residential SSL
2,4-DINITROTOLUENE	121-14-2	MG/KG								NV	1.6C	1.6	Residential SSL
2,6-DINITROTOLUENE	606-20-2	MG/KG								NV	61N	61	Residential SSL
NITROBENZENE	98-95-3	MG/KG		40	1000	40			40	Reg 4	4.4C	4.4	Residential SSL
2,4,6-TRINITROTOLUENE	118-96-7	MG/KG							1.2	USACE	19N	1.2	USACE
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	MG/KG								NV	150N	150	Residential SSL
2-NITROTOLUENE	88-72-2	MG/KG								NV	2.9N	2.9	Residential SSL
3-NITROTOLUENE	99-08-1	MG/KG								NV	1200N	1200	Residential SSL
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	MG/KG								NV	150N	150	Residential SSL
4-NITROTOLUENE	99-99-0	MG/KG								NV	30N	30	Residential SSL
HMX	2691-41-0	MG/KG								NV	3800N	3800	Residential SSL
TETRYL	479-45-8	MG/KG								NV	240N	240	Residential SSL
RDX	121-82-4	MG/KG								NV	5.5C	5.5	Residential SSL
NITROGLYCERIN	55-63-0	MG/KG								NV	6.1N	6.1	Residential SSL

1 - Minimum of USEPA Ecological Soil Screening Levels (USEPA, 2006)
2 - Region 4 Screening Levels (USEPA, 2001)
3 - Oak Ridge National Laboratory Benchmarks (Efryomson, 1997a, b)
4 - Final Screening Levels were selected in the following order of preference:
  a. USEPA Ecological Soil Screening Level
  b. Region 4 Screening Level
  c. Lower of ORNL benchmarks
  d. Other sources as presented in source of screening level column

Source of Screening Level
Residential SSL - Oakridge National Laboratory Regional screening levels (April 2009)
Reg 4 - Region 4 Screening Level
Eco SSL - USEPA Ecological Soil Screening Level
ORNL Plant - Oak Ridge National Laboratory Plant Benchmark
ORNL INV - Oak Ridge National Laboratory Invertebrate Benchmark
USACE - 2,4,6-Trinitrotoluene Screening Benchmark (Best, et al., 2004)

Sediment Screening Table

Parameter	CAS	Units	Region 4 Screening Level[1]	Region 3 Screening Levels[2] Freshwater	Region 3 Screening Levels[2] Saltwater	ORNL Secondary Chronic Value[3]	ECOTOX Thresholds[4]	Final Screening Level[5]	Source of Final Screening Level	Direct Contact Residential (mg/kg) Direct Contact	Minimum of Eco and ORNL	Reference of Mimimum
ALUMINUM	7429-90-5	MG/KG						18000	NOAA AET	77000 N	18000	NOAA AET
ANTIMONY	7440-36-0	MG/KG	2	2				2	Reg 4	31 N	2	Reg 4
ARSENIC	7440-38-2	MG/KG	7.24	9.8	7.24		8.2	7.24	Reg 4	0.39 C	0.39	Residential SSL
BARIUM	7440-39-3	MG/KG						48	NOAA AET	15000 N	48	NOAA AET
BERYLLIUM	7440-41-7	MG/KG							NV	160 N	160	Residential SSL
CADMIUM	7440-43-9	MG/KG	0.676	0.99	0.68		1.2	0.676	Reg 4	70 N	0.676	Reg 4
CALCIUM	7440-70-2	MG/KG							NV	NA	0	NV
CHROMIUM	7440-47-3	MG/KG	52.3	43.4	52.3		81	52.3	Reg 4	280 C	52.3	Reg 4
COBALT	7440-48-4	MG/KG		50				50	Reg 3 FW	23 N	23	Residential SSL
COPPER	7440-50-8	MG/KG	18.7	31.6	18.7		34	18.7	Reg 4	3100 N	18.7	Reg 4
IRON	7439-89-6	MG/KG		20000				20000	Reg 3 FW	55000 N	20000	Reg 3 FW
LEAD	7439-92-1	MG/KG	30.2	35.8	30.2		47	30.2	Reg 4	400	30.2	Reg 4
MERCURY	7439-97-6	MG/KG	0.13	0.18	0.13		0.15	0.13	Reg 4	4.3 N	0.13	Reg 4
MAGNESIUM	7439-95-4	MG/KG							NV	NA	0	NV
MANGANESE	7439-96-5	MG/KG		460				460	Reg 3 FW	NA	460	Reg 3 FW
NICKEL	7440-02-0	MG/KG	15.9	22.7	15.9		21	15.9	Reg 4	1500 N	15.9	Reg 4
POTASSIUM	7440-09-7	MG/KG							NV	NA	0	NV
SELENIUM	7782-49-2	MG/KG		2				2	Reg 3 FW	390 N	2	Reg 3 FW
SILVER	7440-22-4	MG/KG	0.733	1	0.73			0.733	Reg 4	390 N	0.733	Reg 4
SODIUM	7440-23-5	MG/KG							NV	NA	0	NV
THALLIUM	7440-28-0	MG/KG							NV	5.1 N	5.1	Residential SSL
VANADIUM	7440-62-2	MG/KG						57	NOAA AET	550 N	57	NOAA AET
ZINC	7440-66-6	MG/KG	124	121	124		150	124	Reg 4	23000 N	124	Reg 4
1,3,5-TRINITROBENZENE	99-35-4	MG/KG						0.002	Talmage	2200 N	0.002	Talmage
1,3-DINITROBENZENE	99-65-0	MG/KG						0.007	Talmage	6.1 N	0.007	Talmage
2,4-DINITROTOLUENE	121-14-2	MG/KG		0.0416				0.0416	Reg 3 FW	1.6 C	0.0416	Reg 3 FW
2,6-DINITROTOLUENE	606-20-2	MG/KG		0.0416				0.0416	Reg 3 FW	61 N	0.0416	Reg 3 FW
NITROBENZENE	98-95-3	MG/KG						0.021	NOAA AET	4.4 C	0.021	NOAA AET
2,4,6-TRINITROTOLUENE	118-96-7	MG/KG		0.092				0.092	Reg 3 FW	19 N	0.092	Reg 3 FW
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	MG/KG							NV	150 N	150	Residential SSL
2-NITROTOLUENE	88-72-2	MG/KG		4.06				4.06	Reg 3 FW	2.9 N	2.9	Residential SSL
3-NITROTOLUENE	99-08-1	MG/KG		4.06				4.06	Reg 3 FW	1200 N	4.06	Reg 3 FW
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	MG/KG							NV	150 N	150	Residential SSL
4-NITROTOLUENE	99-99-0	MG/KG		4.06				4.06	Reg 3 FW	30 N	4.06	Reg 3 FW
HMX	2691-41-0	MG/KG						0.005	Talmage	3800 N	0.005	Talmage
TETRYL	479-45-8	MG/KG							NV	240 N	240	Residential SSL
RDX	121-82-4	MG/KG		0.013				0.013	Reg 3 FW	5.5 C	0.013	Reg 3 FW
NITROGLYCERIN	55-63-0	MG/KG							NV	6.1 N	6.1	Residential SSL

Sediment Screening Table

Parameter	CAS	Units	Region 4 Screening Level[1]	Region 3 Screening Levels[2]		ORNL Secondary Chronic Value[3]	ECOTOX Thresholds[4]	Final Screening Level[5]	Source of Final Screening Level	Direct Contact Residential (mg/kg)	Minimum of Eco and ORNL	Reference of Mimimum
				Freshwater	Saltwater					Direct Contact		

1 - Region 4 Screening Levels (USEPA, 2001)
2 - Region 3 Screening Levels (USEPA, 2006)
3 - Oak Ridge National Laboratory Secondary Chronic Value (Jones et al., 1997)
4 - USEPA ECOTOX Thresholds (USEPA, 1996)
5 - Final Screening Levels were selected in the following order of preference:
  a. Region 4 screening levels (Effects Levels)
  b. Lower of freshwater or marine Region 3 screening levels
  c. Oak Ridge National Laboratory Secondary Chronic Value (Jones et al., 1997)
  d. Other sources as presented in source of screening level column

Source of Screening Level

Residential SSL - Oakridge National Laboratory Regional screening levels (April 2009)
Reg 4 FW - Region 4 Screening Level
Reg 3 FW - Region 3 Freshwater Screening Level
Reg 3 MA - Region 3 Marine Screening Level
NOAA AET - NOAA Marine Apparent Effects Threshold
NOAA FW - NOAA Freshwater Water Quality Criteria (Buchman, 2008)
NOAA MA - NOAA Marine Water Quality Criteria (Buchman, 2008)
NOAA IV - NOAA Dutch Intervention Value (Buchman, 2008)
NOAA TV - NOAA Dutch Target Value (Buchman, 2008)
Talmage - Talmage et al., (1999)
NV - No value available

B3

PARTNERING MEETING MINUTES AND MEETING NOTES

MCRD PARRIS ISLAND PARTNERING MEETING

March 17-19, 2009
MCRD Parris Island, SC

Leader: Mac McRae Time Keeper: Mark Sladic Scribe: Libby Claggett

Members Present:	Meredith Amick	SCDHEC
	Charles Cook	NAVFAC SE
	Annie Gerry	SCDHEC
	Tim Harrington	MCRD PI
	Lila Llamas	USEPA
	Mac McRae	TechLaw, Inc.
	Heber Pittman	MCRD PI
	Mark Sladic	Tetra Tech, Pittsburgh
	Kelly Taylor	CH2M Hill
	Debra Kraemer	The Management Edge, Facilitator
	Libby Claggett	Tetra Tech, Jacksonville, Scribe
Guests:	Ralph Basinski	TtNUS, Pittsburgh
	Michelle Blanken	TtNUS, Pittsburgh
	Bob Bohn	TechLaw, Inc.
	Joe Bowers	SCDHEC
	Ralph Brooks	TtNUS, Stone Mountain
	Laurel Rhoten	SCDHEC

Meeting Start Time: 1:00 p.m.

1.1 Check-in, Agenda Modifications/Additions, Ground Rules, Minutes Approval, Parking Lot Review, Action Item Review

Action Items Developed January 2009

Item	Responsible	Action Item	Due Date
01.09.1.1	Charles	Arrange a conference call with Team members to discuss conceptual site model for vapor intrusion Site 45. **Ongoing – waiting for TtNUS PhD to be available for call.**	By 02-10-2009
01.09.1.5.2	Mark	Overlay UXO map with Site map. **Done – will send out electronically to Team members.**	Done
01.09.1.7	Team	Provide SCDHEC (Meredith) with comments on the CA 400/550 spreadsheet regarding dates, information, and the new sites identified post signing of the FFA. **Done**	Done
01.09.1.8	Tier II (Stacey)	Take the lead in facilitating determination of how and if sites can be added to the FFA and reporting back to Tier I. **Ongoing**	By 02-28-2009
01.09.2.2.1	Lila	Arrange a conference call between SCDHEC and EPA to discuss the Technical Memorandum to determine if in agreement or concurrence after EPA reviews the Technical Memorandum. **Done**	Done
01.09.2.2.2	Mark	Arrange a conference call with all risk assessors and all Team members to determine if in agreement or concurrence and decide on a path forward for Site 3. **Done**	Done

01.09.2.2.3	Charles	Research what is involved with fish tissue sampling and starting a Work Plan for Site 3 and locate the 1998 RI. **Done – Have an example fish tissue plan from Pearl Harbor and working with a support group. Working with Sherri Eng (chemist), NAVFAC SE.**	Done
01.09.2.3.1	SCDHEC (Sommer)	Investigate if a NPDES permit is required since Site 45 chlorinated solvents are being discharged into the marsh. **Done – not a point discharge; it is seepage. Will be handled under the stormwater program.**	Done
01.09.2.3.2	Mark	Post the Tri-Services guidance for vapor intrusion on the Tetra Tech ftp site. **Done**	Done
01.09.2.4.1	Charles	Attain the proposal from the RAC contractor and share with Team members. **Ongoing – Proposal attained, but not shared with Team – still reviewing data.**	By 01-14-2009
01.09.2.4.2	Charles	Provide the MIP data referenced in the preliminary data analysis to Team members (Site 27). **Done – no new MIP data – see Site 55 PA report appendix.**	Done
01.09.2.4.3	Mark	Arrange a conference call with Team members to discuss comments on the Proposed Path Forward for Site 27. **Ongoing – waiting for comments**	By 01-31-2009
01.09.2.5	Charles/Mark	Develop a schedule and arrange a conference call for Site 3. **Done**	Done

Action Items Developed October 2008

Item	Responsible	Action Item	Due Date
11.08.1.1.1	Deb	Update the Team contract/contact list (again). Add Tim, remove Joe. **Done**	Done
11.08.1.1.2	Mark	Revise April 2008 meeting minutes for approval by the Team. Team members please resend any comments to Mark. **Ongoing – waiting on comments**	By 01-31-2009
11.08.1.1.5	Mark	Send Kelly the list of missing sites for the Base Sites map. **Done.** Mark to contact Joe Hamilton to get information on missing sites. **Ongoing**	By 01-31-2009
11.08.1.3.4	Charles	Speak with NAVFAC attorneys and get further information regarding LNAPL concentrations at Site 27 and P-listed wastes. **Done – Joe Logan, TtNUS, confirmed LNAPL is not a listed waste.**	Done
11.08.1.4	Meredith / Charles	Look into the WWTP demolition and SWMU 42 to see if regulatory oversight and/or closure are needed. **Ongoing**	Ongoing – internal meeting to be held
11.08.2.2.3	Charles	Prepare a draft extension letter for the Site 27 RI D1. **Ongoing – dependent on path forward.**	Agenda Item
11.08.2.2.4	Tim	Develop a list of OWS for the state. **Ongoing**	By 01-16-2009
11.08.2.3.2	Mark	Arrange a conference call with Team members after the development of the UFP SAP for Site 14. **Ongoing**	Ongoing

Previous Action Items

Item	Responsible	Action Item	Due Date
0605-013	Mark	Provide RTC for SCHDEC remaining SI/CS comments. **Ongoing** – need to include most recent data and submit report.	Ongoing

0703-12	Lila	Provide an approval letter for Site 1 LTM WP. **Ongoing** – Lila needs a change page to write the letter. Mark to provide the change page. **Done**	Done
A0801-03	Heber	Provide an engineering analysis to support demolition materials disposal (temp lodging 200). **Ongoing**	By 03-01-2009

1.2 Training

Deb provided training on Conflict Resolution. Team members were provided with DiSC analyses earlier. The training consisted of a DVD presentation, building a foundation based on communication styles (DiSC), and lots of Team participation.

1.3 SMP

Copies of the SMP tracking document were provided to Team members. Review times of the Site 3 UFP SAP were discussed. The review periods were questioned. Timelines (review periods) can be trimmed with Team agreement.

Discussion ensued regarding the possibility of meeting the FY09 ROD date for Site 3. Can there be a different approach to meet the FY09 ROD date? As discussed at the January meeting, Tier II stated fish tissue sampling data is to be included in the Proposed Plan. The Team is concerned that the Work Plan, Field Implementation, and the revised Proposed Plan will result in the Site 3 FY09 ROD date not being met. Since the Site 3 FY09 ROD date cannot be met, this item should be elevated to Tier II for their input.

Action Item: The Navy to send alternatives (realistic schedule) to Tier II for their consideration regarding the Site 3 FY09 ROD timeline.

While reviewing the SMP, USEPA suggested that the Site 14 ground-truthing be performed before the Scoping Document/Plan. TtNUS explained that the Plan is the approach/background information required to perform the ground-truthing.

The Site 45 indoor air CSM needs to be completed before the indoor air/subslab planning. A draft CSM should be sent to Team members for an informal review.

The Site 53 EMAC report was not finalized, and the contract has expired. SCDHEC had previously commented that issues needed to be addressed in future reports. USEPA did not have expectations that the draft EMAC document would ever be finished. The data set in the draft EMAC report would need to be reviewed to see if it is usable for the SI. For EMAC sites, any unresolved regulator comments may require additional funding.

Action Item: The Navy to send extension requests to USEPA and SCDHEC for new milestones.

Milestones need to be distinguished from internal delivery dates.

DAY 2

2.1 Training (continued)

Deb continued the training with a review of the previous DiSC training, how to deal with conflict, more Team participation, and group discussion. Conflict is any situation where your concerns or desires differ from another person's.

2.2 MRP

MRP Session Objectives

- Review Background of DoD Munitions Response Program
- Review Key Definitions
- Visit MPR Sites
- Review UFP SAP Worksheets
- Assess Problems to be Addressed during SI
- Review Field Investigation Techniques
- Outline Field Program
- Identify Action Items
- Establish Schedules

Background

- Ranges and explosives not addressed under DoD environmental programs
- New program dedicated to ranges and explosives
- Follows CERCLA process
- Navy follows UFP SAP

Key Definitions

- MRP – Munitions Response Program
- MEC – Munitions and Explosives of Concern. Consist of UXO, DMM, and soils with MC concentrations high enough to present explosive hazard.
- UXO – Unexploded Ordnance
- DMM – Discarded Military Munitions
- MC – Munitions Constituents (filler such as RDX, TNT, and perchlorate and casings constituents such as metals)

Technical Expertise

- CERCLA Investigations
- Munitions Constituents
- Ordnance
- Geophysics

Site Visits

Ralph Brooks provided a health and safety orientation/briefing before the site visit. UXO 01 (Grenade Range Near Old Swimming Pool at Weapons and Field Training Battalion Area) was not visited. UXO 03 (Aerial Bombing Target at Parade Deck), UXO 04 (Field Artillery West Main Range), and UXO 05/06 (Field Artillery East Shrapnel Range, North and South Sections) were drive bys. Team members walked around the UXO 02 (Rifle Range at Ballast Creek), UXO 07 (Aerial Bombing Target at Golf Course), and UXO 08 (Aerial Bombing Target at Southern Tidal Flats) sites.

UFP SAP Worksheet Review

TtNUS provided a basic overview of the SAP worksheets for the MRP. Team members were provided the opportunity to ask questions regarding the UFP SAP worksheets. Any verbal notes not captured can be emailed to TtNUS. After incorporating comments, TtNUS will submit the document in draft form for formal comments. Verbal comments to the UFP SAP included the following:

- SCDHEC suggested, when/if possible, including firing points, berms, targets, concrete bunkers, etc. on all UXO maps.
- SCDHEC requested paragraph(s) in the Executive Summary describing the sites. USEPA suggested adding a table listing the sites and their associated approach.
- Lila's email address is wrong throughout the document.

- Bob Bohn, TechLaw, needs to be added to the distribution list, and the distribution list updated in general.
- Worksheet 6: SAP/QAPP Amendments need to go back through the Team for approval.
- Worksheet 10, 1st paragraph: "other than operational" should be changed to "closed" as in some of the tables (consistency).
- Worksheet 10.1 (UXO 01): USEPA suggested "beefing up" the argument that the range at UXO 01 did not exist. TtNUS stated that the CSM expands on the information found in the archive search report, and the information on Worksheet 10 is a summary. SCDHEC requested that information from the archive search report be included.
- Worksheet 10.1 and Appendix B: Need to check facts and have consistency.
- Worksheet 10.2 (UXO 02): There was no earthern embankment (berm) to the west. Remove the statement, and determine the orientation of range based on the targets found to find the firing line (firing point). It was agreed that the investigation will also include the firing point for propellants as appropriate. The archive search report is not in correlation with site visit.
- Worksheet 10.2: According to the archive search report, most of UXO 02 has been covered with dredge fill and has had many years of hurricanes and sediments moving. Sediment sampling would initially be limited to very close to the targets (impact point) and firing point, if accessible. Sediment sampling needs to include transport property potentials; however, this could be conducted during the RI or an extended SI.
- Worksheet 10.2: SCDHEC is concerned because soil from UXO 02 was used as borrow material for other sites (CSM, page 23 of 52). Since dredge material from the marina across the street was moved to the dredge spoils area (Site 13C), would the UXO 02 boundary need to be expanded to include the dredge spoils area? Site 13C is already a CS/SI site.
- Worksheet 10.3 (UXO 03): Geophysics will not work on the paved area at this site. It is believed that the construction of the parade deck and parking lot would have removed any remaining practice bombs. MCRD PI would like to avoid having a LUC at this site if possible. The Navy suggested that if construction methods can be verified, an LUC could be avoided if any MEC was removed during construction. MCRD PI agreed that if grassy areas are all clean, a sub-parade deck sample can be collected to avoid a possible LUC. Core samples may be needed to get an indication if the grassy area has been disturbed or not. It was agreed that the grassy area would be the starting point for UXO 03. The CSM will be refined.
- Worksheet 10.4 (UXO 04): SCDHEC expressed a concern regarding the mobility of RDX seeping deeper into the soil and not being in the top 1-2 feet of soil. Surface soil samples should indicate if RDX was ever at the site. There is a low probably that RDX was ever at UXO 04.
- Worksheet 10.5 (UXO 05): UXO boundaries with active ranges inside need to be addressed and boundaries revised (UXO 05, UXO 04). USEPA has concerns regarding losing the history of the active range (and MEC or MC potential) when the UXO boundary is revised. An alternative approach suggested would be if UXO 05 comes up clean, the footprint (boundary) of UXO 05 will be reduced to the active grenade range (in lieu of NFA for the entire UXO 05 boundary). TtNUS stated that the final document will have the grenade range at UXO 05 clearly defined.
- Worksheet 10.5: USEPA needs the Navy to propose a process for tracking MRP sites overlain by carved out active areas for review and approval. USEPA and SCDHEC feel that the MRP sites still need to be added to the FFA.
- Worksheet 11.3 (UXO 04): TtNUS suggested reducing the metals list to antimony, arsenic, and lead.
- Worksheet 11: Geophysical sweeps will be conducted primarily on anomalous areas identified during the instrument-assisted survey.
- Worksheet 11.3, Page 43: SCDHEC noted that Figure 17.4 should be Figure 17.2. Double check all figure numbers throughout the document.
- Worksheet 11.3: USEPA and SCDHEC expressed concerns about not investigating wetter areas at UXO 04. TtNUS stated the UFP SAP was based on a biased sampling technique. The expected worse case is searched for during the SI phase. If nothing is found at the source, there is probable cause that nothing else is at the site due to the methodologies used (ground-truthing, geophysical investigation, CMS). TtNUS stated that if an item is found on the surface, UXO 04

will go to an RI or extended SI. USEPA and SCDHEC will have opportunity to review and comment on the conclusions in the SI Report.

- Worksheet 11.3: SCDHEC questioned the "box" that is not part of the traditional "fan" in the UXO 4 Location Map. The "box" outside of the "fan" came from the archive search report and will be retained as a result of additional firing points.
- Worksheet 11.3, Step 3: SCDHEC questioned the leachability of the compounds and sampling surface soil only in the 0-1 foot bgs interval. TtNUS responded that the pH data would indicate any mobility in metals. TtNUS will add soil property data needs (3 parameters) to Step 3.
- Worksheet 11.3, MC Approach (Steps 1 and 2): USEPA requested the section be modified to include argument regarding the applicability of background and fate and transport with respect to recommendations to investigate additional media (subsurface soils, groundwater, etc.).
- Worksheet 11.3, MC Approach (Step 2): SCDHEC requested a statement regarding what will happen if MC is not above levels.
- Worksheet 11.3, Step 6: SCDHEC expressed concern regarding clearing sites (marsh grass). TtNUS indicated that some clearance (site preparation) will be necessary for the geophysical survey; however, no root systems will be removed. TtNUS needs to be informed of any site clearance limitations and regulations (will clearance material be considered fill?).
- Worksheet 11.3, Step 7: The wording of "Conduct a 100 percent detector-aided surface survey" will be changed to more accurately reflect actual areas to be surveyed and be less confusing.
- Worksheet 11.4: TtNUS would need to know any flying restrictions for the aerial magnetometer survey. The issue of aerial detection limitations will be reviewed and addressed by TtNUS. An instrument test strip (11x Box) will be created to ascertain sensitivity of the aerial magnetometer.
- Worksheet 17, Sampling Strategy: SCDHEC has a concern of only 8 samples being sent to the fixed-base laboratory for the larger sites. The Navy requested the wording be changed to "a minimum of" 8 samples throughout the document.
- Worksheet 17, Sampling Strategy: SCDHEC and USEPA would like to have samples other than just surfaced soil as justified by the CSM. Sampling locations and numbers will be determined based on the geophysical and XRF screening and via Team decision.
- SCDHEC stated their concern regarding the term NFA since their standard approach to MRP sites is some level of LUCs.
- The Navy would like to see a definition of sediment for the UXO sites. MCRD PI responded that if the area is tidally influenced, it is considered sediment.
- Change "RI" throughout document to "further investigation in additional phases (i.e., extended SI or RI)".
- SCDHEC noted that in the tables in the CSM, the last column is "Maximum Detection Depth" and would a clarification included as to what this means and where it came from. TtNUS stated the "maximum detection depth" came from the archive search report.
- SCDHEC stated (FYI) that in the future if any found MEC needs to be detonated/destroyed, please contact the department to determine if a emergency permit is needed.
- Verbal comments (concepts) noted on specific worksheets need to be carried throughout the document to the remaining, similar worksheets.

Action Item: Charles to clarify if closed MRP sites are to be added to the FFA.

Action Item: TtNUS to propose sediment PALs for at Parris Island for the UFP SAP.

Background screening levels were determined for the Site 3 investigation. Discussion ensued regarding if the Site 3 data set would be appropriate for use (sediment and soils) at the UXO sites.

Action Item: TtNUS to review the background data set for Site 3 and propose if it is appropriate for use at the UXO sites (for sediment and soils).

Action Item: Heber to investigate whether or not permission is required to leave cut vegetation in the marsh.

Action Item: Tim to investigate any flying restrictions associated with the aerial magnetometer survey for UXO 06.

Action Item: TtNUS to update UFP SAP with the verbal comments noted carrying the concepts throughout the document to the remaining, similar worksheets.

DAY 3

3.1 Site 3

Action Item: Mark to set up a conference call to discuss Site 3 with Team members and Ron Kinlaw, MCRD Conservation Law Enforcement Officer, and to scope the fish tissue Sampling and Analysis Plan.

USEPA requested to have a formal scribe on the Site 3 conference call and to have the minutes available for immediate viewing on Meeting Place.

3.2 GIS/Groundwater Inventory List

SCDHEC would like to have all wells included in the GIS.

Action Item: Mark to send Kelly Tetra Tech's completed well list for Parris Island.

3.3 MRP (continued)

The MRP UFP SAP review continued. Notes are included in Day 2, Item 2.2.

3.4 Meeting Review and Closeout

Next Meeting
The next meeting is scheduled for May 19-20, 2009, in Columbia, SC beginning at 8:30 a.m. on the 19th and concluding at 1:00 p.m. on the 20th. Mark will be the Team Leader, and Kelly will be the Time Keeper.

Agenda Items

Check In/Agenda/Action Items	Leader/All	60 min
Training	Deb	60 min
Site 3	Mark	120 min
Site 14	Mark	60 min
Site 27	Mark	60 min
Site 45	Mark	60 min
SMP	Mark	60 min
MRP	Mark	60 min
Meeting Closeout	All	60 min
Last minute topics and parking lot items	All	?

Tentative Meeting Dates/Proposed Location

July 14-15, 2009	MCRD Parris Island, TRC Meeting
September 15-16, 2009	Columbia, SC
November 17-18, 2009	MCRD Parris Island, TRC Meeting

Action Item, Consensus Item, and Parking Lot Review
Action items, consensus items, and parking lot items were reviewed and are provided on the following pages.

Plus/Delta

+	Δ
Training (DiSC)	Agenda too full
Annie on Team	Cancelled agenda item (without full Team consideration)
UXO discussion	½ day, full day, ½ day
Guests (expertise)	Site tours were inefficient; also need vehicle large enough for all Team members
Working together	Consider a straw man UFP SAP first as opposed to the overwhelming draft document
Entire Team at dinner	

Action Items
MCRD Parris Island Partnering Meeting
March 17-19, 2009

Action Items Developed March 2009

Item	Responsible	Action Item	Due Date
03.09.1.1.1	Team	Provide comments to Mark on the Path Forward for Site 27.	By 04-01-2009
03.09.1.1.2	Charles	Will provide information confirming that LNAPL at Site 27 is not a listed waste to Team members.	By 03-24-2009
03.09.1.3.1	Charles	Send alternatives (realistic schedule) to Tier II for their consideration regarding the Site 3 FY09 ROD timeline.	By 03-24-2009
03.09.1.3.2	Charles	Send extension requests to USEPA and SCDHEC for new milestones.	After Tier II guidance
03.09.2.2.1	Charles	Clarify if closed MRP sites are to be added to the FFA.	By 04-02-2009
03.09.2.2.2	Mark	Propose sediment PALs for at Parris Island for the UFP SAP.	By 04-02-2009
03.09.2.2.3	Mark	Review the background data set for Site 3 and propose if it is appropriate for use at the UXO sites (for sediment and soils).	By 04-02-2009
03.09.2.2.4	Heber	Investigate whether or not permission is required to leave cut vegetation in the marsh.	By 04-02-2009
03.09.2.2.5	Tim	Investigate any flying restrictions associated with the aerial magnetometer survey for UXO 06.	By 04-02-2009
03.09.2.2.6	Mark	Update UFP SAP with the verbal comments noted carrying the concepts throughout the document to the remaining, similar worksheets.	By 05-19-2009
03.09.3.1	Mark	Set up a conference call (with a scribe) to discuss Site 3 with Team members and Ron Kinlaw, MCRD Conservation Law Enforcement Officer, and to scope the fish tissue Sampling and Analysis Plan.	By 04-02-2009
03.09.3.2	Mark	Mark to send Kelly Tetra Tech's completed well list for Parris Island.	By 05-19-2009

Action Items Developed January 2009

Item	Responsible	Action Item	Due Date
01.09.1.1	Charles	Arrange a conference call with Team members to discuss	By 02-10-2009

		conceptual site model for vapor intrusion Site 45. **Ongoing – waiting for TtNUS PhD to be available for call.**	
01.09.1.5.2	Mark	Overlay UXO map with Site map. **Done – will send out electronically to Team members.**	Done
01.09.1.7	Team	Provide SCDHEC (Meredith) with comments on the CA 400/550 spreadsheet regarding dates, information, and the new sites identified post signing of the FFA. **Done**	Done
01.09.1.8	Tier II (Stacey)	Take the lead in facilitating determination of how and if sites can be added to the FFA and reporting back to Tier I. **Ongoing**	By 02-28-2009
01.09.2.2.1	Lila	Arrange a conference call between SCDHEC and EPA to discuss the Technical Memorandum to determine if in agreement or concurrence after EPA reviews the Technical Memorandum. **Done**	Done
01.09.2.2.2	Mark	Arrange a conference call with all risk assessors and all Team members to determine if in agreement or concurrence and decide on a path forward for Site 3. **Done**	Done
01.09.2.2.3	Charles	Research what is involved with fish tissue sampling and starting a Work Plan for Site 3 and locate the 1998 RI. **Done – Have an example fish tissue plan from Pearl Harbor and working with a support group. Working with Sherri Eng (chemist), NAVFAC SE.**	Done
01.09.2.3.1	SCDHEC (Sommer)	Investigate if a NPDES permit is required since Site 45 chlorinated solvents are being discharged into the marsh. **Done – not a point discharge; it is seepage. Will be handled under the stormwater program.**	Done
01.09.2.3.2	Mark	Post the Tri-Services guidance for vapor intrusion on the Tetra Tech ftp site. **Done**	Done
01.09.2.4.1	Charles	Attain the proposal from the RAC contractor and share with Team members. **Ongoing – Proposal attained, but not shared with Team – still reviewing data.**	By 01-14-2009
01.09.2.4.2	Charles	Provide the MIP data referenced in the preliminary data analysis to Team members (Site 27). **Done – no new MIP data – see Site 55 PA report appendix.**	Done
01.09.2.4.3	Mark	Arrange a conference call with Team members to discuss comments on the Proposed Path Forward for Site 27. **Ongoing – waiting for comments**	By 01-31-2009
01.09.2.5	Charles/Mark	Develop a schedule and arrange a conference call for Site 3. **Done**	Done

Action Items Developed October 2008

Item	Responsible	Action Item	Due Date
11.08.1.1.1	Deb	Update the Team contract/contact list (again). Add Tim, remove Joe. **Done**	Done
11.08.1.1.2	Mark	Revise April 2008 meeting minutes for approval by the Team. Team members please resend any comments to Mark. **Ongoing – waiting on comments**	By 01-31-2009
11.08.1.1.5	Mark	Send Kelly the list of missing sites for the Base Sites map. **Done.** Mark to contact Joe Hamilton to get information on missing sites. **Ongoing**	By 01-31-2009
11.08.1.3.4	Charles	Speak with NAVFAC attorneys and get further information regarding LNAPL concentrations at Site 27 and P-listed wastes. **Done – Joe Logan, TtNUS, confirmed LNAPL is not a listed waste.**	Done

11.08.1.4	Meredith / Charles	Look into the WWTP demolition and SWMU 42 to see if regulatory oversight and/or closure are needed. **Ongoing**	Ongoing – internal meeting to be held
11.08.2.2.3	Charles	Prepare a draft extension letter for the Site 27 RI D1. **Ongoing – dependent on path forward.**	Agenda Item
11.08.2.2.4	Tim	Develop a list of OWS for the state. **Ongoing**	By 01-16-2009
11.08.2.3.2	Mark	Arrange a conference call with Team members after the development of the UFP SAP for Site 14. **Ongoing**	Ongoing

Previous Action Items

Item	Responsible	Action Item	Due Date
0605-013	Mark	Provide RTC for SCHDEC remaining SI/CS comments. **Ongoing** – need to include most recent data and submit report.	Ongoing
0703-12	Lila	Provide an approval letter for Site 1 LTM WP. **Ongoing** – Lila needs a change page to write the letter. Mark to provide the change page. **Done**	Done
A0801-03	Heber	Provide an engineering analysis to support demolition materials disposal (temp lodging 200). **Ongoing**	By 03-01-2009

Parking Lot Items
MCRD Parris Island Partnering Meeting
March 17-19, 2009

Parking Lot Items from March 2009

Site 45 NPDES (Joe, SCDHEC)
Agenda time frames – last day, scheduled flights
It was suggested to break on the last day before lunch (1:00).
UXO sites, MC sites – NFA – real estate regs – deed restrictions, annotations (state)
Site 3 – conference call – what is going to be discussed (agenda, scribe)

Parking Lot Items from January 2009

Ground rules exercise – Deb
Tier I expectations of Tier II – Feedback for Tier II
Meeting Evaluation
Exit Strategy

MCRD PARRIS ISLAND PARTNERING MEETING

May 18-20, 2009
MCRD Parris Island, SC

Leader: Mark Sladic Time Keeper: Meredith Amick Scribe: Libby Claggett

Members Present:	Meredith Amick	SCDHEC
	Charles Cook	NAVFAC SE
	Annie Gerry	SCDHEC
	Tim Harrington	MCRD PI
	Lila Llamas	USEPA
	Mac McRae	TechLaw, Inc.
	Heber Pittman	MCRD PI
	Mark Sladic	Tetra Tech, Pittsburgh
	Stacey French	SCDHEC, Tier II Link
	Pat Franklin	The Management Edge, Facilitator
	Libby Claggett	Tetra Tech, Jacksonville, Scribe
Guests:	Joe Bowers	SCDHEC
	Susan Byrd	SCDHEC
	Peggy Churchill	Tetra Tech, Cocoa
	Tim Frederick	USEPA
	Richard Haynes	SCDHEC
	Greg Zimmerman	Tetra Tech, Pittsburgh

Meeting Start Time: 1:15 p.m.

1.1 Check-in, Agenda Modifications/Additions, Ground Rules, Minutes Approval, Parking Lot Review, Action Item Review

Action Items Developed May 4, 2009 (Conference Call)

Item	Responsible	Action Item	Due Date
05.09.1cc	Charles	Charles to check with Steve Beverly regarding the NAVFAC acceptance of a Hazard Index greater than 1. **Done – checked with David Barclift – no policy**	Done
05.09.2cc	Mark	Mark to provide Meredith with the model from NOAA. **Done**	Done
05.09.3cc	Amy and Dave	Amy and Dave to review assumptions to minimize uncertainty. **Ongoing**	Before next meeting
05.09.4cc	Meredith	Meredith to check with the state ichthyologist regarding their opinion on using red drum fish in the fish tissue sampling. **OBE**	OBE
05.09.5cc	Meredith	Meredith to check on state protocol for fish tissue sampling and send to Lila. **Done**	Done
05.09.6cc	Mark	Mark to have information together including a chart of fish (foraging range, home range of the species), species information, etc. by the next meeting. **Done**	Done
05.09.7cc	John	John to send Mark Sladic the .pdf files (life history information) on red drum, flounder, mullet, etc. so Mark can send to all Team members. **Done**	Done
05.09.8cc	Team	Team members to prepare a list of information they feel should be included on the fish table (i.e., food items, maximum reasonable age, etc.) and send to Mark. **Done**	Done

05.09.9cc	Mark	Mark to prepare a draft agenda to for the next meeting and send to Team members for review. **Done**	Done

Action Items Developed March 2009

Item	Responsible	Action Item	Due Date
03.09.1.1.1	Team	Provide comments to Mark on the Path Forward for Site 27. **Ongoing – agenda item**	By 04-01-2009
03.09.1.1.2	Charles	Will provide information confirming that LNAPL at Site 27 is not a listed waste to Team members. **Ongoing - Mark needs to send information to Team members.**	By 03-24-2009
03.09.1.3.1	Charles	Send alternatives (realistic schedule) to Tier II for their consideration regarding the Site 3 FY09 ROD timeline. **Ongoing – Cannot make FY09 timeline for Site 3 ROD**	By 03-24-2009
03.09.1.3.2	Charles	Send extension requests to USEPA and SCDHEC for new milestones. **Ongoing**	By 06-01-2009
03.09.2.2.1	Charles	Clarify if closed MRP sites are to be added to the FFA. **Ongoing – Steve Beverly said no. Texas does add closed sites to FFA. Charles to check with Navy Tier II for direction.**	By 04-02-2009
03.09.2.2.2	Mark	Propose sediment PALs for at Parris Island for the UFP SAP. **Ongoing**	By 04-02-2009
03.09.2.2.3	Mark	Review the background data set for Site 3 and propose if it is appropriate for use at the UXO sites (for sediment and soils). **Ongoing – need more information**	By 04-02-2009
03.09.2.2.4	Heber	Investigate whether or not permission is required to leave cut vegetation in the marsh. **Ongoing**	By 04-02-2009
03.09.2.2.5	Tim	Investigate any flying restrictions associated with the aerial magnetometer survey for UXO 06. **Ongoing – Charles to get with Tt and Navy to see if aerial mag survey is necessary. Mark to schedule a conference call.**	By 04-02-2009
03.09.2.2.6	Mark	Update UFP SAP with the verbal comments noted carrying the concepts throughout the document to the remaining, similar worksheets. **Ongoing**	By 05-19-2009
03.09.3.1	Mark	Set up a conference call (with a scribe) to discuss Site 3 with Team members and Ron Kinlaw, MCRD Conservation Law Enforcement Officer, and to scope the fish tissue Sampling and Analysis Plan. **Done**	Done
03.09.3.2	Mark	Mark to send Kelly Tetra Tech's completed well list for Parris Island. **Ongoing**	By 05-19-2009

Action Items Developed January 2009

Item	Responsible	Action Item	Due Date
01.09.1.1	Charles	Arrange a conference call with Team members to discuss conceptual site model for vapor intrusion Site 45. **Ongoing – waiting for TtNUS PhD to be available for call.**	By 06-01-2009
01.09.1.8	Tier II (Stacey)	Take the lead in facilitating determination of how and if sites can be added to the FFA and reporting back to Tier I. **Done – add MMRP sites to FFA and track other sites elsewhere.**	Done

01.09.2.4.1	Charles	Attain the proposal from the RAC contractor and share with Team members. **Ongoing – Proposal attained, but not shared with Team. Have not decided on technology for Site 45. Need to have EE/CA for Site 27.**	By 01-14-2009
01.09.2.4.3	Mark	Arrange a conference call with Team members to discuss comments on the Proposed Path Forward for Site 27. **Ongoing – waiting for comments**	By 01-31-2009

Action Items Developed October 2008

Item	Responsible	Action Item	Due Date
11.08.1.1.2	Mark	Revise April 2008 meeting minutes for approval by the Team. Team members please resend any comments to Mark. **Ongoing – waiting on comments from EPA.**	By 01-31-2009
11.08.1.1.5	Mark	Send Kelly the list of missing sites for the Base Sites map. **Done.** Mark to contact Joe Hamilton to get information on missing sites. **Ongoing**	By 01-31-2009
11.08.1.4	Meredith / Charles	Look into the WWTP demolition and SWMU 42 to see if regulatory oversight and/or closure are needed. **Ongoing**	Ongoing – internal meeting to be held
11.08.2.2.3	Charles	Prepare a draft extension letter for the Site 27 RI D1. **Ongoing – dependent on path forward.**	Agenda Item
11.08.2.2.4	Tim	Develop a list of OWS for the state. **Ongoing**	By 01-16-2009
11.08.2.3.2	Mark	Arrange a conference call with Team members after the development of the UFP SAP for Site 14. **Ongoing**	Ongoing

Previous Action Items

Item	Responsible	Action Item	Due Date
0605-013	Mark	Provide RTC for SCHDEC remaining SI/CS comments. **Ongoing** – need to include most recent data and submit report. Mark needs EMAC report from Charles or Meredith.	Ongoing
A0801-03	Heber	Provide an engineering analysis to support demolition materials disposal (temp lodging 200). **Ongoing**	By 03-01-2009

1.2 Site 3

Peggy Churchill, DQO Facilitator, provided a presentation to Team members.

USEPA commented that the “site” includes the landfill, causeway, and contaminated Areas 1 through 4.

PRE-REMEDY
Original sources of contamination included the following:

- Construction debris
- Paint waste
- Pesticide disposal – empties
- Dry cleaner waste
- Dental / biomedical waste
- Etc.
- Volume of waste unknown

Media included the following:
- Sediments
- Soil
- Groundwater (chlorobenzene / benzene)
- Surface water

Migration pathways included the following:
- Erosion of landfilled material
- Contamination of sediments
- Some mixing within water column with minimal impacts
- Fish food chain

Site receptors / users included the following:
- Site remedy driven by ecological receptors – human receptors evaluated during RI.
- Tech memo / original risk assessment evaluated fisher people

ATSDR recommends to recalculate risk if noteworthy fish consumption.

5-year review determined remedy still protective / LUCs in place (signage).

Interim ROD – to re-characterize the sediment following completion of the remedy

---

Receptors for current investigation (fish tissue sampling) include the following:
- Recreational and subsistence fisher people

Migration Pathway:
- Benthic ingestion of sediment
- Bottom feeding fish that also ingest sediment

2001 human health post-remedy COPCs:
- PAHs, DDD, DDT, chlordane, arsenic, copper, lead, mercury, zinc, PCBs (Arochlors)
- Arochlor 1254, dieldrin, and heptachlor epoxide were identified in the fish.

2001/2003 tech memo sediment COPCs:
- DDD, copper, and mercury

COC identified: mercury

Ecological post remedy:
- Risk to eco unacceptable, but risk management decisions allow RAOs to be met.

PROBLEM STATEMENT:

What environmental question are we trying to answer?
- Is there an unacceptable human health exposure based on recent consumption information?

- Risk communication to subsistence fisherwoman based on back-calculation to determine number of meals it is acceptable to consume (ATSDR).
- What is the risk to fisher people (adult and child recreational) from consumption of fish (Site 3 COCs) from the Site 3 pond?
  - Recreational
  - Subsistence (99th percentile) (EPA subsistence guidance)

Study Goal:

1) Determine risk to recreational and subsistence fisher people from exposure to DDX, copper, mercury, and PCBs in fish caught in the Site 3 (3rd Battalion) pond.

What media will be investigated?

Fish tissue

What are the COCs?

DDX, copper, mercury, and PCBs

DHEC stated the risk communication should be a separate document (i.e., Fact Sheet). When completed, the separate document would be delivered to the fisherwoman by DHEC.

USEPA stated that agreement to the study goal is based on an agreement that decisions derived from the study would be limited to LUCs at Site 3.

DAY 2

2.1 Site 3 (Continued)

STEP 3: Information Inputs

Previously collected data – informational aside from interview – exposure assumptions – sample population

- Original RI data
- Data after RI
- EPA sediment data

Chemical data – fish tissue

Field parameters –

- Water quality indicators – DO, pH, temperature, salinity, turbidity, etc.
- Tidal influences
- Site conditions – meteorological data, temporal

Screening values – USEPA screening values (no zinc)

Target Analyte	Recreational Fisher		Subsistence Fisher	
	Non-carcinogens	Carcinogens	Non-carcinogens	Carcinogens
Total DDT	0.2 mg/kg	0.117 mg/kg	0.0245 mg/kg	1.44E-2 mg/kg
Total PCBs	0.008 mg/kg	0.02 mg/kg	9.83E-4 mg/kg	2.45E-3 mg/kg
Copper	5.4 mg/kg	---	5.4 mg/kg	---
Mercury	0.04 mg/kg	---	0.0049 mg/kg	---
Zinc	41 mg/kg	---	41 mg/kg	---

- RSL calculator to develop values – USEPA will check
- No Region 3 (dated)
- Subsistence fishing screening values
- Use 10^{-6} screening values and HI of 0.1

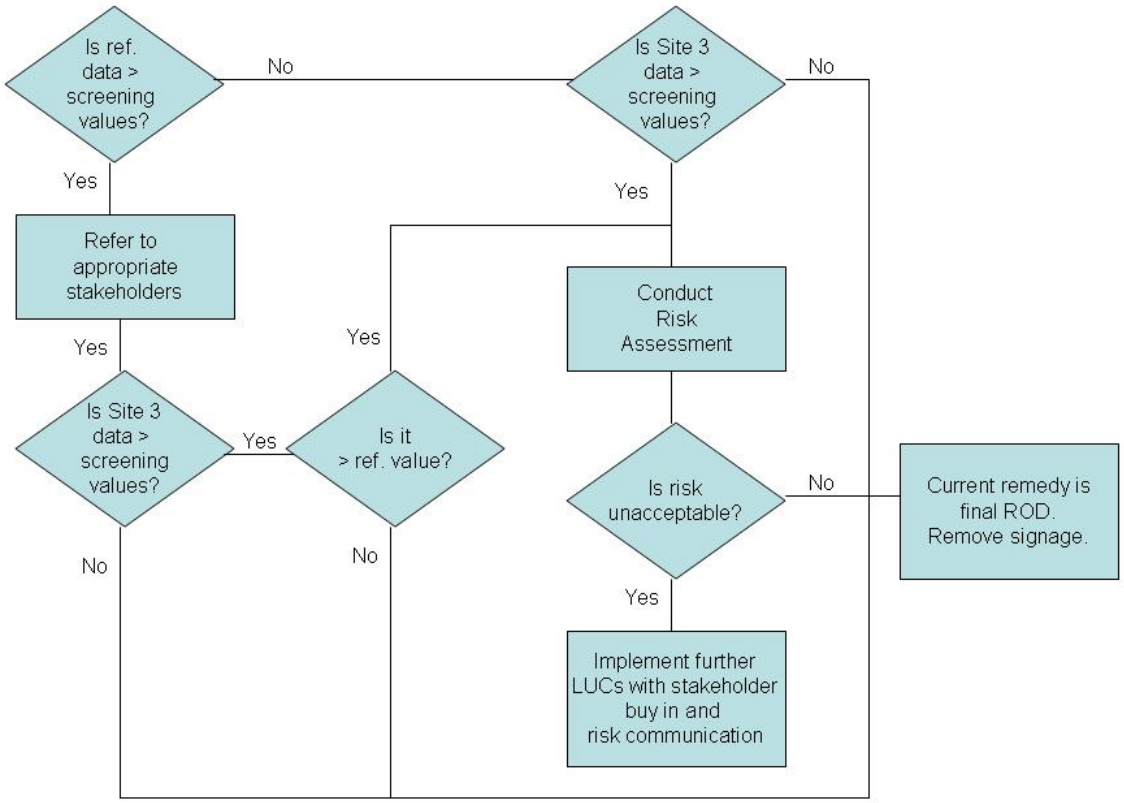
Action Item: Tim Frederick, USEPA, to check to see if there are contaminants that do not have subsistence screening values.

STEP 4: Study Area Boundaries

Site Boundary – look at what was in the previous documents for LUC/remedy boundary.
Study Area Boundary – both lobes of the Site 3 (3rd Battalion) pond
Fishing LUC would apply to whole pond
Reference Location
- Will be outside of the Site 3 pond
- Outside of any site influence
- Technical reason for location selection

STEP 5: Decision Rules

Action Item: Tetra Tech to ensure that the text for Step 5 follows the flow chart that was created at the meeting.



Concentrations of contaminants in fish tissue will be compared to screening values in order to select COPCs and evaluate risk to site users.

If contaminant concentrations are less than screening values, risk to human health receptors will not be evaluated and the current remedy will be described in the final ROD for the site. Possibly remove subsistence fishing signage.

If contaminant concentrations are greater than screening values, but less than the reference location, the Team will evaluate the need for data referral for the reference fish tissue, risk communication, etc. This information will not be used to amend the current site remedy and would not be a Navy responsibility under this document.

If contaminant concentrations are greater than screening values and greater than the reference location, contaminants will be carried through the risk assessment. If risks are unacceptable, all stakeholders need to be involved in the decision process for the final remedy in the ROD. The project Team will evaluate the implementation of LUCs and long term monitoring as the final remedy. No changes will be made to the engineered remedy for sediment in the Site 3 Pond.

Note: USEPA, through CERCLA authority, and the Navy will require LUCs be applied to the site as the final remedy of the ROD if contaminant concentrations show an elevated risk. This is to be captured on Worksheet 9. Discussion on backgrounds will be included. Risk assessment and risk communication on background concentration is an option as recommended in USEPA guidance, but would be addressed in a separate investigation.

If reference concentrations show that there is unacceptable risk from consumption of fish caught in the reference location, this information would be communicated to the appropriate stakeholders (i.e., Bureau of Water).

If contaminant concentrations are less than screening values, but greater than the detection limits, DHEC will conduct risk communication with subsistence fisher people that frequently fish at the Site 3 pond.

USEPA recommends the reference concentration be 2 times the mean concentration of the reference location or background concentration.

The Team reached **consensus** that the reference concentration be 2 times the mean concentration of the reference location or background concentration.

USEPA guidance recommends using the maximum concentration for the comparison to screening values and reference concentrations and the average concentration would be used for the EPC in risk calculations.
The Team reached **consensus** to use the maximum concentration for the comparison to screening values and reference concentrations and the average concentration for the EPC in risk calculations.

USEPA guidance states using ½ the MDL for nondetects. Using the "ProUCL calculator" to see what happens with values/concentrations between 0 and MDL in small data sets will also be investigated.

Action Item: Tim F. to bring alternatives to ½ the detection limit to small data sets to the Team.

The Team reached **consensus** that if relatively high concentrations are found, the approach would be to make a risk management decision using the uncertainties associated with the fish tissue sampling. The Team would need to notify the appropriate stakeholders of elevated fish tissue concentrations. This issue will be addressed in Worksheet 9 and will not impact the remedy for sediments at Site 3.

STEP 6: Measurement and Performance Criteria

STEP 7: Data Collection Plan

<u>What type</u>? Bottom feeder (for PCBs) and top predator (for mercury) from each location.

<u>What species</u>? Recommend a bottom feeder (Mullet) and a top predator (Red Drum, Croaker). Flounder was not recommended since they are harder to collect in a net. DHEC suggested proposing an alternate top predator (Croaker) since Red Drum may also be difficult to net. It was also suggested to target the legal catch, but get a permit to keep larger fish. Reference samples need to be taken after fish are caught at the Site 3 pond.

<u>Who to catch (net) the fish</u>? Should the fisherwoman be compensated for fish she catches for the day? Buying the fisherwoman's daily catch would provide a true representation of what she actually eats;

however, sampling protocols would be difficult to determine. Also, how to approach the fisherwoman and buying game fish are other concerns. It was suggested that all fisher people at the Site 3 pond be approached to help supplement the netting of fish. Net fishing would provide a better control for worse-case sampling. However, red drum fish are not easily catchable with cast netting and seine netting attracts alligators.

Action Item: Tim H. to review restrictions regarding game fish and if the fish can legally be purchased from the fisherwoman and/or other fisher people at the Site 3 pond.

How many species? Top predators and bottom feeders.

What age? Size? Fish need to be of an edible/legal size. Game fish include Flounder and Red Drum.

How many locations? 4 – divide each lobe into 2 quadrants for a total of 4 quadrants for the entire pond. No less than ½ of the total fish mass collected from the causeway lobes.

How many fish within each category per location? Ideally, 2 per category per location (8 bottom, 8 top).

Whole versus fillet? Fillet

Composite versus discrete? Discrete

Tetra Tech path forward: Provide draft DQOs to Team members for review, conference call to discuss comments, provide draft UFP/SAP to Team, Team review, revised UFP/SAP to government chemist.

2.2 Site 45

Status update: Pilot tests are ongoing. There is nothing new from USGS. The Pilot Study Plan was sent to the Team for review. Field work will be conducted the weeks of June 22 and June 29. A vapor intrusion CSM will be completed and out to Team for review by next week at the latest. Data from the Pilot Study Plan may be used in future Site 45 efforts.

Action Item: Team members to provide feedback on the Pilot Study Work Plan for Site 45 to Charles.

Action Item: Lila to check if Scott Huling's project is ESTCP or SERDP and help resolve any conflict with USEPA hierarchy.

USGS data suggests storm sewer is a French drain and a preferential pathway. The Navy does not believe that lining the storm sewer would cause further issues. However, it is part of the risk that will be evaluated in the RI Addendum. USEPA expressed concern that the plume could be migrating along the preferential pathway of the storm sewer.

The remedy will be evaluated to ensure injections do not create more vinyl chloride.

It is believed the NPDES issue (Bureau of Water) will be resolved with sealing the storm drains.

The Depot is repaving the road (Panama) on the northern side of Site 45. This involves milling down the existing road surface. There are 3 flush mounted wells in the road that will be impacted. The concrete collars will be replaced with reinforced collars. Storm drain repair across Samoa Street (on the eastern side of the site) may generate some contaminated soil. The Depot will be submitting a letter describing the work to be performed.

Action Item: Tim H. to provide building construction date and solvent type information to Team members.

2.3 Site 27

Action Item: Lila to provide comments to Mark on the Site 27 proposed path forward.

The Navy wants to delineate the LNAPL before pumping. Tetra Tech is waiting on a list of data needs from the contractor for LNAPL hot spot and soil delineation. A CSM will be prepared for Site 27. Data gaps will need to be filled before moving on to the EE/CA. The Navy suggested providing an unofficial submittal of the draft CSM for Team use for the path forward. An EE/CA and Action Memo have to be completed before going on to the Removal Action Work Plan.

Action Item: Mark to provide to Team members the Site 27 CSM including maps and data, Geotech data, building footprint, vapor intrusion information, and IM support sampling work plan.

Action Item: Charles to send the RFP for Site 27 Geotechnical borings to Mark.

2.4 Site 14

Tetra Tech attempted to find all of the stormwater outfalls. Over 80 outfalls were located. The Navy sediment policy was reviewed for its application to Site 14. The sediment policy states that, "All sediment investigations and response actions must be directly linked to Navy CERCLA/RCRA contaminated releases (BRAC and/or ER,N eligible). Directly linked means that the sediment contamination is scientifically connected to a Navy IR/BRAC site." Out of the over 80 outfalls located, approximately 12 are related to known sites. Any data collection effort requires a UFP/SAP. The Team needs to hear back from Tom Dillon and Priscilla Wendt regarding the approach. USEPA and DHEC will need to look at the issues with respect to Navy policy.

Action Item: Team members to review Navy sediment policy and provide Mark with comments regarding its application at Site 14.

Action Item: Mark to check the original drivers that established Site 14.

Action Item: Mark to provide Team members with a scoping document containing data collected, outfalls to be sampled, and rationale of sampling.

Action Item: Mark to schedule a conference call to discuss Site 14 outfall sampling.

<u>DAY 3</u>

3.1 SMP

Copies of the were provided to Team members. Page 3, Line 117, Site 5 pre-draft UFP SAP is almost ready for Team review. Page 4, Line 361, Tetra Tech is revising detailed path forward for Site 14. Page 6, Line 488, Site 27 Contracting and Funding – a memo will be sent so work can begin on Site 27. Steps for EE/CA need to be added to Site 27.

Action Item: Mark to add steps for the EE/CA, action memo, and removal action report for Site 27 to the schedule.

Action Item: Lila to check on the requirements for EE/CA, action memo, and removal action report.

Page 7, Line 560, Site 45, Indoor Air CSM – draft CSM should be completed no later than next week. The dry cleaning facility not only uses non-chlorinated solvents, but had previously been using a petroleum-derived solvent, but no longer does that. The dry cleaner is a store front – dry cleaning is done off site.

Page 8, Lines 585 and 594, Site 45 Treatability Studies – The RI Addendum schedule is independent of the studies. Page 9, Line 642, CSSI Report – EMAC data has been provided. Page 9, Line 653, Site 53 SI – needed data has been provided. Page 10, Line 691, draft UFP SAP Munitions Response Program – DQOs will be prepared during this meeting. Page 10, Line 715, FY10 SI Completion – Tetra Tech is working on requirement for submittals.

Action Item: Charles to provide extension request letters to USEPA and DHEC and copy Team members for informational purposes.

USEPA recommended taking current schedule and adding a buffer to the milestones to provide new dates for the extension letters. Site 3 is a top priority. Tier II will be meeting in June; Site 3 will be a topic of discussion. Tier II would like to have the revised schedule before their June meeting.

Action Item: Mark/Charles to provide revised schedule to Tier II before their June meeting.

The d1 SMP for 2010 is due June 15.

3.2 Training

Pat provided training on the role of the Facilitator. The training consisted of sharing Pat's background, relating the Team's expectations of a Facilitator, and discussing possible training.

Action Item: Team members to email MBTI and DiSC scores, contact information, any Roles and Responsibilities, Mission Statements, etc. to **Pat.Franklin@mail.com**.

Action Item: Pat to send Team charter to Team members.

Expectations from Team	Training
Help with meeting process	Task management
Keep business flowing	Staying on schedule
Focus	Try a tool
Balance > all viewpoints expressed	Incorporate into discussion item
Help interject fun	Delegation
Monitor and stop interruptions	Conflict resolution
Unbiased mindset	Decomposition
Calm conflict	
Have different perspective	
Provide feedback to Team members	
Don't have favorites	

3.3 MRP

There are 7 MRP sites. The DQO discussion will focus on Steps 2 and 5. The draft SI Report is due by September 2010.

Delineation requires a minimum of two mobilizations for sampling. The SI provides a means to move forward without delineation (NFA, NA, LUCs). DHEC stated its position with LUCs is that they are not a property restriction. At a minimum, an LUC is a form of notification in the base master plan about use related to digging, notification that is was a munitions site, etc.

Parade Deck – Human health criteria, building records (construction information)

MEC – Examine the building records to determine if pavement, if maintained, can serve as an exposure pathway barrier. Investigate for the presence of MEC or MEC debris in the subsurface through geophysics in the grassy area. Determine potential extent of LUC boundary.

The Team reached **consensus** on the following actions for UXO 3 (Parade Deck):

1. Look for records. Use construction records to justify that geophysics are not needed in the paved area.
2. Conduct geophysics in the grassy area. If anomalies are not found in the grassy area, investigate for MC. If anomalies are found in the grassy area, investigate the anomalies for the presence of MEC and proceed with MC investigation.

The Team reached **consensus** that the LUC for the paved area (Parade Deck) will include keeping the pavement in place to serve as a barrier to the receptor of a potential risk. If work is conducted that disrupts the LUC, workers must be notified the site was a former bombing range through the dig permit process. Notification of use of the location (UXO 3) as a former UXO range will be included in the base master plan.

Action Item: Meredith to provide the Team with examples of previous LUC language for UXO sites.

Action Item: Annie to talk with Joe regarding the need for groundwater samples in the grassy area at the Parade Deck.

Action Item: Mark to arrange and conference call with Team members to finish UXO UFP/SAP discussion.

3.4 Meeting Review and Closeout

Next Meeting

The next meeting is scheduled for July 14-15, 2009, at MCRD Parris Island, SC beginning at 8:30 a.m. on the 14th and concluding at 1:00 p.m. on the 15th. Meredith Amick will be the Team Leader, and Charles Cook will be the Time Keeper.

Agenda Items

Check In/Agenda/Action Items	Leader/All	30 min
Training	Pat	60 min
Site 3	Mark	60 min
Fish tissue sampling plan (draft)		
Site 5	Mark	60 min
UFP/SAP pre-draft		
Site 14	Mark/Peggy	120 min
DQOs		
Site 27	Mark/Peggy	120 min
UFP/SAP, review CSM		
Site 45	Mark	30 min
Vapor intrusion CSM update, GSI study		
SMP, Schedule Review	Charles/Mark	60 min
MRP	Mark	30 min
Revised DQOs, status update		
Prep for TRC Meeting	Team	15 min
TRC Meeting	Tim	90 min
Meeting Closeout	All	60 min
Last minute topics and parking lot items	All	? min

Tentative Meeting Dates/Proposed Location

September 15-16, 2009	Columbia, SC
November 17-18, 2009	MCRD Parris Island, TRC Meeting

Action Item, Consensus Item, and Parking Lot Review
Action items, consensus items, and parking lot items were reviewed and are provided on the following pages.

Plus/Delta

+	Δ
DQO discussion	Kelly not at meeting
Most of Team at dinner	Get info to people before the meeting; better utilization of meeting time
Meeting in a working format and not just updates	Better planning for all stakeholders at meeting
Pat facilitating	Interrupting people speaking (sidebars)
Risk assessors at meeting	Misunderstanding – jumping to conclusions
Real time meeting minutes	
Participation in DQO discussion	
Meredith as timekeeper and Mark as Team leader	
Meeting more focused than in the past	
Team members more willing to speak up if difference of opinion	

Facilitator Feedback
Discussions good, better understanding of general outcome, DQO good session, agenda timing could be efficient. Overall as a Team, Pat is exciting about working with us. Stacey provided good Tier II input for the Team.

Action Items
MCRD Parris Island Partnering Meeting
May 18-20, 2009

Action Items Developed May 18-20, 2009

Item	Responsible	Action Item	Due Date
05.09.1.1.1	Mark	Schedule a conference call with Navy to determine if an aerial mag survey is necessary for UXO 06. **OBE**	OBE
05.09.1.1.2	Lila	Check to see if any comments were made on the April 2008 minutes and forward any comments to Mark.	05-27-2009
05.09.1.1.3	Libby	Send PI Completion Report Site 35 to Team members. The report will be put on the ttnus ftp site. An email will be sent when the report is uploaded with a link to the file.	06-01-2009
05.09.1.2.1	Mark	Send .pdf of ASTDR information to Team members.	05-21-2009
05.09.2.1.1	Tim F.	Check to see if there are contaminants that do not have subsistence screening values.	06-01-2009
05.09.2.1.2	Mark	Schedule a conference call to complete the DQO Facilitation (Step 6).	06-01-2009
05.09.2.1.3	Mark	Ensure that the text for Step 5 follows the flow chart that was created at the meeting.	06-01-2009
05.09.2.1.4	Tim F.	Bring alternatives to ½ the detection limit to small data sets to the Team.	

05.09.2.1.5	Tim H.	Review restrictions regarding game fish and if the fish can legally be purchased from the fisherwoman and/or other fisher people at the Site 3 pond.	06-05-2009
05.09.2.1.6	Libby	Include the DQO flow chart in the minutes. **Done**	05-21-2009
05.09.2.2.1	Team	Provide feedback on the Pilot Study Work Plan for Site 45 to Charles.	Before 06-22-2009
05.09.2.2.2	Lila	Check if Scott Huling's project is ESTCP or SERDP and help resolve any conflict with USEPA hierarchy.	06-01-2009
05.09.2.2.3	Tim H.	Provide building construction date and solvent type information to Team members.	05-29-2009
05.09.2.3.1	Lila	Provide comments to Mark on the Site 27 proposed path forward.	06-15-2009
05.09.2.3.2	Mark	Provide to Team members the Site 27 CSM including maps and data, Geotech data, building footprint, vapor intrusion information, and IM support sampling work plan.	06-30-2009
05.09.2.3.3	Charles	Send the RFP for Site 27 Geotechnical borings to Mark.	05-28-2009
05.09.2.4.1	Team	Review Navy sediment policy and provide Mark with comments regarding its application at Site 14.	06-15-2009
05.09.2.4.2	Mark	Check the original drivers that established Site 14.	06-05-2009
05.09.2.4.3	Mark	Provide Team members with a scoping document containing data collected, outfalls to be sampled, and rationale of sampling.	06-05-2009
05.09.2.4.4	Mark	Schedule a conference call to discuss Site 14 outfall sampling.	06-12-2009
05.09.3.1.1	Mark	Add steps for the EE/CA, action memo, and removal action report for Site 27 to the schedule.	05-26-2009
05.09.3.1.2	Lila	Check on the requirements for EE/CA, action memo, and removal action report.	05-29-2009
05.09.3.1.3	Charles	Provide extension request letters to USEPA and DHEC and copy Team members for informational purposes.	05-26-2009
05.09.3.1.4	Mark/Charles	Provide revised schedule to Tier II before their June meeting	06-01-2009
05.09.3.2.1	Team	Email MBTI and DiSC scores, contact information, any Roles and Responsibilities, Mission Statements, etc. to Pat.Franklin@mail.com	05-26-2009
05.09.3.2.2	Pat	Send Team charter to Team members.	05-22-2009
05.09.3.3.1	Meredith	Provide the Team with examples of previous LUC language for UXO sites.	05-29-2009
05.09.3.3.2	Annie	Talk with Joe regarding the need for groundwater samples in the grassy area at the Parade Deck.	05-29-2009
05.09.3.3.3	Mark	Arrange a conference call with Team members to finish UXO UFP/SAP discussion.	TBD
05.09.3.4	Tier II	Report back to Team about status of adding MRP sites to the FFA.	By next meeting

Action Items Developed May 4, 2009 (Conference Call)

Item	Responsible	Action Item	Due Date
05.09.1cc	Charles	Charles to check with Steve Beverly regarding the NAVFAC acceptance of a Hazard Index greater than 1. **Done – checked with David Barclift – no policy**	Done
05.09.2cc	Mark	Mark to provide Meredith with the model from NOAA. **Done**	Done
05.09.3cc	Amy and Dave	Amy and Dave to review assumptions to minimize uncertainty. **Ongoing**	Before next meeting

05.09.4cc	Meredith	Meredith to check with the state ichthyologist regarding their opinion on using red drum fish in the fish tissue sampling. **OBE**	OBE
05.09.5cc	Meredith	Meredith to check on state protocol for fish tissue sampling and send to Lila. **Done**	Done
05.09.6cc	Mark	Mark to have information together including a chart of fish (foraging range, home range of the species), species information, etc. by the next meeting. **Done**	Done
05.09.7cc	John	John to send Mark Sladic the .pdf files (life history information) on red drum, flounder, mullet, etc. so Mark can send to all Team members. **Done**	Done
05.09.8cc	Team	Team members to prepare a list of information they feel should be included on the fish table (i.e., food items, maximum reasonable age, etc.) and send to Mark. **Done**	Done
05.09.9cc	Mark	Mark to prepare a draft agenda to for the next meeting and send to Team members for review. **Done**	Done

Action Items Developed March 2009

Item	Responsible	Action Item	Due Date
03.09.1.1.1	Team	Provide comments to Mark on the Path Forward for Site 27. **Ongoing – agenda item**	By 04-01-2009
03.09.1.1.2	Charles	Will provide information confirming that LNAPL at Site 27 is not a listed waste to Team members. **Ongoing - Mark needs to send information to Team members.**	By 03-24-2009
03.09.1.3.1	Charles	Send alternatives (realistic schedule) to Tier II for their consideration regarding the Site 3 FY09 ROD timeline. **Ongoing – Cannot make FY09 timeline for Site 3 ROD**	By 03-24-2009
03.09.1.3.2	Charles	Send extension requests to USEPA and SCDHEC for new milestones. **Ongoing**	By 06-01-2009
03.09.2.2.1	Charles	Clarify if closed MRP sites are to be added to the FFA. **Ongoing – Steve Beverly said no. Texas does add closed sites to FFA. Charles to check with Navy Tier II for direction.**	By 04-02-2009
03.09.2.2.2	Mark	Propose sediment PALs for at Parris Island for the UFP SAP. **Ongoing**	By 04-02-2009
03.09.2.2.3	Mark	Review the background data set for Site 3 and propose if it is appropriate for use at the UXO sites (for sediment and soils). **Ongoing – need more information**	By 04-02-2009
03.09.2.2.4	Heber	Investigate whether or not permission is required to leave cut vegetation in the marsh. **Ongoing**	By 04-02-2009
03.09.2.2.5	Tim	Investigate any flying restrictions associated with the aerial magnetometer survey for UXO 06. **Ongoing – Charles to get with Tt and Navy to see if aerial mag survey is necessary. Mark to schedule a conference call.**	By 04-02-2009
03.09.2.2.6	Mark	Update UFP SAP with the verbal comments noted carrying the concepts throughout the document to the remaining, similar worksheets. **Ongoing**	By 05-19-2009
03.09.3.1	Mark	Set up a conference call (with a scribe) to discuss Site 3 with Team members and Ron Kinlaw, MCRD Conservation Law Enforcement Officer, and to scope the fish tissue Sampling and Analysis Plan. **Done**	Done
03.09.3.2	Mark	Mark to send Kelly Tetra Tech's completed well list for Parris Island. **Ongoing**	By 05-19-2009

Action Items Developed January 2009

Item	Responsible	Action Item	Due Date
01.09.1.1	Charles	Arrange a conference call with Team members to discuss conceptual site model for vapor intrusion Site 45. **Ongoing – waiting for TtNUS PhD to be available for call.**	By 06-01-2009
01.09.1.8	Tier II (Stacey)	Take the lead in facilitating determination of how and if sites can be added to the FFA and reporting back to Tier I. **Done – add MMRP sites to FFA and track other sites elsewhere.**	Done
01.09.2.4.1	Charles	Attain the proposal from the RAC contractor and share with Team members. **Ongoing – Proposal attained, but not shared with Team. Have not decided on technology for Site 45. Need to have EE/CA for Site 27.**	By 01-14-2009
01.09.2.4.3	Mark	Arrange a conference call with Team members to discuss comments on the Proposed Path Forward for Site 27. **Ongoing – waiting for comments**	By 01-31-2009

Action Items Developed October 2008

Item	Responsible	Action Item	Due Date
11.08.1.1.2	Mark	Revise April 2008 meeting minutes for approval by the Team. Team members please resend any comments to Mark. **Ongoing – waiting on comments from EPA.**	By 01-31-2009
11.08.1.1.5	Mark	Send Kelly the list of missing sites for the Base Sites map. **Done.** Mark to contact Joe Hamilton to get information on missing sites. **Ongoing**	By 01-31-2009
11.08.1.4	Meredith / Charles	Look into the WWTP demolition and SWMU 42 to see if regulatory oversight and/or closure are needed. **Ongoing**	Ongoing – internal meeting to be held
11.08.2.2.3	Charles	Prepare a draft extension letter for the Site 27 RI D1. **Ongoing – dependent on path forward.**	Agenda Item
11.08.2.2.4	Tim	Develop a list of OWS for the state. **Ongoing**	By 01-16-2009
11.08.2.3.2	Mark	Arrange a conference call with Team members after the development of the UFP SAP for Site 14. **Ongoing**	Ongoing

Previous Action Items

Item	Responsible	Action Item	Due Date
0605-013	Mark	Provide RTC for SCHDEC remaining SI/CS comments. **Ongoing** – need to include most recent data and submit report. Mark needs EMAC report from Charles or Meredith.	Ongoing
A0801-03	Heber	Provide an engineering analysis to support demolition materials disposal (temp lodging 200). **Ongoing**	By 03-01-2009

Consensus Items
MCRD Parris Island Partnering Meeting
May 18-20, 2009

The Team reached consensus that the reference concentration be 2 times the mean concentration of the reference location or background concentration.

The Team reached consensus to use the maximum concentration for the comparison to screening values and reference concentrations and the average concentration for the EPC in risk calculations.

The Team reached consensus that if relatively high concentrations are found, the approach would be to make a risk management decision using the uncertainties associated with the fish tissue sampling. The Team would need to notify the appropriate stakeholders of elevated fish tissue concentrations.

The Team reached consensus on the following actions for UXO 3 (Parade Deck):

1. **Look for records. Use construction records to justify that geophysics are not needed in the paved area.**
2. **Conduct geophysics in the grassy area. If anomalies are not found in the grassy area, investigate for MC. If anomalies are found in the grassy area, investigate the anomalies for the presence of MEC and proceed with MC investigation.**

The Team reached consensus that the LUC for the paved area (Parade Deck) will include keeping the pavement in place to serve as a barrier to the receptor of a potential risk. If work is conducted that disrupts the LUC, workers must be notified the site was a former bombing range through the dig permit process. Notification of use of the location (UXO 3) as a former UXO range will be included in the base master plan.

Parking Lot Items
MCRD Parris Island Partnering Meeting
May 18-20, 2009

Parking Lot Items from May 2009

Site 3 discussion
Quantitation limits based on laboratory bid
Bureau of Water involvement

Parking Lot Items from March 2009

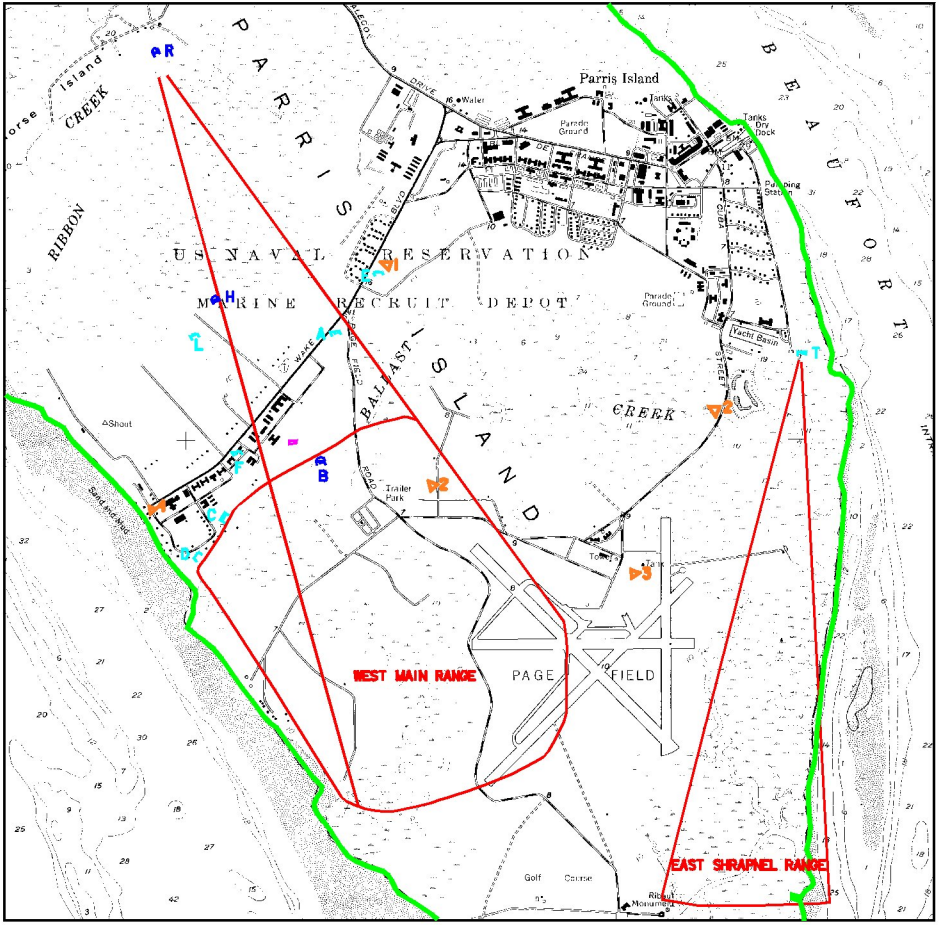
Agenda time frames – last day, scheduled flights
It was suggested to break on the last day before lunch (1:00).

Parking Lot Items from January 2009

Ground rules exercise – Pat
Tier I expectations of Tier II – Feedback for Tier II
Meeting Evaluation
Exit Strategy

B4

TECHNICAL SITE INFORMATION



LEGEND

- PROJECT BOUNDARY
- RANGES
- OBSERVATION POINT
- NON-PERMANENT FIRING POSITION
- CONCRETE FIRING POSITION
- CONCRETE OBSERVATION POST

0 2000 4000

APPROXIMATE SCALE IN FEET

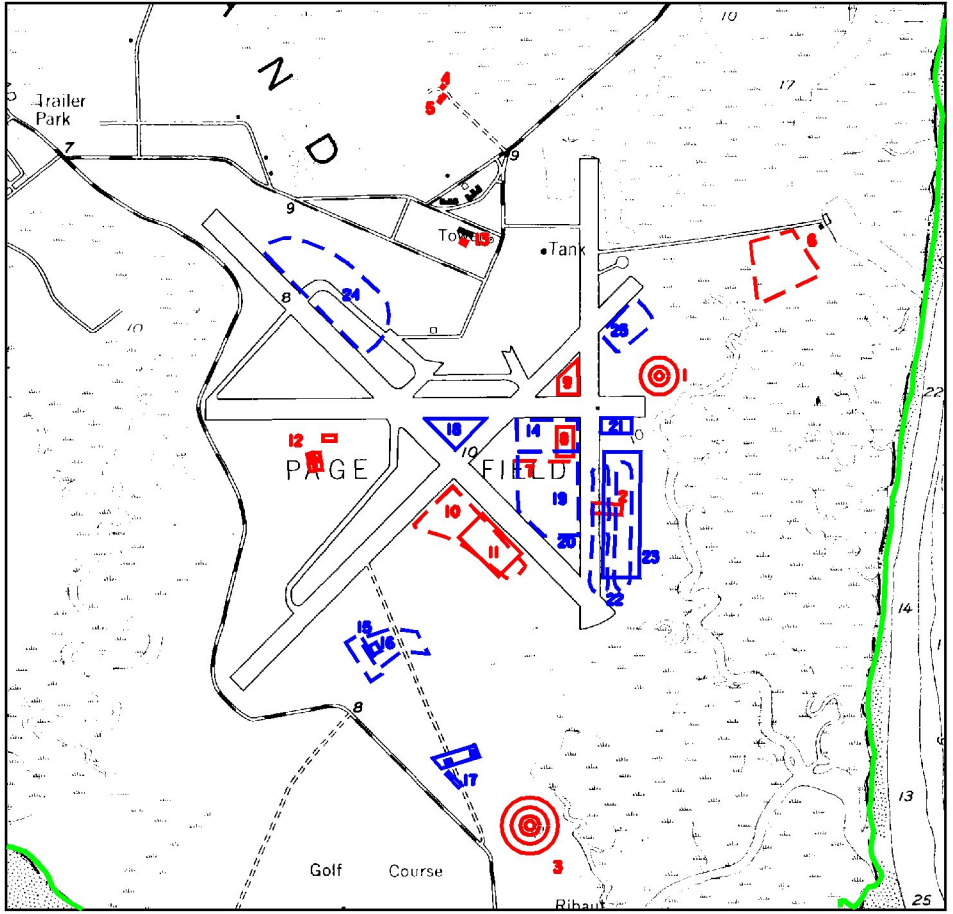
N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY

RANGES 1937 FIELD ARTILLERY

PROJ. DATED APRIL, 1999	DATE OF PHOTO: 1937	PLATE NO. 2
07-JAN-1999 08:7	mikeo/dev/25ft/coord/parris/map13/r15/y.dgn	



KEY TO FEATURES:

FEATURE NUMBER	FEATURE DESCRIPTION
1	AERIAL BOMBING TARGET AT PAGE FIELD 1937)
2	STRAFING RANGE AT PAGE FIELD (1937-1940) (EST. LOCATION)
3	AERIAL BOMBING TARGET AT GOLF COURSE (1946)
4	SKEET RANGE, BUILDING A548 AT PAGE FIELD (1946-53)
5	TRAP RANGE, BUILDING A547 AT PAGE FIELD (1946-53)
6	GUADALCANAL HAND GRENADE RANGE (1987-92)
7	MINE/BOOBY TRAP (1994)
8	BLDG. 4119, PRACTICE GRENADE AND MINE FIELD (1983)
9	PRACTICE GRENADE RANGE (1987)
10	CAC (COMBAT ASSAULT COURSE) (1994)
11	INFILTRATION COURSE (1987)
12	COMBAT TOWN (1994)
13	GAS CHAMBER, T95 (1988)
14	NBC MOVEMENT COURSE (1987)
15	FIELD FORTIFICATION COURSE II (1994)
16	INFILTRATION COURSE, SOUTH OF PAGE FIELD (1983) BUILDING 4024
17	NIGHT MOVEMENT COURSE SOUTH OF PAGE FIELD (1983) BUILDING 4022
18	WIRE ENTANGLEMENT DISPLAY (1987)
19	DAY MOVEMENT STATIONS (1994)
20	SQUAD OFFENSE COURSE (1987)
21	NIGHT MOVEMENT COURSE (1987)
22	DAY MOVEMENT 1 AND DAY MOVEMENT 2 (1994)
23	FIRE TEAM/NBC MOVEMENT COURSE (1987)
24	NBC FIELD COURSE (1994)
25	BOOBY TRAP COURSE (1994)

LEGEND

- PROJECT BOUNDARY
- RANGES
- MISC. TRAINING STATIONS AND COURSES

0 1000 2000

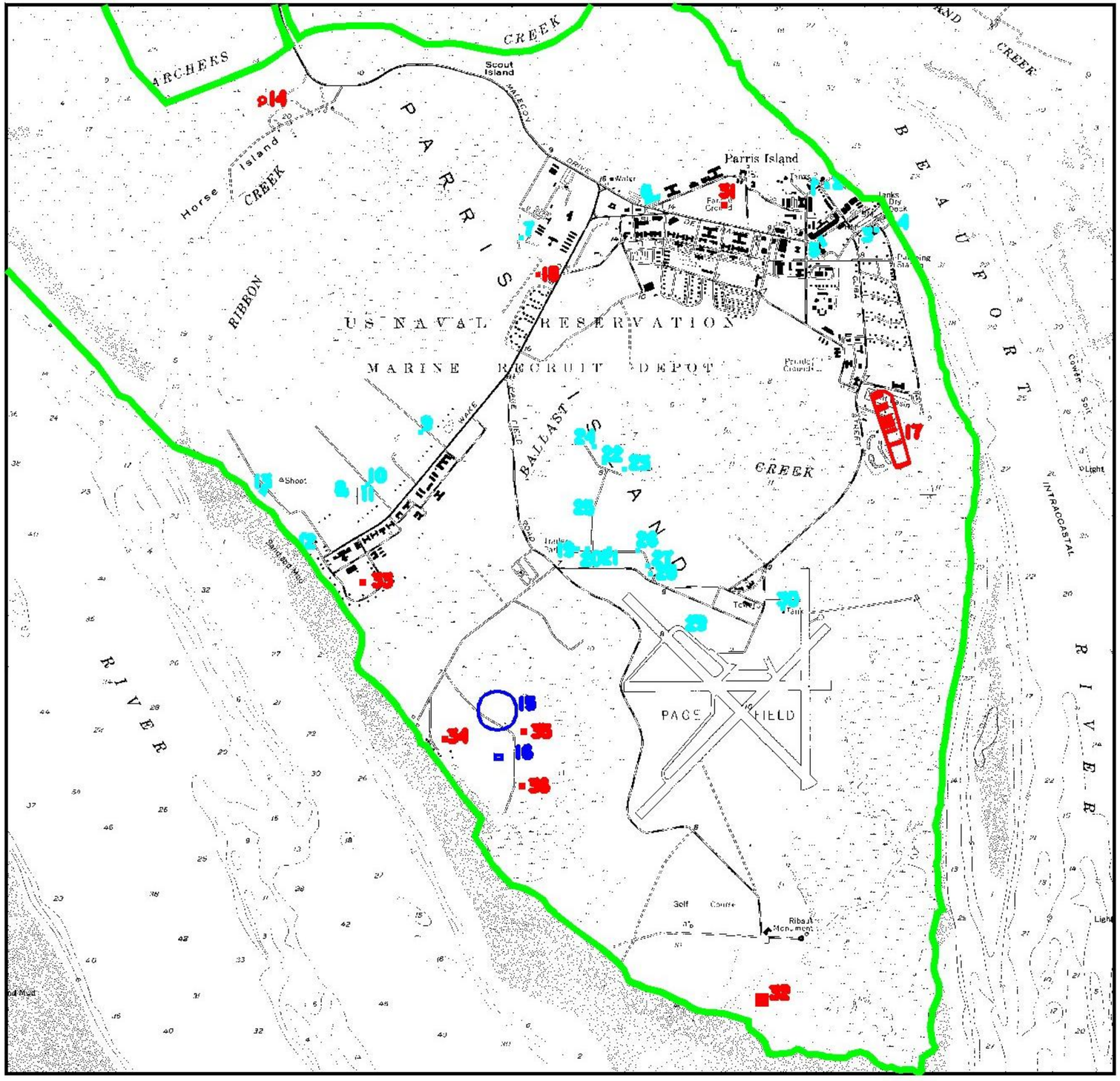
APPROXIMATE SCALE IN FEET

N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY
RANGES
PAGE FIELD TRAINING AREA

PROJ. DATED APRIL, 1999	DATE OF MAP: 1943	PLATE NO. 4
07-JUN-1999 09:02	[illegible]	



KEY TO FEATURES

FEATURE NUMBER	FEATURE DESCRIPTION
1	BLDG. 42, UNKNOWN USE, PARIT LOCKER [illegible], BLDG. 17 UNKNOWN [illegible]
2	FORT MARION
3	FORT MACKAY
	TEMPORARY UNKNOWN USE [illegible] – not specifically located
4	BLDG. 2, AMMUNITION [illegible] – probable location – not specifically located
5	BLDG. 65 AMMUNITION SMALL STORAGE [illegible]
6	[illegible]
7	BLDG. [illegible] WAX STORAGE BLDG. [illegible]
8	BLDG. 30 AMMUNITION STORAGE [illegible]
9	BLDG. 724, HEAVY AMMUNITION STORAGE [illegible]
10	BLDG. 726, HEAVY AMMUNITION STORAGE [illegible]
11	BLDG. 724, HEAVY AMMUNITION STORAGE [illegible]
12	BLDG. 724, HEAVY AMMUNITION STORAGE [illegible]
13	BLDG. 726, AMMUNITION STORAGE [illegible]
14	RECREATIONAL FIRING RANGE AT RIFLE [illegible]
15	TACTICAL BIVOUAC AREA
16	BLDG. [illegible], FIELD FORTIFICATION DISPLAY
17	RIFLE RANGE AT BALLAST CREEK [illegible]
18	BLDG. [illegible] CHAMBER
19	BLDG. 41, SMALL ARMS UNKNOWN USE [illegible]
20	BLDG. 42, SMALL ARMS UNKNOWN USE [illegible]
21	BLDG. 43, SMALL ARMS UNKNOWN USE [illegible]
22	BLDG. 44, HIGH EXPLOSIVES UNKNOWN USE [illegible]
23	BLDG. 45, HIGH EXPLOSIVES UNKNOWN USE [illegible]
24	BLDG. 46, HIGH EXPLOSIVES UNKNOWN USE [illegible]
25	BLDG. 47, FREE UNKNOWN USE [illegible]
26	BLDG. 48, BLACK POWDER UNKNOWN USE [illegible]
27	BLDG. 49, SHOT UNKNOWN USE [illegible]
28	BLDG. 50, HEAVY UNKNOWN USE [illegible]
29	BLDG. 51, HEAVY UNKNOWN USE [illegible]
30	BLDG. [illegible] [illegible]
31	AERIAL BOMB TARGET AT PARRIS ISLAND [illegible] – approximate boundaries interviews
32	AERIAL BOMB TARGET AT [illegible] TOILE PLATE [illegible] [illegible] as located by [illegible]
33	POSSIBLE [illegible] [illegible]
	[illegible] FOR MARINE BATTALION TRAINING AREA
34	GAS CHAMBER AT ELLIOTT'S BEACH
35	POSSIBLE FIRE RANGE AT ELLIOTT'S BEACH
36	POSSIBLE HAND GRENADE RANGE AT ELLIOTT'S BEACH

LEGEND

- PROJECT BOUNDARY
- RANGES
- ORDNANCE STORAGE AND HISTORICAL FORTIFICATIONS
- MISCELLANEOUS TRAINING STATIONS, ORDNANCE AND UNKNOWN AREAS

0 2500 5000

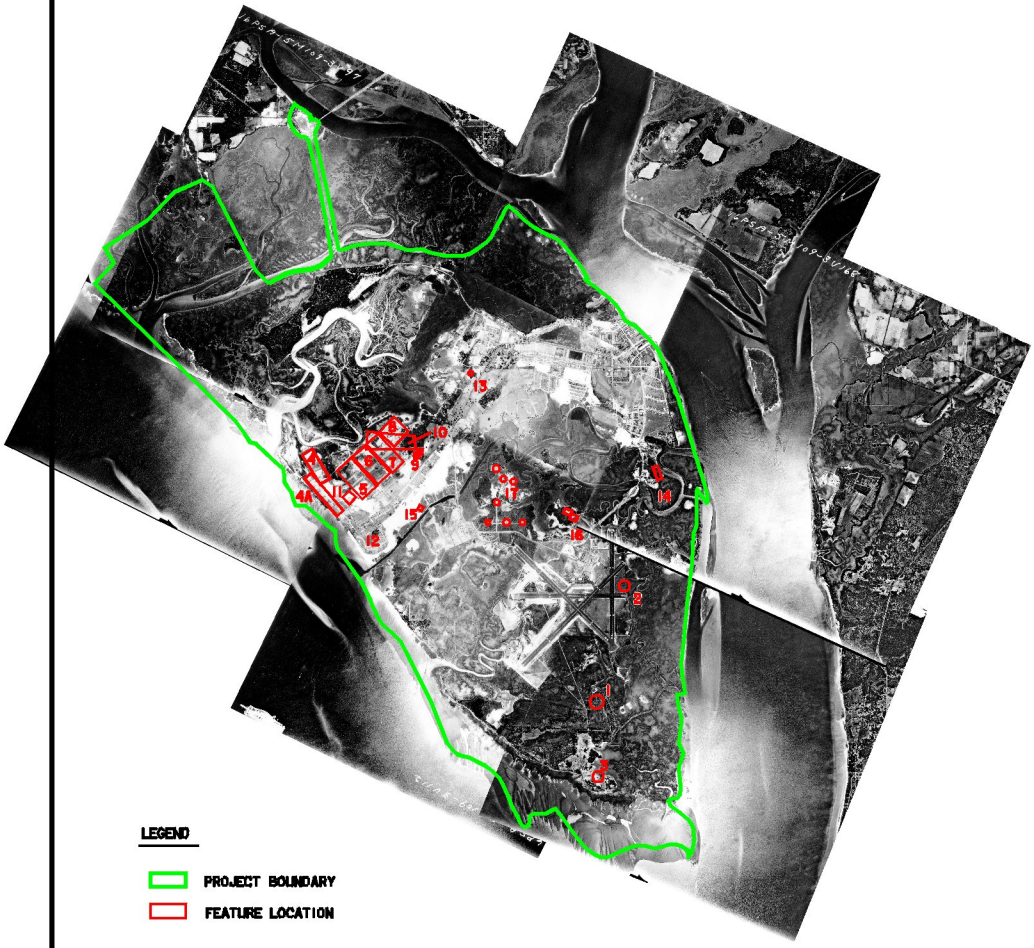
APPROXIMATE SCALE IN FEET

N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY
RANGES MISCELLANEOUS AREAS, ORDNANCE STORAGE & HISTORIC FORTIFICATION

PROJ. DATE: APRIL 1999	DATE OF MAP: 1978	PLATE NO. 5
07-JUN-1999 [illegible]	[illegible]	



KEY TO FEATURES:

FEATURE NUMBER	FEATURE DESCRIPTION
1.	AERIAL BOMBING TARGET, AT GOLF COURSE
2.	AERIAL BOMBING TARGET AT PAGE FIELD
3.	AERIAL BOMBING TARGET AT SOUTHERN TITLE FLATS
4.	RANGE A
4A.	SMALL BORE RANGES 1-8
5.	RANGE B
6.	RANGE C
7.	RANGE D
8.	350 YARD WIDE TARGET BERM AND FIRING LINES AT APPROXIMATELY 100, 200, AND 300 YARDS VISIBLE ON THE HAND GRENADE PRACTICE AREA WHICH BECOMES RANGE E
9.	TWO CIRCULAR FEATURES APPROXIMATELY 150 FEET IN DIAMETER, WHICH RESEMBLES SNAP IN OR DRY FIRE RANGES
10	POSSIBLE EARLIER RANGE WITH A WESTERN DIRECTION OF FIRE, WHICH CUTS ACROSS BOTH RANGES E AND D; 300 YARDS WIDE AND POSSIBLY 600 YARDS LONG
11.	GROUND SCARRING EVIDENT AT THE LOCATION OF THE 1942 RIFLE GRENADE CIRCLES
12.	NO EVIDENCE ON THE REPORTED GRENADE COURT SOUTH OF THE SWIMMING POOL
13.	TREES OBSCURE GAS CHAMBER, BUILDING 673
14.	BUILDING DEVELOPMENT ON NORTHERN PORTION OF THE RIFLE RANGE AT BALLAST CREEK
15.	FIELD ARTILLERY CONCRETE OBSERVATION POST
16.	TRAP AND SKEET RANGES AT PAGE FIELD
17.	ORDNANCE STORAGE STRUCTURES

0 4000 8000

APPROXIMATE SCALE IN FEET

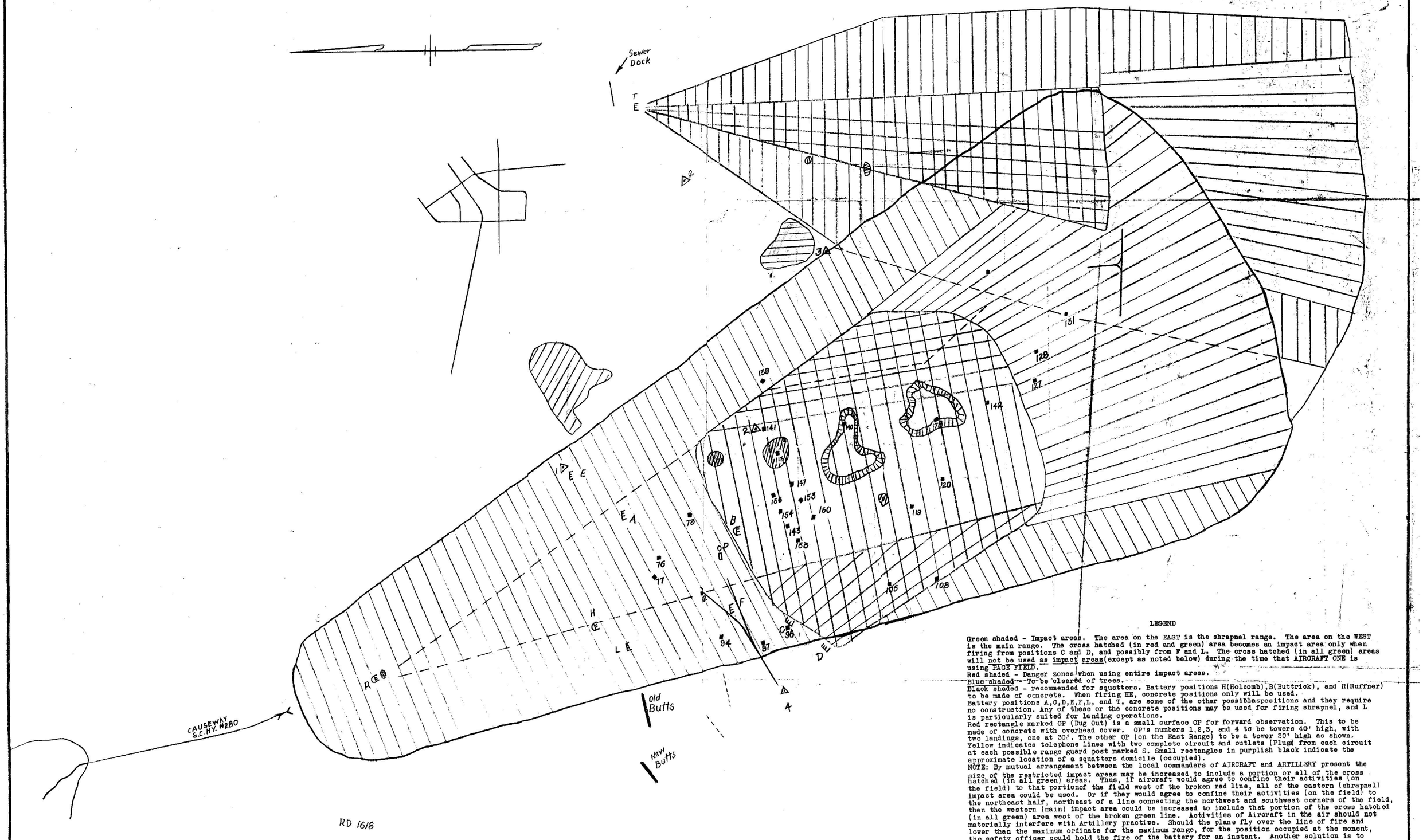
N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY

1945 AERIAL PHOTOGRAPHY

PROJ. DATE: APRIL, 1999	DATE OF PHOTO: 1945	PLATE NO. 7
07-JAN-1999 10:46	/usacoe/cecw95/eco/dr/par/ts/phot/45parris.dgn	



LEGEND

Green shaded - Impact areas. The area on the EAST is the shrapnel range. The area on the WEST is the main range. The cross hatched (in red and green) area becomes an impact area only when firing from positions C and D, and possibly from F and L. The cross hatched (in all green) areas will not be used as impact areas(except as noted below) during the time that AIRCRAFT ONE is using PAGE FIELD.
Red shaded - Danger zones when using entire impact areas.
Blue shaded - To be cleared of trees.
Black shaded - recommended for squatters. Battery positions H(Holcomb),B(Buttrick), and R(Ruffner) to be made of concrete. When firing HE, concrete positions only will be used.
Battery positions A,C,D,E,F,L, and T, are some of the other possible spositions and they require no construction. Any of these or the concrete positions may be used for firing shrapnel, and L is particularly suited for landing operations.
Red rectangle marked OP (Dug Out) is a small surface OP for forward observation. This to be made of concrete with overhead cover. OP's numbers 1,2,3, and 4 to be towers 40' high, with two landings, one at 30'. The other OP (on the East Range) to be a tower 20' high as shown.
Yellow indicates telephone lines with two complete circuit and outlets (Plugs from each circuit at each possible range guard post marked S. Small rectangles in purplish black indicate the approximate location of a squatters domicile (occupied).
NOTE: By mutual arrangement between the local commanders of AIRCRAFT and ARTILLERY present the size of the restricted impact areas may be increased to include a portion or all of the cross hatched (in all green) areas. Thus, if aircraft would agree to confine their activities (on the field) to that portionof the field west of the broken red line, all of the eastern (shrapnel) impact area could be used. Or if they would agree to confine their activities (on the field) to the northeast half, northeast of a line connecting the northwest and southwest corners of the field, then the western (main) impact area could be increased to include that portion of the cross hatched (in all green) area west of the broken green line. Activities of Aircraft in the air should not materially interfere with Artillery practice. Should the plane fly over the line of fire and lower than the maximum ordinate for the maximum range, for the position occupied at the moment, the safety officer could hold the fire of the battery for an instant. Another solution is to use field 5 miles to northeast. Particularly when the only mission of the aircraft present is to observe for Artillery.

TRACED FROM:
OVERLAY FOR
KEY MAP (BLUEPRINT)
OF PARRIS ISLAND S.C.
SCALE: 1/12,000, DATED 30 JUNE, 1936
SHOWING PROPOSED ARTILLERY RANGES

TRACED BY BELL
CHECKED BY FARMER

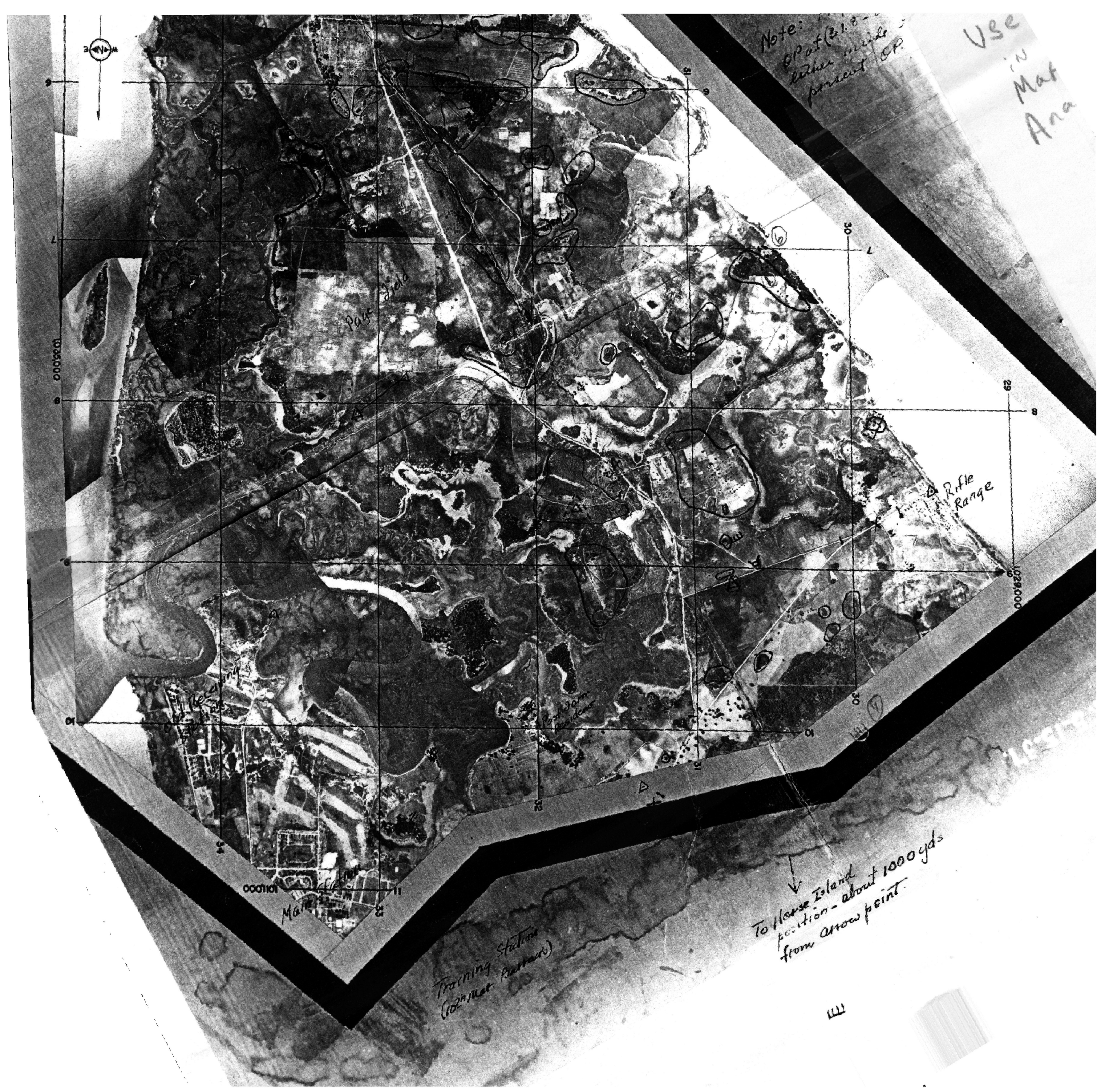
U S MARINE BARRACKS
PARRIS ISLAND S.C.

FIELD ARTILLERY RANGE

APPROVED: 1 DEC. 1937

H. MacT. Sylvester
LIEUT CDR USN.
PUBLIC WORKS OFFICER

SCALE 1 IN = 1000 FT.


Use in Mat Ana
Note: OP at (31.8 - 3 below middle present OP
Page field
Rifle Range
Training Station (102nd Mat Battalion)
To Horse Island position - about 1000 yds from arrow point
Mat
1029000
1028000

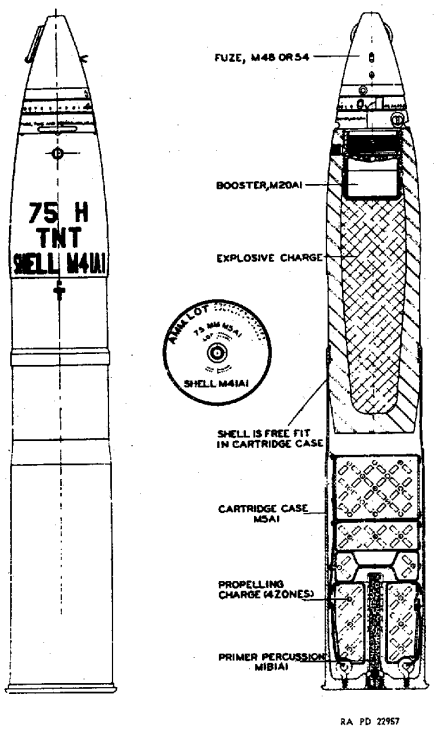
APPENDIX A

ORDNANCE TECHNICAL DATA SHEETS

ORDNANCE TECHNICAL DATA SHEETS

Ordnance Technical Data Sheet ..... Page
SHELL, 75MM, HIGH EXPLOSIVE, M41A1 ..... A-2
PROJECTILE, 75MM, SHRAPNEL, MKI A-3
MORTAR, 60-MM, HE, M49A2 ..... A-4
MORTAR, 60-MM, ILLUMINATING, M83A3, M83A2, & M83A1 ..... A-5
MORTAR, 81-MM, HE & PRACTICE, M43A1 ..... A-6
TRENCH MORTAR, HE, 3-INCH, MK I, MK II, and PRACTICE MK III A-7
BOMB, PRACTICE, 100-LBS, Mk 15 Mod 3 ..... A-8
MINIATURE PRACTICE BOMBS AN-Mk 5 Mod 1, AN-Mk 23, AN-Mk 43 ..... A-9
GRENADE, FRAGMENTATION Mk II, Mk IIA1 ..... A-10
GRENADE, FRAGMENTATION, DELAY, M67 ..... A-11
GRENADE, HAND, PRACTICE, M21 ..... A-12
GRENADE, HAND, PRACTICE, DELAY, M30 ..... A-13
GRENADE, HAND, PRACTICE, DELAY, M69 ..... A-14
GRENADE, SMOKE, M18, with FUZE, M201, M201A1 ..... A-15
GRENADE, HAND, TEAR, CN M7 and M7A1 ..... A-16
CARTRIDGE, 40-MM, PRACTICE, M781 ..... A-17
CARTRIDGE, 40-MM, PARACHUTE,
WHITE STAR, M583A1; GREEN STAR, M661; RED STAR, M662 ..... A-18
V.B. RIFLE GRENADE, MARK I A-19
GRENADE, RIFLE PRACTICE, M11A2 ..... A-20
RIFLE GRENADE, SMOKE, M22 ..... A-21
MINE, ANTIPERSONNEL, PRACTICE, M8 ..... A-22
MINE, ANTIPERSONNEL, M18A1 ..... A-23
MINE, ANTI-TANK, PRACTICE, M12 SERIES A-24
ROCKET, 2.25 INCH PRACTICE A-25
ROCKET, 2.36-INCH ANTITANK, M6A1 PRACTICE, M7 ..... A-26
ROCKET, PRACTICE, 3.5-INCH, M29 ..... A-27
ROCKET, HE 4.5 INCH, M8 ..... A-28
SMALL-ARMS AMMUNITION A-29-45
SMALL ARMS, GENERAL A-46
SHELL, SHOTGUN, 12 GAGE A-47
SIGNALS, ILLUMINATION, GROUND, STAR CLUSTERS,
GREEN, M125A1; RED, M158; WHITE, M159 ..... A-48
SIMULATOR, HAND GRENADE, M116A1 ..... A-49
SIMULATOR, PROJECTILE, GROUND BURST, M115A2 ..... A-50
SIMULATOR, BOOBYTRAP, FLASH, M117;
ILLUMINATING, M118; WHISTLING, M119 ..... A-51
SURFACE TRIP FLARE, M49A1 ..... A-52
TNT, (TRINITROTOLUENE) A-53
CHEMICAL AGENT IDENTIFICATION SET (CAIS)
SET GAS IDENTIFICATION, DETONATION M1 ..... A-54
CAPSULE, RIOT CONTROL AGENT: CS A-55
CORD, DETONATING AND FUSE, BLASTING: TIME M700 ..... A-56
CAP, BLASTING: ELECTRIC, M6 AND NONELECTRIC, M7 ..... A-57
CHARGE DEMOLITION: BLOCK M112 AND BLOCK M5A1 (COMPOSITION 4) A-58
IGNITOR, TIMER BLASTING FUSE: M60, WEATHERPROOF A-59

SHELL, 75MM, HIGH EXPLOSIVE, M41A1



Shell, Semifixed, H.E., M41A1

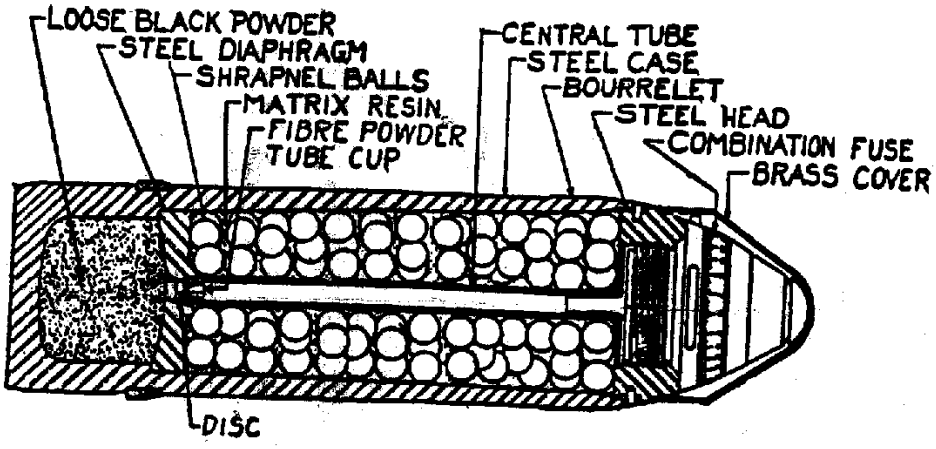
General. This round is a substitute for the M48 H.E. Shell in the 75-mm howitzer. This projectile is made by cutting off the nose of the Mk. IV, H.E. Shell and rethreading it to take the M48, M48A1, M54 fuzes, and the M20 Booster.

Description. This projectile has an 11-caliber radius of ogive and a boat-tail base with a 9-degree taper. The rotating band is of copper and a steel base plate is soldered to the base. It is a low-capacity shell, having a bursting charge in the howitzer of 1.11 pounds of TNT. There are only two weight zones in this projectile. The markings of the projectile will be in yellow on an olive-drab base coat, and will include the designation of weapon (75 H), filler (TNT), complete round (Shell M41A1), and weight zone (+).

Filler ..... TNT
Filler weight ..... 1.11 pounds
Cartridge Case M5A1, M5A1B1
Propellant ..... FNH powder
Primer M1B1A2
Fuze M48, M48A1,M54
Painting and markings ..... Olive drab w/ yellow markings

Reference: TM 9-1904, *Ammunition Inspection Guide*, March 1944

PROJECTILE, 75MM, SHRAPNEL, MKI



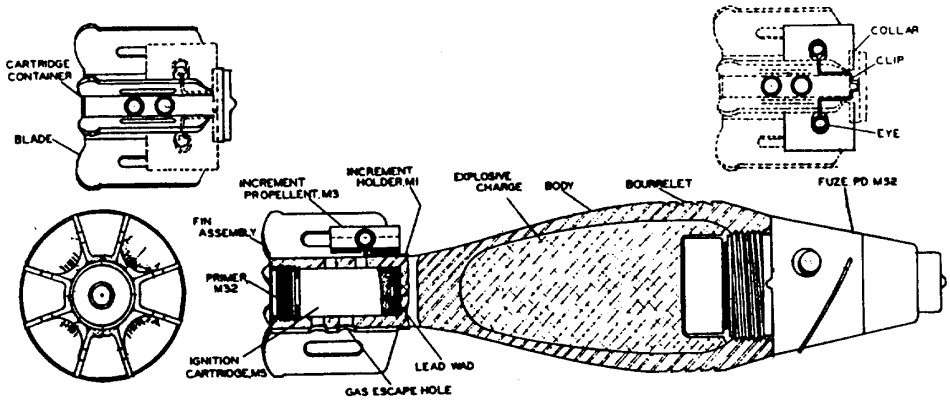
Description. This projectile consists of a steel case, near the base of which a shoulder is formed on the interior surface. A base charge of 3 ounces of black powder is packed in the base of the projectile beneath a diaphragm of steel which rests on the shoulder. This diaphragm also supports a flash tube, the upper end of which is flared out into a smaller thin diaphragm. Between the two diaphragms is held a charge of melted resin which holds 270 lead balls suspended within it. These balls average 42 to the pound, the 270 totaling 6 pounds, 7 ounces. Above the lower diaphragm, the interior of the shrapnel case is gradually enlarged in diameter so that it tapers outward from the base to head. The top of the case is closed by a steel head which fastens to the case with a fine thread, and which is adapted to the fuze with a coarse thread. The shrapnel is issued fuzed with the 21-second Combination Fuze M1907M, which is set at safe, and covered with a metallic moisture proof cap.

Function. The flame from the magazine charge of the fuze flashes down the central tube and ignites the black powder base charge. Explosion of this charge forces the lower diaphragm matrix and balls, and flash tube upward, blowing off the fuze and the head as a unit, the rupture occurring at the fine threads between the head and the case. It is painted red and stenciled in black with the designations of weapon, and complete round.

Fuze M1907M
Cartridge Case M18
Propelling Charge A normal charge of 1.69 pounds of powder which imparts a muzzle velocity of about 1,755 feet per second.
Primer M1B1A1
Guns This round is issued for the 75-mm field gun only.

Reference: TM 9-1904, *Ammunition Inspection Guide*, March 1944

MORTAR, 60-MM, HE, M49A2



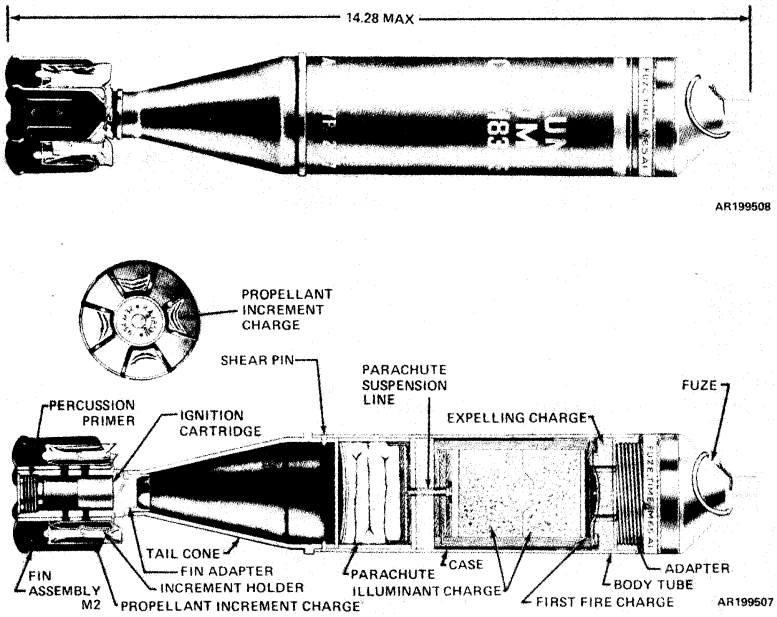
Description: The body of this shell may be constructed of forged steel, cupped-rolled, plate-welded longitudinally, or a machined casting. It is tear-dropped in shape, having a blunt nose and tapered tail. Near the nose end of the shell is a machined bourrelet which acts as a forward bearing surface and as a gas check. The nose is threaded to receive the fuze directly. The fuze used is the Point-detonating Fuze M525A2 which has a superquick action. The tail end is closed and internally threaded to receive the stabilizer assembly. The shell filler is 0.34 pounds of flake TNT. The ignition cartridge M5A1, contains 40 grains of double base powder. The propellent increments, M3, consists of square strips of double base powder sewn together. Each increment has 35 grains of finely granulated double base powder. The shell body is painted olive drab and stencilled in yellow.

Shell, Practice, M50A2 is identical to the service round. It differs in that the filler consists of 0.05 pounds of black powder to act as a spotting charge, and 0.29 pounds of inert filler. The body is painted blue with white stencilling.

Over-all Length..... 9.5 inch
Diameter (body) ..... 2.34 inch
Total Weight..... 2.94 pound
Filler..... TNT (flaked)
Filler weight..... 0.34 pounds
Propellent ..... ballistite
Fuze..... M52 PD
M525A1 PD
Painting and markings ..... Olive drab w/ yellow markings

Reference TM 9-1904, Ammunition Inspection Guide, March 1944
TM 9-1300-205, Ammunition for Mortars, September 1960

MORTAR, 60-MM, ILLUMINATING, M83A3, M83A2, & M83A1



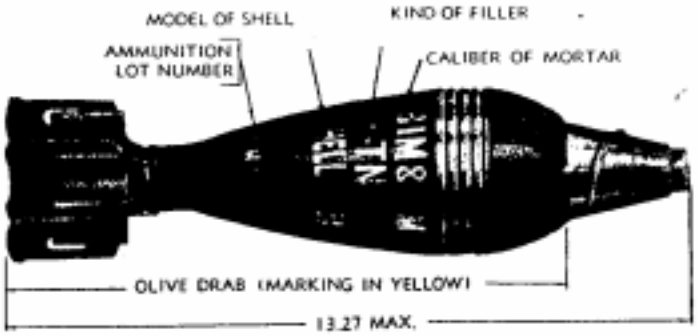
Use: This cartridge provides illumination for observation during night missions.

Description: The complete round consists of a body tube, a tail cone assembly, an illuminant charge, a parachute assembly, a time fuze, a fin assembly with four increments of propellant charge, an ignition cartridge, and a percussion primer. The nose of the thin-walled steel tubing body is fitted with a steel adapter and internally threaded to accept the fuze. The cone is fitted with an internally threaded adapter to accept the fin assembly, and is attached to the body tube with four equally spaced shear pins. The illuminant assembly, which consists of a first-fire charge and an illuminant charge, is contained in a boxboard casing which is attached to the parachute with a suspension line. An expelling charge directly below the fuze, ejects the illuminant and parachute assembly.

Length ..... 14.28 inches
Diameter (body) ..... 81 mm
Weight ..... 4.15 pounds
Filler ..... Illuminating
Filler weight ..... 0.49 pounds
Propellent
  M83A3 ..... M182
  M83A2 & M38A1 ..... M3A1
Fuze ..... Time, M65A1
Painting and markings ..... White with black markings
Fin assembly M2

Reference TM 43-0001-28, Army Ammunition Data Sheets, April 1977

MORTAR, 81-MM, HE & PRACTICE, M43A1



Shell, HE, M43A1*, Shell Body,* is constructed of forged steel. It is tear-dropped in shape; that is, blunt nose and tapered tail. It has a bourrelet machined near the nose of the shell consisting of several annular grooves which serves to act as a forward bearing surface and a gas check The nose is machined and threaded to receive an adapter. The adapter is threaded and acts as a bushing for a bakelite fuze well cup and the fuze. The fuze used is the Point-detonating Fuze M45 This fuze has a selective element and can be set for either superquick or delay action. The shell filler is 1.22 pounds of TNT. The total weight of the completely assembled round is 7.05 pounds. Entire length of the fuzed shell is 13 1/4 inches.

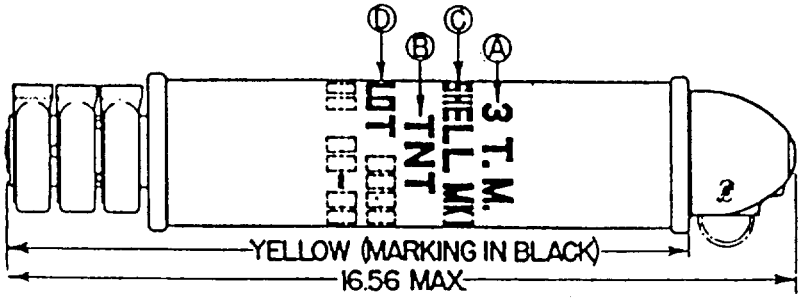
Fin assembly. The fin assembly consists of a machined cartridge container to which are attached six stationary fins. One end is threaded so as to be screwed on to the body of the shell. The other end is machined and hollow inside so as to receive the ignition cartridge. Several holes leading from the interior to the exterior periphery of the cartridge container serve to conduct the flames from the ignition cartridge to the propellent increments which are seated in the fins.

Shell, Practice, M43A1. The shell body, components used, and packing are identical to the shell previously described. It differs in that the filler consists of 0.16 pound of black powder to act as a spotting charge, and 1.06 pounds of inert filler such as wax, talcum, or rosin. The body is painted blue with white stencil to indicate a practice shell.

Over-all Length:..... 13.25 inch
Diameter (body): ..... 3.16 inch
Total Weight: ..... 7.05 pounds
Filler:
  HE..... TNT, 1.22 pound
  Practice..... Black powder, 0.16 pound
Propellent: ..... Ballistite
Fuze:..... M45, point-detonating
Painting and markings:
  HE..... Olive drab, yellow markings
  Practice..... Blue, white markings

Reference: TM 9-1904, Ammunition Inspection Guide, March 1944

TRENCH MORTAR, HE, 3-INCH, MK I, MK II, and PRACTICE MK III



A - CALIBER OF MORTAR
B - TYPE OF FILLER
C - MODEL OF SHELL
D - AMMUNITION LOT NUMBER

The 3-inch trench mortar, often called the Stokes mortar, uses the following projectile and components:

Shell, Mark I, is made up of a cylindrical steel casing, into which a forged steel base, and head, are screwed. To the base is attached a short steel tube, or cartridge container which has 16 holes drilled in it to permit the flash from the cartridge to ignite the powder rings. The head has a hole through the center which permits the insertion of the drawn steel booster casing and has a threaded recess for the fuze. This recess is plugged with a threaded fuze hole plug to protect the threads from dirt and damage during storage and shipping.

Shell, Mark II, differs from the Mark I only in the shell body construction, as the casing, head, and base are welded together. Both shells are loaded with a high explosive charge of either TNT or Nitostarch.

Practice Shell, Mark III, is made up of a cast-iron body with a threaded hole in the upper end for assembling a dummy fuze similar to the trench-mortar fuze, Mark VI. The complete round consists of one Shell, Mark III, a dummy fuze, and propellant charges as used with the high explosive round.

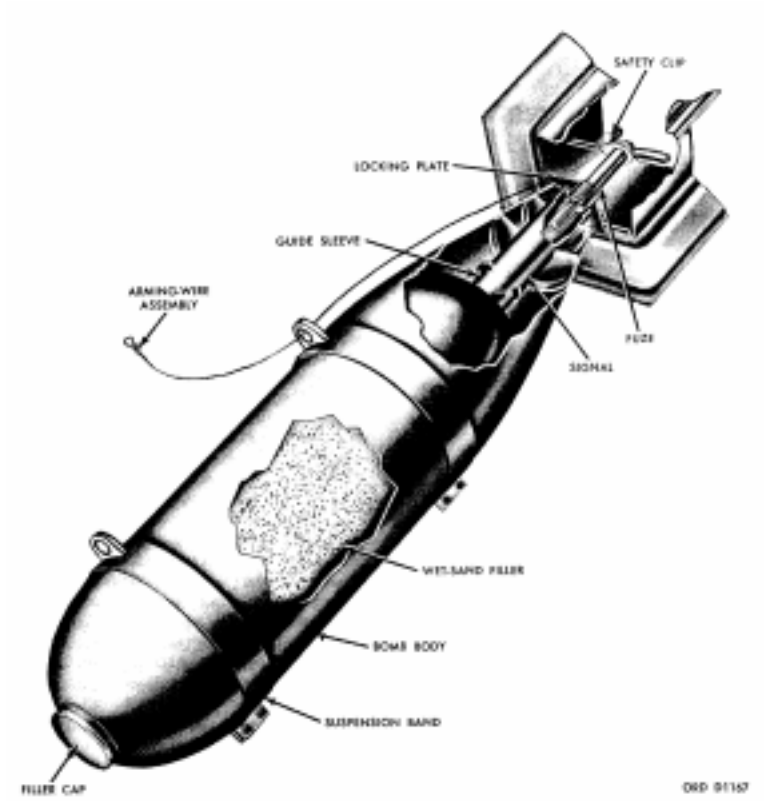
Fuze, Mark VI., is an "all-ways acting" fuze, designed to function upon impact, regardless of the manner in which the shell strikes the ground. The safety pin is withdrawn by means of a safety pin ring immediately before dropping the shell into the muzzle of the gun.

Mark I Booster is made up in cartridge form and is placed in the body casing in the shell, upon assembling the round immediately before firing. The booster consists of a paper cartridge which supports the detonator. The detonator is a commercial detonator or a No. 8 blasting cap.

Propellant Charge consists of one green paper brass-tipped cartridge, loaded with 120 grains of sporting ballistite powder, and from one to three ring-shaped silk bags, each containing 110 grains of M.R. 31 ballistite powder.

Reference: TM 9-1904, Ammunition Inspection Guide, March 1944
Hand Book of the 3-inch Stokes Trench Mortar, Jul 1921

BOMB, PRACTICE, 100-LBS, Mk 15 Mod 3

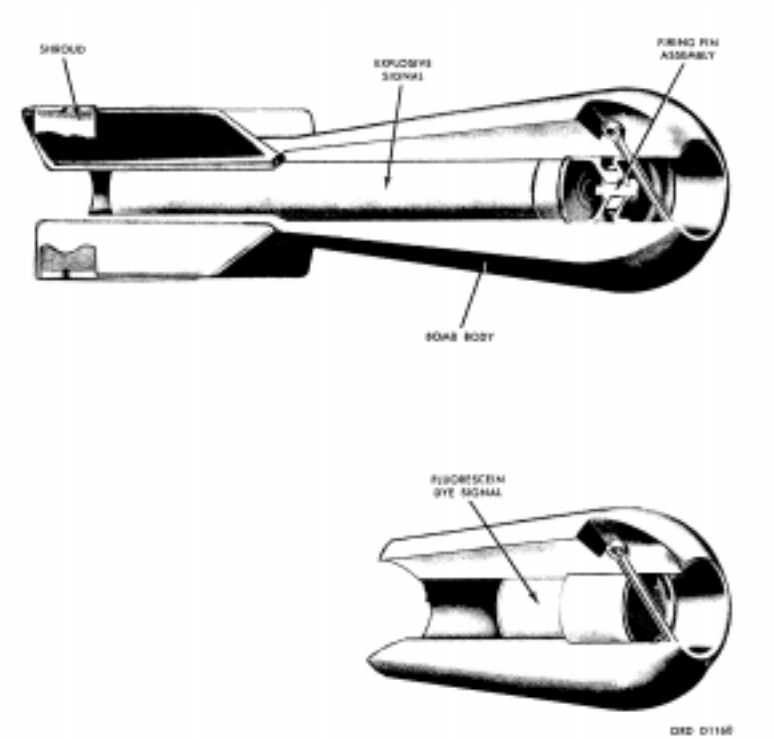


Description The Mk 15 Mod 3 Practice Bomb is a light-cased, cylindrical body with a threaded filling hole in its rounded nose. A box fin assembly consisting of four metal vanes attached to a cone is welded to the aft end of the body. The bomb has two metal suspension band assemblies (each consisting of a circular clamp, a suspension lug, and two cap screws) for tightening the band to the bomb. The bomb is used with the practice bomb signal, Mk7 Mod 0 and inert fuze Mk 247 Mod 0 both of which are secured to the aft of the bomb. Upon impact of the bomb with the target, the signal is detonated, producing a flash and a large puff of smoke. The bomb is filled with wet sand and when fully assembled weighs approximately 100 pounds

Length of assembled bomb ..... 41.2 inches
Diameter ..... 8.0 inches
Fin Span ..... 11.24 inches
Weight, assembled ..... 100 pounds
Filler ..... Sand, Wet sand, or water
Signal ..... Mk 7 Mod 0
Color ..... Black

Reference: TM 9-1325-200, Bombs and Bomb Components, April 1966
NAVSEA OP 1664 Vol 2, U.S. Explosive Ordnance, February 1954

MINIATURE PRACTICE BOMBS
AN-Mk 5 Mod 1, AN-Mk 23, AN-Mk 43

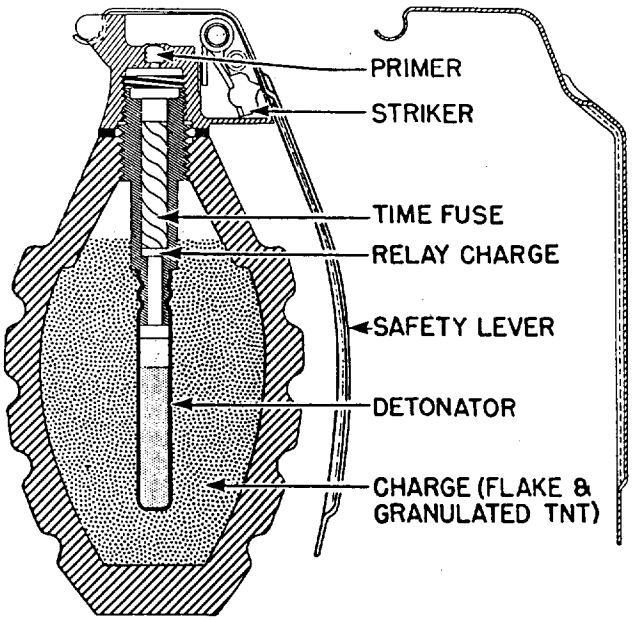


Description: These bombs are used for low-altitude horizontal, or dive bombing practice. The three bombs are similar in physical appearance, but differ basically in the metal used to cast the body. Bombs are used with the AN-Mk 4 practice bomb signal which is a blank 10 gauge shotgun shell (extended length). Signals contain a black powder expelling charge and a red phosphorous pyrotechnic mixture. These bombs also are used with the MK5 signal which contains a fluorescein dye and is actuated by impact on water. When the Mk5 signal is installed, the firing pin assembly is not used.

Over-all length .....8.25 inches
Body Diameter .....2.18 inches
Fin Dimension .....2.5 inches
Weight.....AN-Mk 5 Mod 1 - 2 lb. 11 oz. ± 1 oz
AN-Mk 23 -3 lb. ± 2 oz
AN-Mk 43 - 4 lb. 7 oz. ± 2 oz.
Signal.....AN-Mk 4, Black powder/pyro-technic charge Mk 5, Fluorescein dye

Reference: OP 1280, Aircraft Bombs, February 1945
TM 9-1325-200, Bombs and Bomb Components, April 1966

GRENADE, FRAGMENTATION
Mk II, Mk IIA1



Description:

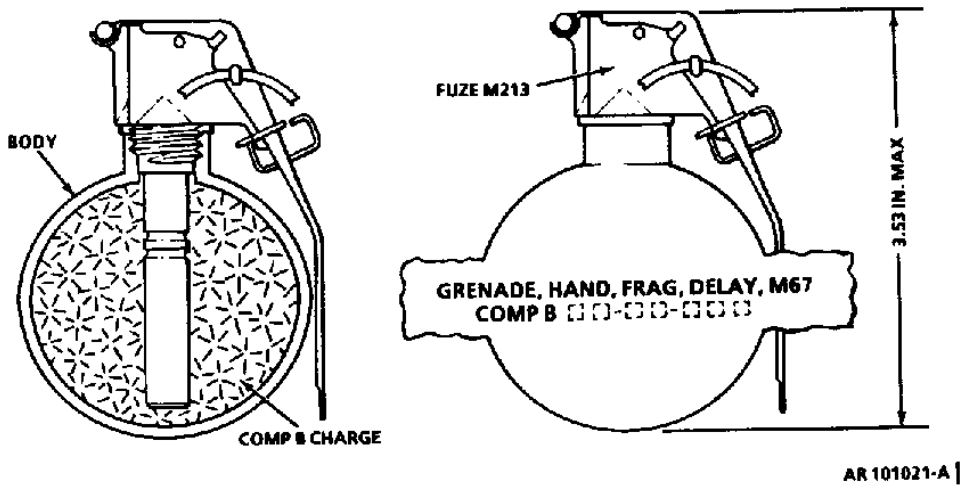
Mk II The grenade has a serrated cast-iron body of the familiar "pineapple" design. The groves run both horizontally and vertically to assist in the formation of uniform fragments of effective size. The grenade is issued with Igniting Fuze M204.

Mk IIA1 Identical to the Mk II except for the Fuze M10A3. The only external difference is that the safety lever fits over rather than under the lip of the fuze body.

DODAC..... 1330-G890
Length..... 4.5 inches
Diameter ..... 2.25 inches
Color ..... Olive Drab, with or without yellow band
Weight..... 21 ounces
Filling..... TNT, Flaked or granular, older models used E.C. Blank Smokeless Powder
Weight of filling ..... 2 ounces
Fuze..... M204A1, M204A2

Reference TM 43-0001-29, Ammunition Data Sheets for Grenades October 1977
TM 9-1904, Ammunition Inspection Guide, March 1944
NAVSEA OP 1664 Vol 1&2 w/change 1, U.S. Explosive Ordnance, February 1954

GRENADE, FRAGMENTATION, DELAY, M67



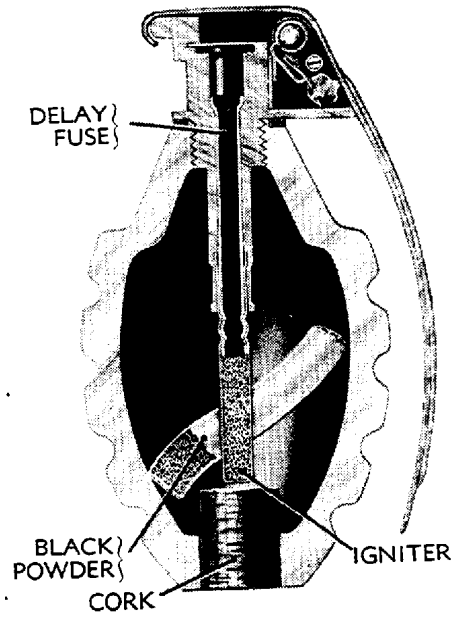
Use: The M67 fragmentation hand grenade is used to supplement small arms fire against the enemy in close combat. The grenade produces casualties by high velocity projection of fragments in a uniform distribution pattern..

Description: The grenade body is a 2.5-inch diameter steel sphere which is designed to burst into numerous fragments when detonated. The grenade body contains 6.5 ounces of high explosive, Composition B. Each grenade is fitted with a fuze that initiates the explosive charge. The M67 grenade uses the M213 fuze which is a pyrotechnic delay-detonating fuze. It will function the grenade 4 to 5 seconds after release of the safety lever. The body of the fuze contains a primer and a pyrotechnic delay column. Assembled to the body are a striker, striker spring, safety lever, safety pin, pull ring, and a detonator assembly. The M213 fuze is equipped with a steel safety pin and pull ring. The split end of the safety pin is either spread approximately 40 degrees or diamond-shaped to prevent accidental removal and arming during shipping and handling. The pull ring is provided to facilitate easy removal of the safety pin. A second safety feature is the steel safety clip.

Length..... 3.53 inches
Diameter..... 2.5 inches
Weight ..... 14 ounces
Color ..... Olive Drab, with yellow markings
Filler..... Comp B
Weight ..... 6.5 ounces
Fuze..... M213 Pyrotechnic delay

Reference TM 43-0001-29, Ammunition Data Sheets for Grenades October 1977

GRENADE, HAND, PRACTICE, M21



PRACTICE GRENADE, M21

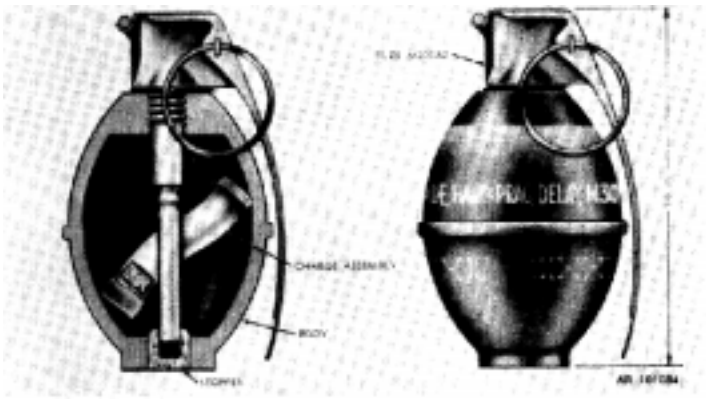
Description and Use: The M21 practice grenade is made of cast iron and is the same shape, size, and weight as a loaded fragmentation Hand Grenade Mk II. The fuze for the grenade has a primer, a combustible time-delay train and igniter. When the grenade is thrown, the safety lever is pushed off by the striker, allowing the striker to impact against the primer. The primer ignites the time-delay train and , after 4 or 5 seconds, the igniter initiates the black powder. The black powder contained in a cloth tube and is inserted into the filling hole, which is closed with a cork.

This grenade is later know as the Grenade, Practice, MkI1.

Length: ..... 4.5 inches
Diameter:..... 2.25 inches
Weight: ..... 21 ounces
Filler: ..... Black powder

Reference: TM 9-1900, Ammunition General, June 1945
FM 23-30, Hand and Rifle Grenades, April 1949

GRENADE, HAND, PRACTICE, DELAY, M30



Use: The grenade M30 is used for training in care, handling and throwing of fragmentation hand grenade M26A1 and M26.

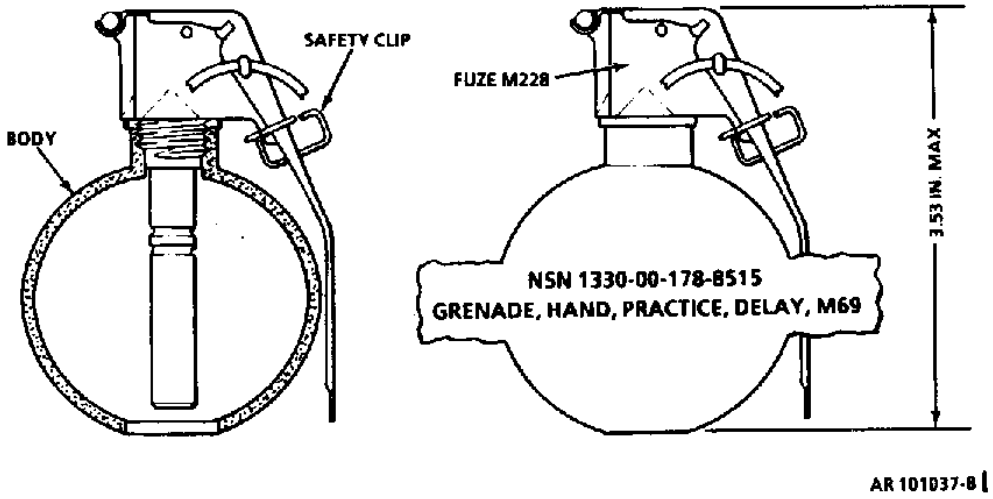
Description: The body is not loaded with a high-explosive filler but may have a small, separate black powder charge. The hand grenade fuzes M205A1 and M205A2 are pyrotechnic delay-igniting fuzes. They differ in body construction only. The body contains a primer and a pyrotechnic delay column. Assembled to the body are a striker, striker spring, safety lever, safety pin with pull ring, and an igniter assembly. The split end of the safety pin has an angular spread or a diamond crimp.

The grenade safety clip is designed to keep the safety lever in place, should the safety pin be unintentionally removed from the grenade. It is an additional safety device used in conjunction with the safety pin.

Length..... 3.9 inches
Diameter..... 2.25 inches
Weight ..... 16 ounces
Color ..... Blue, with brown band with white or no markings
Filler..... Black Powder
Filler Weight ..... 21 grains
Fuze..... M205A1, M205A2

Reference TM 43-0001-29, Ammunition Data Sheets for Grenades, October 1977

GRENADE, HAND, PRACTICE, DELAY, M69



Use: Delay practice hand grenade M69 is the practice version of the M67 fragmentation delay grenade.

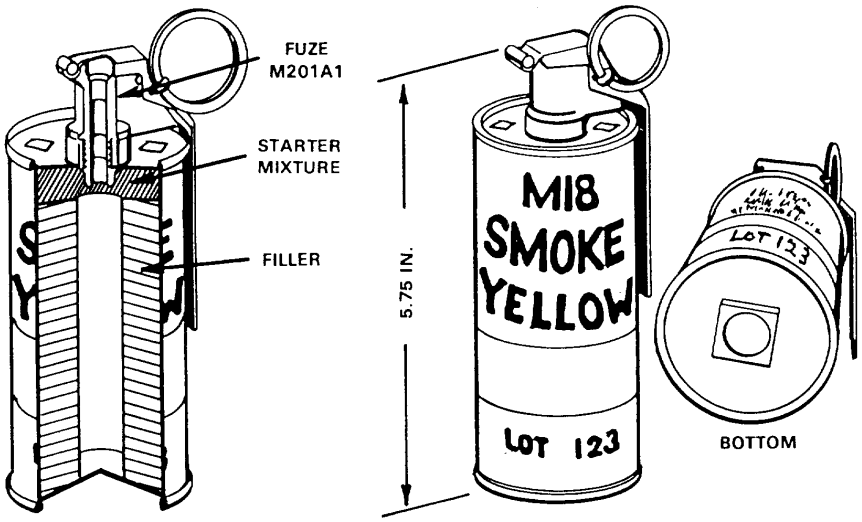
Description: The grenade body, of steel, is essentially spherical in shape. The body is empty, i.e., without any explosive filler. there is a hole in the base of the body. (This vents the gases generated from the fuze igniter and permits removal of residual metal that remains in the grenade body from the igniter case. The grenade body may be recovered and reloaded with a new fuze and safety clip.

Fuze: Hand grenade practice fuze M228 is a pyrotechnic delay-igniting fuze. The body contains a primer and a pyrotechnic delay column. Assembled to the body are a striker, striker spring, safety lever, safety pin with a pull ring, safety clip, and igniter assembly. (Older models do not have the safety clip).

Length..... 3.53 inches
Diameter..... 2.5 inches
Weight ..... 14 ounces
Color ..... Blue w/brown band and white markings
Filler..... None **Fuze** M228 Pyrotechnic delay
Igniter ..... Black powder (2.5 oz)

Reference TM 43-0001-29, Ammunition Data Sheets for Grenades October 1977

GRENADE, SMOKE, M18, with FUZE, M201, M201A1



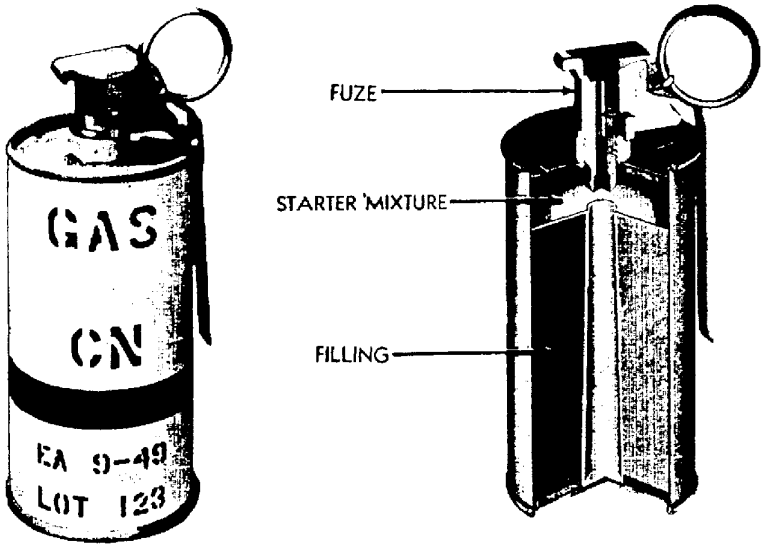
Description: These grenades may be filled with any one of seven smoke colors; red, orange, blue, green, black, violet, and yellow. The grenade body is of thin sheet metal and filled with a smoke composition. Emission ports are covered with small squares of adhesive tape and vary in quantity and location depending on the year of manufacturing.

The Fuze M201 and M201A1 is a pyrotechnic delay-igniting fuze. The body contains a primer, first fire mixture, pyrotechnic delay column, and ignition mixture

Length..... 5.75 inch
Diameter..... 2.5 inch
Color..... Blue grey or light green with black markings
Weight..... 19 ounces
Filler..... Smoke composition
Weight of filler..... 11.5 ounces
Fuze..... M201A1

Reference TM 43-0001-29 w/change 11, Ammunition Data Sheets for Grenades, Oct 77
NAVSEA OP 1664, U.S. Explosive Ordnance, May 47

GRENADE, HAND, TEAR, CN
M7 and M7A1



Description:

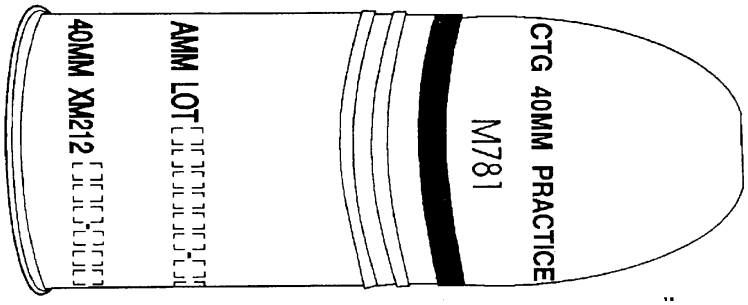
M7A1 grenade is a cylindrical thin sheet metal container with four emission holes in the top and one in the bottom. The filler is a mixture of CN, sugar, potassium chlorate, potassium bicarbonate, and a finely divided inert substance (diatomaceous earth). The emission holes are covered with adhesive tape to protect the filling from moisture. filled with CN. The Fuze M201A1 is a pyrotechnic-igniting fuze.

M7 grenade is similar to the M7A1 grenade, except that the M7 grenade has 18 emission holes in the sides and none in the bottom. It also contains less filler and produces about half as much effective CN gas as the M7A1. The grenade operates and functions in the same manner as the M7A1.

DODAC 1330-G960
Length ..... 5.7 inches
Diameter ..... 2.5 inches
Color ..... Blue grey or grey with 1 red band & red markings
Weight
M7 ..... 17 ounces
M7A1 ..... 18.5 ounces
Filler ..... CN- Pyrotechnic composition
Weight of filler
M7 ..... 10.25 ounces
M7A1 ..... 12.5 ounces
Fuze M201A1

Reference TM 43-0001-29 w/change 11, Ammunition Data Sheets for Grenades, Oct 77
TM 3-300, Miscellaneous Chemical Munitions, Mar 50

CARTRIDGE, 40-MM, PRACTICE, M781



General: This cartridge is a fixed, practice type ammunition designed to be fired from 40mm Grenade Launchers M79 and M203 (attached to the M16 series rifle).

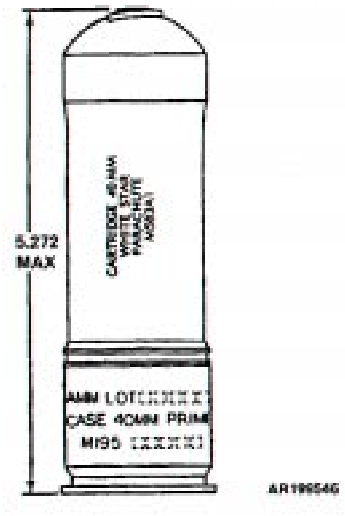
Description: This cartridge is a fixed round of ammunition consisting of a metal projectile body with a rotating band and a cartridge case assembly. a hollow plastic ogive is filled with a high visibility yellow-orange dye. The projectile assembly is attached to a cartridge case with an attached adhesive substance. The case is a hollow bichambered plastic cylinder. A .38 caliber blank cartridge is press-fitted into the base of the cartridge case and provides the gas pressure needed to propel the projectile through the launcher barrel.

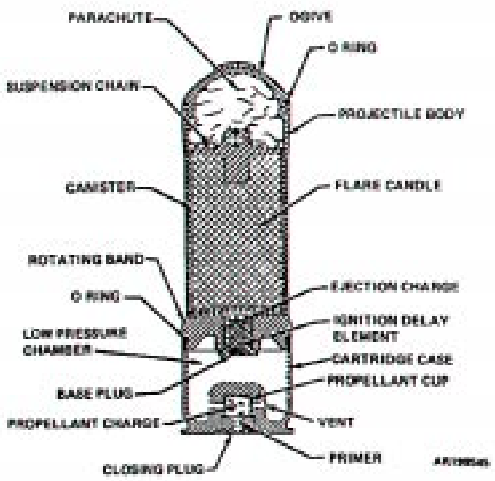
Functioning: The weapon firing pin strikes the .38 caliber blank cartridge primer igniting the propelling charge. Upon impact with the target, the frangible ogive ruptures and releases the dye causing a puff of yellow-orange smoke which simulates explosive impact.

Length..... 405 in.
Weight ..... 205 g.
Propelling Charge..... M9, 340 mg.
Color ..... Blue with white markings
Maximum Range ..... 400 meters

Reference TM 43-0001-28, Army Ammunition Data Sheets, April 1994

CARTRIDGE, 40-MM, PARACHUTE, WHITE STAR, M583A1; GREEN STAR, M661; RED STAR, M662





General: These cartridges are designed for illumination and signaling with less weight and bulk and greater accuracy than comparable hand-held signals. They are fired rom 40mm Grenade Launchers M79 and M203.

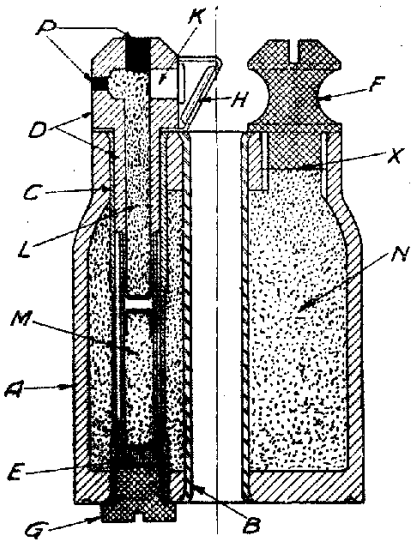
Description: The cartridge is a fixed round of ammunition consisting of a projectile assembly and a cartridge case assembly. The projectile has a one piece, hollow aluminum body with a metal rotating band. A plastic ogive, embossed with a raised letter for night identification of payload, is snapped into an O-ring in the front opening of the projectile cavity. The cavity contains a pyrotechnic flare candle assembly, and an integral ignition/ejection charge attached to a 20-inch diameter parachute. The projectile has a 4- to 5-second delay ignition element crimped into the center opening of a metal delay carrier.

Functioning: The weapon firing pin strikes the primer igniting the propelling charge. Gases from the burning propellant propels the projectile forward with the velocity required to reach burst altitude. The burning propellant also ignites the 5-second delay element in the base of the projectile. At the end of the delay, the delay element ignites the ejection charge. The ejection charge ignites the candle and blows the candle assembly out through the top of the projectile body. The candle burns for approximately 40-seconds.

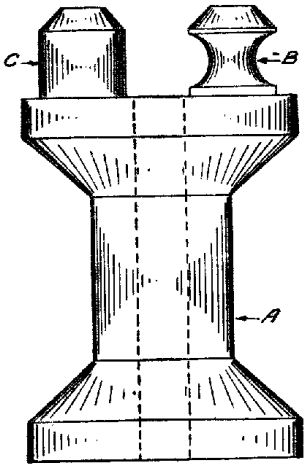
Length ..... 5.272 inches
Weight ..... 0.49 pounds
Propelling charge ..... M9, 330 milligrams
Filler and weight ..... Illum comp:
M583A1 - 93 g
M661 & M662 - 85 g
Color ..... White with Black markings

Reference TM 43-0001-28, Army Ammunition Data Sheets Artillery Ammunition Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers, and Artillery Fuzes, April 1977

V.B. RIFLE GRENADE, MARK I



CROSS SECTION OF V-B. RIFLE GRENADE.



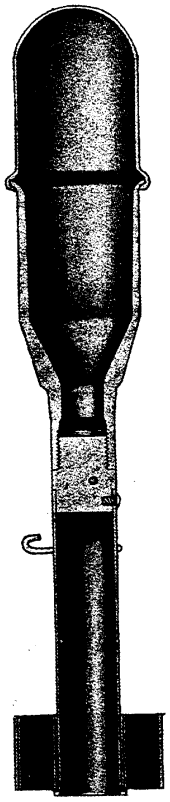
DUMMY V.B.RIFLE GRENADE

Description: The V.B. Rifle Grenade, Mark I is copied from the French V.B. grenade. The grenade is approximately 2½ inches in length by 2 inches in diameter, and weighs, when loaded ready to fire, 17¼ ounces. *The body* (A) is divided on the inside surface into 40 parts by deep grooves in order to insure proper fragmentation. The *central tube* and the *lateral tube* © are expanded into the machined holes of the body, the central tube having its ends beveled on the inside to permit the free passage of the bullet. The *fuze container* (D) is provided with a hole for the primer, a loading hole in the top through which the meal and loose powder are inserted, and a vent opposite the primer. The fuze container carries the primer at its upper end, with the striker projecting obliquely over the end of this bullet tube. When the bullet from the rifle cartridge has passed through the tube it hits the striker and thus fires the primer; from the primer the flash is transmitted to the fuze, which runs longitudinally through the center of the fuze container into the interior of the grenade, and is timed to burn 8 seconds. The fuze in turn fires the detonator attached to its lower end, which bursts the walls of the detonator tube and detonates the main charge. The grenade is fired from a discharger by the gasses behind the bullet from the rifle cartridge, which exerts their pressure on the flat base of the grenade. The normal range is aimed at 45 degrees is about 200 yards.

Dummy V.B. Riffle Grenade The dummy rifle grenade is an iron casting with a hole left through the center to represent the central tube and to allow the bullet to pass through when using the grenade. The filling plug and the top of the fuze container are cast with the body, making the whole grenade one piece. The weight of the dummy, 17¼ ounces. The weight is regulated by cutting out the sides of the body. The dummy rifle grenade is used in the same manner as the loaded grenade.

Reference: No. 1743, Description and instructions for the use of V.B. Rifle Grenade, Mark I, October 25, 1917
No. 1861, Handbook of Ordnance Data, November 15, 1918

GRENADE, RIFLE PRACTICE, M11A2

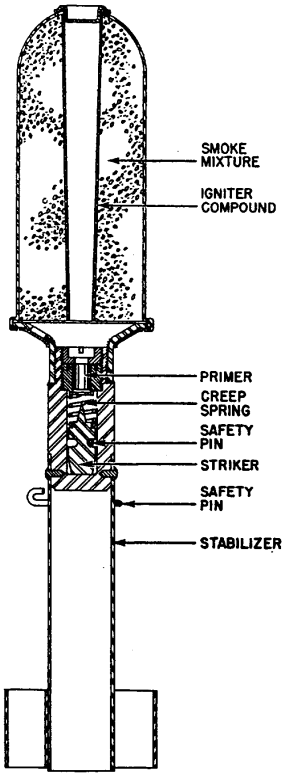


Description and Use: This grenade simulates the Anti-Tank Grenade M9A1. The grenade consists of a body, a stabilizer assembly, and a fin. The body is cylindrical, the two pieces joined in the middle with rounded ends. The stabilizer is a hollow tube which screws into the base of the body and fits over the launcher. The body is made of cast metal. It was so constructed that the fin and the ogive (upper body assembly), which are most liable to damage in use, may be replaced and the grenade used repeatedly. It is for training in marksmanship. This item is inert and contains no explosives. Except for color and filler, the grenade is identical to the tactical M9A1.

Length..... 11.18 inches
Diameter..... 2.25 inches
Filler..... INERT
Color ..... Black

Reference: NAVSEA OP 1664, U.S. Explosive Ordnance, May 47

RIFLE GRENADE, SMOKE, M22

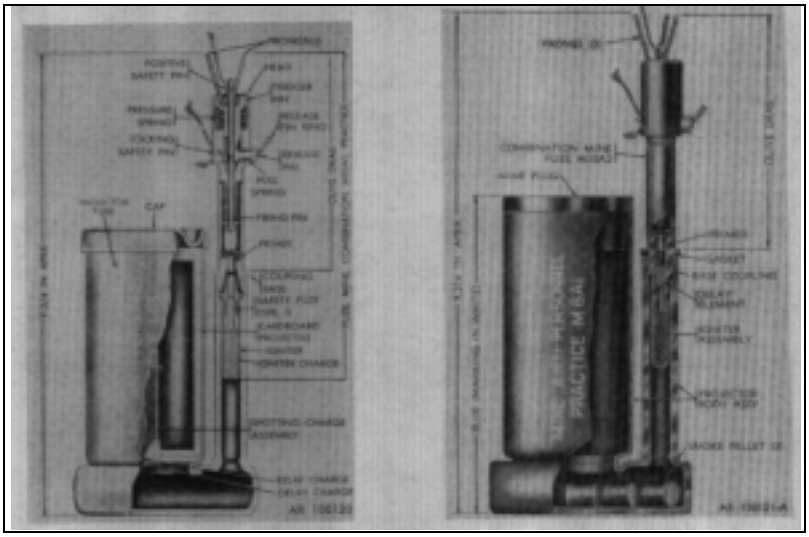


The grenade consists of a body, a stabilizer assembly, and a fin. The body is cylindrical. In an outward appearance, it is similar to the Anti-Tank Grenade M9A1, except that is does not have the joining rib. The nose of the body has a small circular opening which is closed with a light metal cover. The stabilizer contain the Fuze M9A1 Type. The body is filled through the nose. After filling, a tool is inserted longitudinally through this nose opening, and the filling is packed against the sides of the body, leaving a central channel. This channel is coated with an igniting composition. The smoke-emission holes are through the base shoulder of the grenade body. Four colors were issued: red, green, violet, and yellow.

Length: ..... 10.72 inches
Diameter ..... 2.0 inches
Color ..... Blue Grey
Filler ..... Smoke mixture

Reference: NAVSEA OP 1664, U.S. Explosive Ordnance, May 1947

MINE, ANTIPERSONNEL, PRACTICE, M8



Use. The antipersonnel practice mines M8 and M8A1 simulates the M2 series of antipersonnel mines and are used for training in the proper methods and precautions to be observed in the care, handling, laying, booby trapping, arming, and disarming of the M2 and M15 series.

Description. The metal parts of these mines are similar to those of service mine M2A4, The M8 mine uses a cardboard projectile containing a spotting charge. The M8A1 uses smoke pellets to indicate activation of the mine. These practice mines may be used many times by replacing the fuzes and separately requisitionable components.

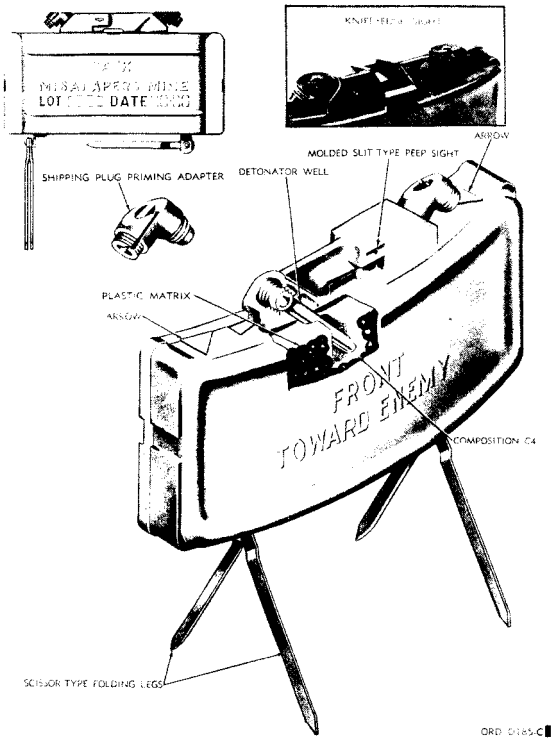
Functioning. Mine M8 with Fuze M10 or M10A1~~The fuze firing mechanism is activated by an applied load of 8 to 20 pounds on any of the prongs or by pull of 3 to 10 pounds of the trip wire. The fuze firing train ignites the delay element in the projectile and also propels it about 2 meters into the air. The delay initiates the spotting charge which explodes with a loud report and emits smoke.

Mine M8A1 with Fuze M10A2~~The fuze firing mechanism is activates in the e same manner as the M8. The fuze firing train ignites the yellow smoke pellets through 4 to 5 second delay. The plastic plug is propelled in the air allowing the yellow smoke to be emitted from the top of container

Height - fuzed ..... 9.75 inches
Diameter ..... 4.03 inches
Weight ..... 4.5 pounds
Filler Weight
  M8 ..... Black powder, 186.32 gr. max
  M8A1 ..... Smoke composition, 11.92 gr.
  Yellow Smoke, 92.7 gr.
Color ..... Blue
Fuze
  M8 ..... M10, M10A1
  M8A1 ..... M10A2

Reference: TM 43-0001-36, Army Ammunition Data Sheets for Land Mines, February 1977

MINE, ANTIPERSONNEL, M18A1



Use: The M18A1 mine is used when a directional, fixed, fragmentation mine is rewired for the defense of bivouac areas, outposts, and against infiltration tactics. It is also used against thin-skinned vehicles.

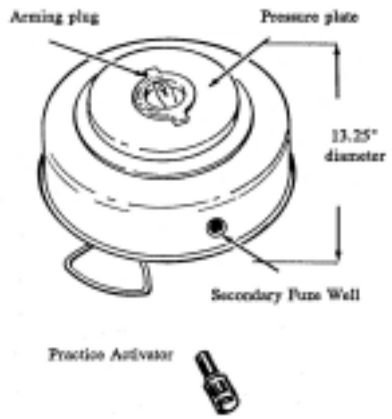
Description: The mine has a curved, rectangular, molded case of fiberglass filled plastic. The front face is lined with steel spheres embedded in a plastic matrix. The back portion of the case, behind the matrix, contains C4 explosive. The fragmentation face is convex, horizontally, to direct the fragments in a 60 degree arc, and concave, vertically, to control the vertical dispersion of the fragments. Two detonator wills located in the top of the mine enable the mine to be fired from two locations. The mine is shipped with the M4 assembly consisting of an M6 electric blasting cap and 30 meters of firing wire, terminating in an electrical connector and shorting plug. The firing device is an M57 hand held pulse generator with an electrical connector and dust cover. The test set M40 is used to visually test the circuit continuity. The bandoleer M7 is constructed to carry one complete set of components.

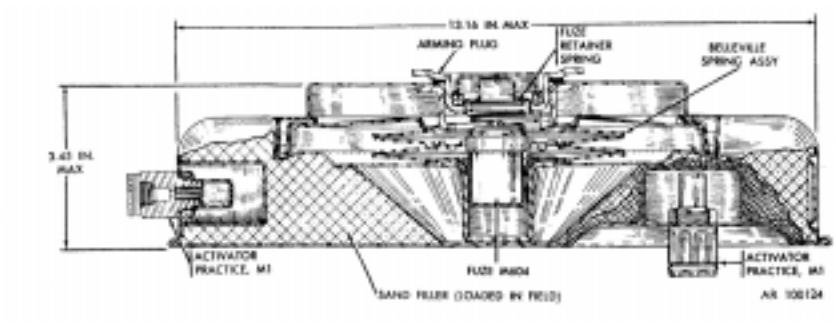
Dimensions
- **Height** ..... 3.25 inches
- **Width** ..... 8.5 inches
- **Thickness** ..... 1.375 inches

Material ..... Plastic
Filler C4
Weight of Filler ..... 1.5 pounds
Color ..... Olive Drab

Reference TM 43-0001-36, Army Ammunition Data Sheets for Landmines, February 1977

MINE, ANTI-TANK, PRACTICE, M12 SERIES





Use: The antitank practice mine M12 (M12A1, M12B1) is used for training personnel in the precautions and proper methods to be observed in the care, handling, laying and arming, booby trapping, and disarming of the high explosive antitank mine M15.

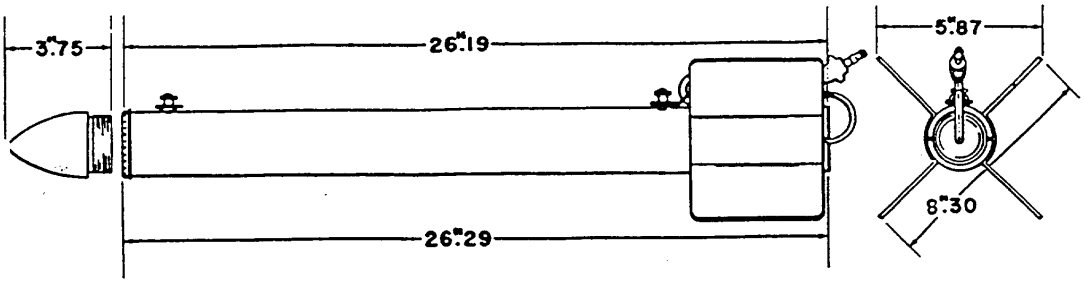
Description: The M12 practice mine is a flat, cylindrical, steel casing externally similar to the high explosive mine M15. The mine is shipped empty, with arming plug M4 assembled over the primary fuze well, but without primary or secondary fuzes. It is loaded with sand and fuzed in the field. The mine is inert, but explosive components will be found in the primary fuze, and if used, in the secondary fuze and activator. The arming plug has a steel shutter which moves from a side position to a center position as the setting knob is moved from SAFE through DANGER to ARMED position. The words are appropriately color coded, green red, red respectively. A wire carrying handle is provided.

Functioning: The mine is activated by a force of 565± 174 ponds on the pressure plate of the mine. This force overcomes both mine and fuze spring systems. Functioning of the practice fuze M604 ignites a smoke charge which emits a cloud of smoke and creates a noise. When booby trapped, the mine may be functioned by a pull or by release of trip wires attached to either of the secondary fuzes. Functioning of the secondary fuzes ignites a small smoke charge in the M1 practice activator.

Height..... 3.5 inches
Diameter ..... 13.25 inches
Weight..... 20.0 pounds
Material ..... Steel
Fuze ..... M604 practice
Primer ..... PA #100, 1.62 grs
Black Powder, 262.3 grs
Color ..... Blue with White markings

Reference: TM 43-0001-36, Army Ammunition Data Sheets for Land Mines, February 1977

ROCKET, 2.25 INCH PRACTICE



Use. These rockets were used for practice firing against surface targets. The rocket is forward fired from aircraft and simulated the trajectories of the 5 inch rockets.

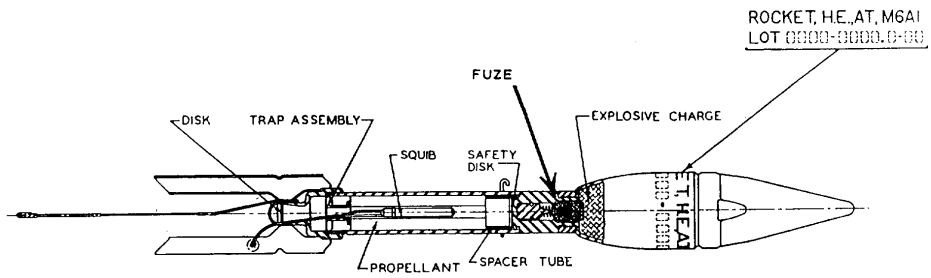
Description. The 2.25 inch practice rockets originally came in two different Marks (Mk) or models, the Mk II and Mk III. The acronym associated with them was SCAR, or sub-caliber aerial rocket. Other models followed. They consisted of a head, rocket motor, fins, igniter, and an electrical cable. The heads are solid steel, zinc die cast, or cast iron and contain no fuzes,

Motor. Mk 15 Mod 0,2, is 26.18 inches long and weighs to 10.90 pounds (max). The item's explosive hazard is the propellant (Mk 16 Mod 0,1) in the rocket motor and the igniter (Mk 112 Mod 0,1,2).

Weight ..... 12.47 pounds
Diameter of Body..... 2.25 inches
Length..... 29.07 inches

Reference: NAVSEA OP 1415, Rocket Assemblies, May 1955

ROCKET, 2.36-INCH ANTITANK, M6A1 PRACTICE, M7



Use: Pill boxes, tanks, and armored vehicles are prime targets. The rocket can also be used in a stationary emplacement for demolition or as an anti-tank mine or booby trap.

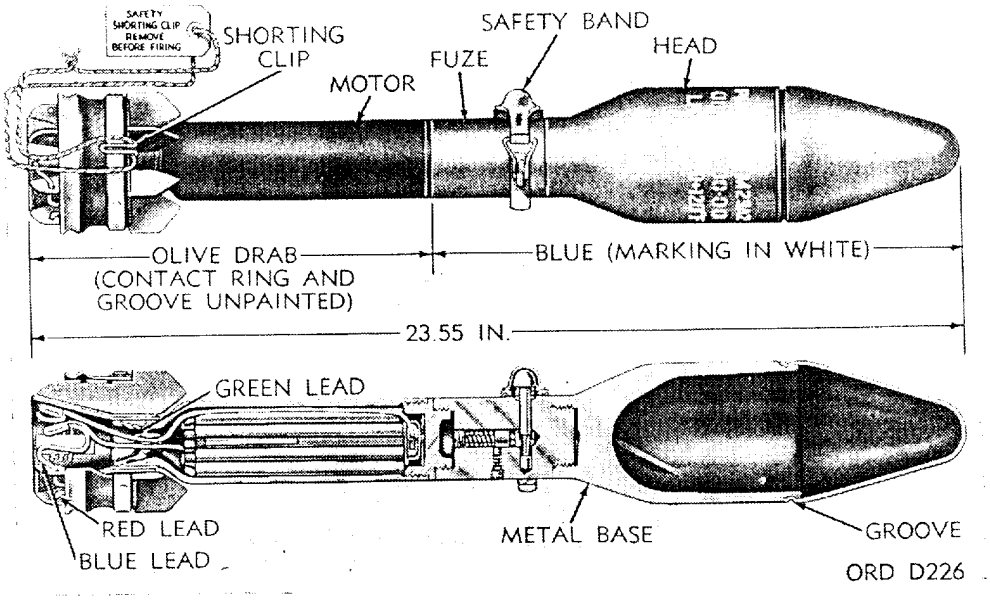
Description: The Rocket is 21½ inches long and weighs 3½ pounds. The rocket consists of the high-explosive head, the stabilizer tube and the fin assembly. The head contains a shape-charge containing a composition which is mainly 50/50 pentolite with a 10/90 pentolite booster surround. The stabilizer tube consists of the fuze body which contains the fuze mechanism, and the powder tube contains the propellent charge. The fuze consists of a steel firing pin which slips into the central cavity of the fuze body, where it is held in a rearward position by the firing-pin spring. When the safety pin is removed, the firing pin will overcome the spring and detonate the rocket if dropped over four feet. The fin assembly consists of the nozzle, the trap and six metal fins. The rocket is painted lustreless olive drab and stenciled in yellow.

Practice Rocket, M7A1 is similar to the service round in shape, size, and weight. However, it is provided with only a propellent charge, the head is inert and no fuze is provided. The end of the stabilizer tube is extended to counter-weight the head and make ballistics similar. A safety pin passes through the stabilizer to simulate realism during training. The rocket is painted black and stenciled in white.

Over-all Length:.....21.6 inches
Diameter (body): .....2.23 inches
Total Weight: .....3.5 pounds
Filler:.....Pentolite
Propellent: .....ballistite
Fuze:.....M400
Painting and markings:.....M6A1- olive drab w/ yellow markings
M7A1- black w/ white markings

Reference: TM 9-1904, Ammunition Inspection Guide, March 1944
OS 9-69, Ordnance School Text, Rockets & Launchers, February 1944

ROCKET, PRACTICE, 3.5-INCH, M29

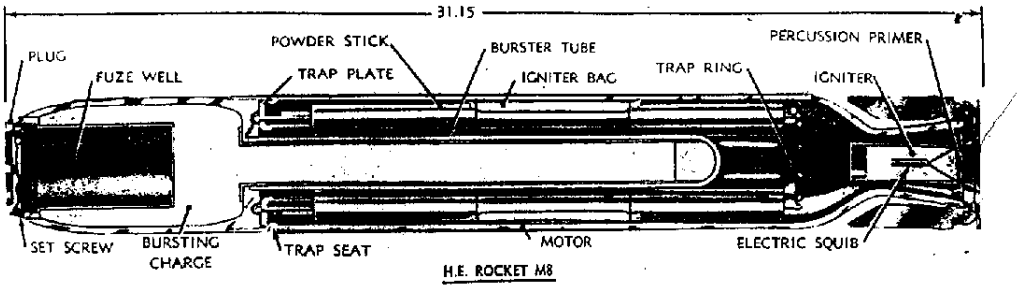


Description: This rocket generally is similar to the M28 High-explosive rocket except that it is provided with an inert bursting charge and the inert dummy fuze M405. The head is of light steel construction. It is cylindrical in shape, 3.5 inches in diameter, with a conically shaped ogive, and tapers to 2 inches in diameter at the rear. The rear of the head is threaded internally for attachment of dummy fuze M405. The rear of the fuze is threaded internally to receive the motor. The inert charge (plaster of paris and stearic acid) weighs 1.82 pounds. The motor consists of a body, closure, trap and spacer assembly, propellant, igniter with electric squib (cap) and leads, nozzle closure (blow out plug), and nozzle and fin assembly . Other characteristics are the same as for the M28.

Over-all Length: ..... 23.67 inch
Diameter: ..... 3.5 inch
Weight: ..... 8.61 pound
Filler: ..... Plaster of paris/stearic acid
Propellant: ..... M7 propellant powder
Propellant weight: ..... 12 grains
Igniter: M20

Reference: TM 9-1950, Rockets, July 1950

ROCKET, HE 4.5 INCH, M8



This type of rocket is cylindrical except for the ogival nose and nozzle constriction at the tail. It is issued as unfuzed complete rounds.

Head. The head consists of a shell body and a burster tube . The burster tube extends about 15 inches from the base of the shell body into the motor. In addition to increasing the explosive capacity of the head, the burster tube has the advantage of using the motor as a n additional source of fragments. The bursting charge consists of 4.3 lb. Cast TNT.

Fuze. The standard impacct fuze for the service rocket is point-detonating rocket fuze M4A2 with auxiliary booster M1A1.

Motor. The basic components of the motor are the motor tube, propellant, the propellant support, and the igniter with electric squib and leads, nozzle closure, and nozzle and fin assembly.

Over-all length ..... 31.15 inch
Diameter ..... 4.5 inch
Weight ..... 38.1 pound
Filler ..... Cast TNT
Filler weight ..... 4.3 pounds
Propellant ..... Double-base powder
Propellant weight ..... 4.65 pounds
Igniter ..... Squib

Reference: TM 9-1950, Rockets, July 1945

SMALL-ARMS AMMUNITION

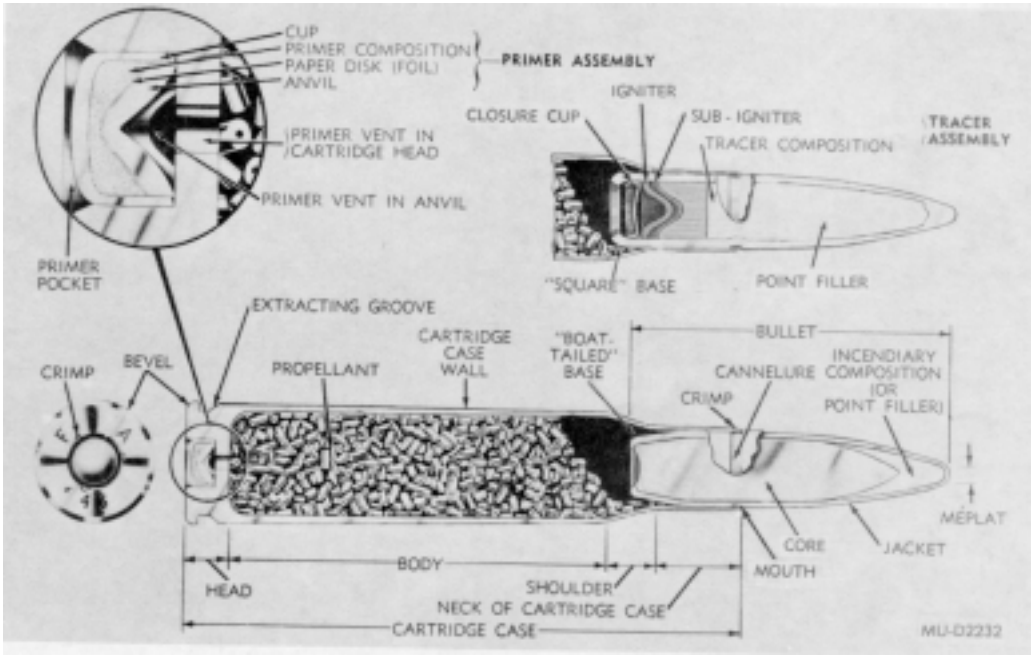


Figure 1. Typical cartridge (sectional)

1. General Small-arms ammunition, as used herein, describes a cartridge or families of cartridges intended for use in various types of hand-held or mounted weapons through 30 millimeter. Within a caliber designation, these weapons may include one or more of the following: rifles (except recoilless), carbines, pistols, revolvers, machineguns and shotguns. For purposes of this publication, small-arms ammunition may be grouped as cartridges intended primarily for combat or training purposes (API, HEI, tracer or ball); for training purposes only (blank or dummy); or for special purposes (rifle grenade or spotter-tracer). Refer to TM 9-1306-200 for more detailed information on small-arms ammunition.

2. Cartridges In general, a small-arms cartridge is identified as an assembly of a cartridge case, primer, a quantity of propellant within the cartridge case, and a bullet or projectile. Blank and rifle grenade cartridges are sealed with paper closure disks in lieu of bullets. Dummy cartridges are composed of a cartridge case and a bullet. Some dummy cartridges contain inert granular materials to simulate the weight and balance of live cartridges. A typical cartridge and the terminology of its components are shown in figure 1.

a. Case. Although steel, aluminum, zinc and plastic materials have been used experimentally, brass, a composition of 70 percent copper and 30 percent zinc, is the most commonly used material for cartridge cases. Steel, as well as brass, is an approved material for caliber .45 cartridge cases. Brass, paper and plastic are used for 12 gage shotshell bodies and aluminum is used for military-type .410 gage shotshell bodies. Configurations of cartridges and bullets are illustrated in figures 2 through 11.

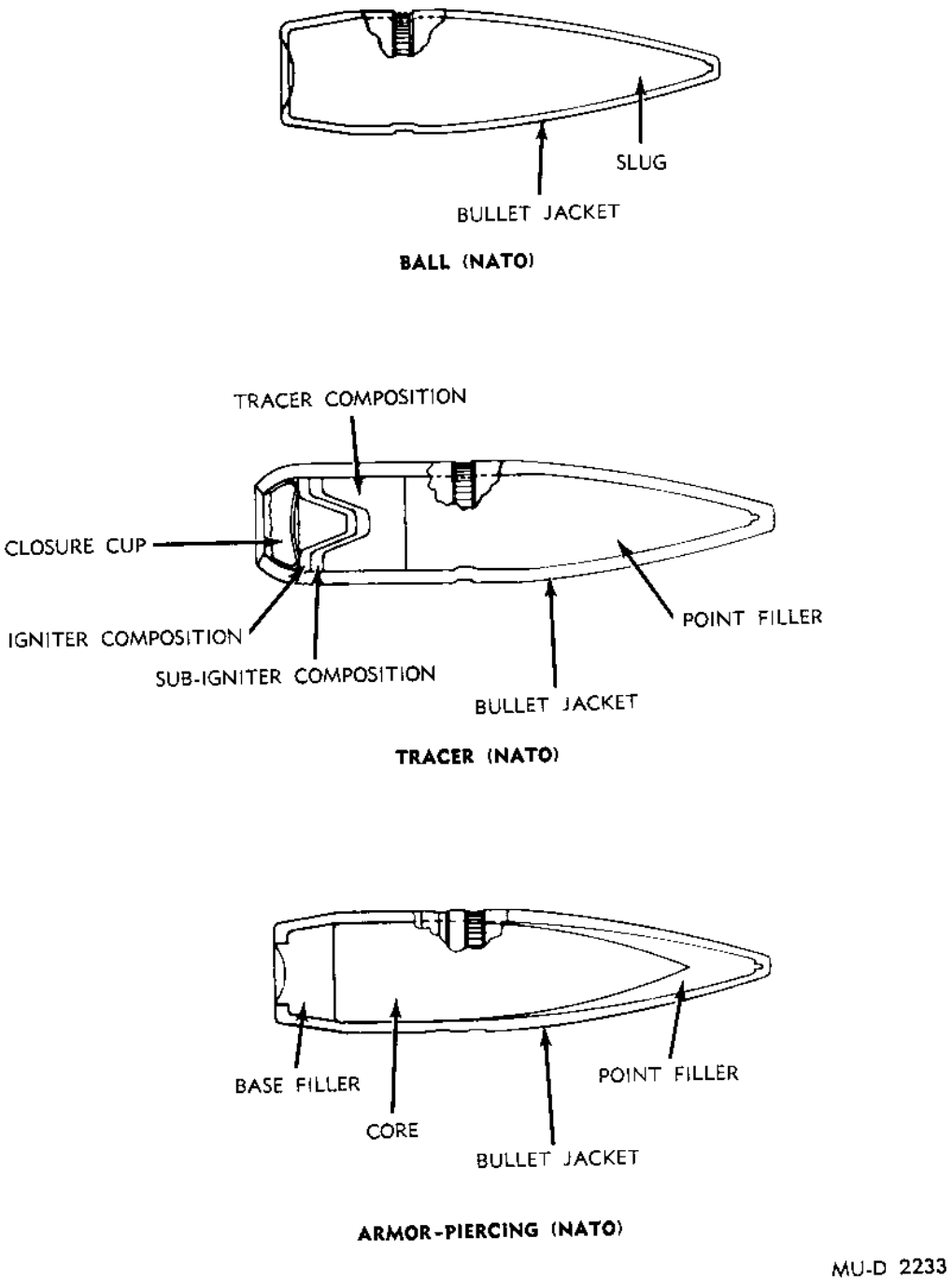


Figure 2. 7.62 MM bullets (sectional)

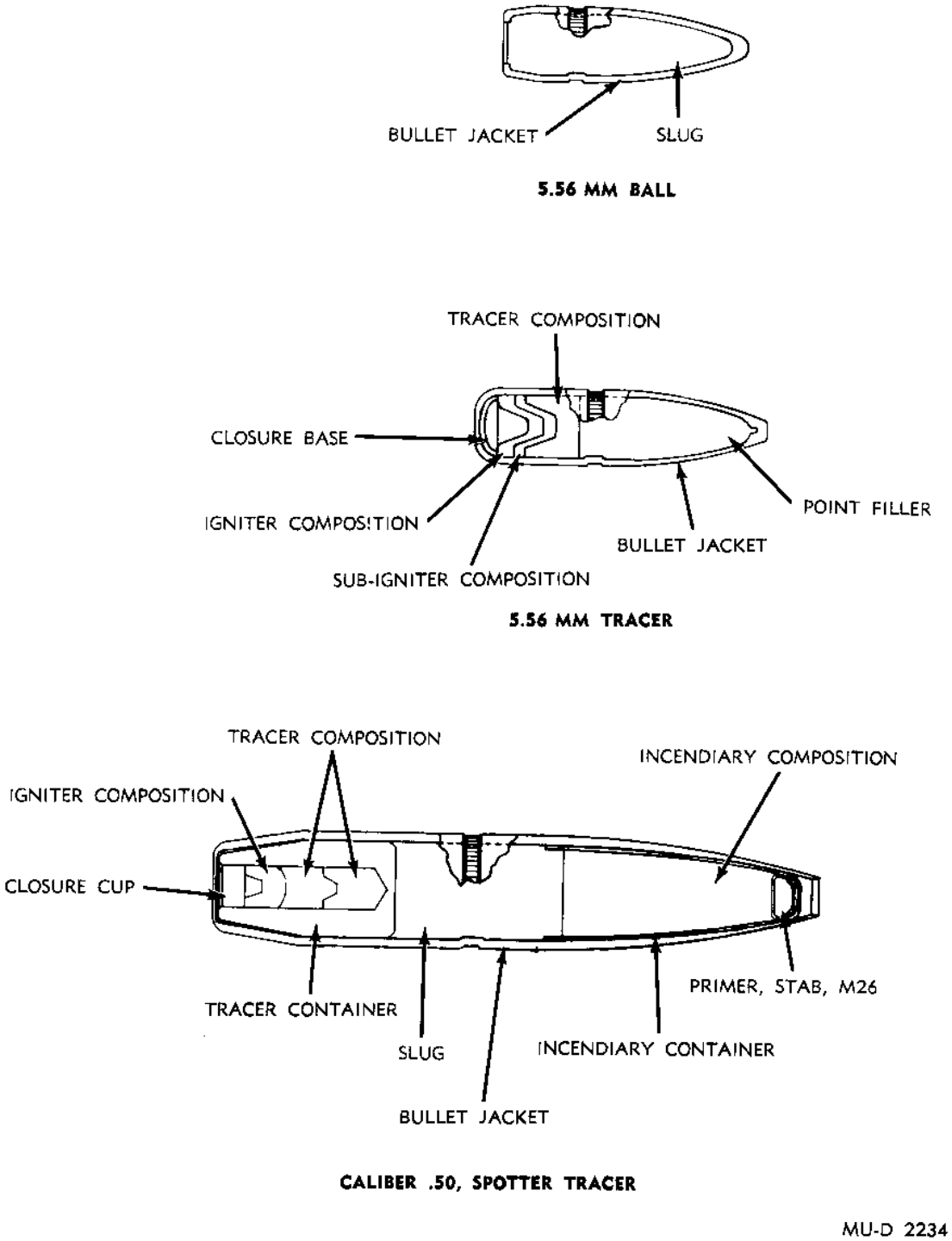


Figure 3. 5.56MM and caliber .50 spotter tracer bullets (sectioned).

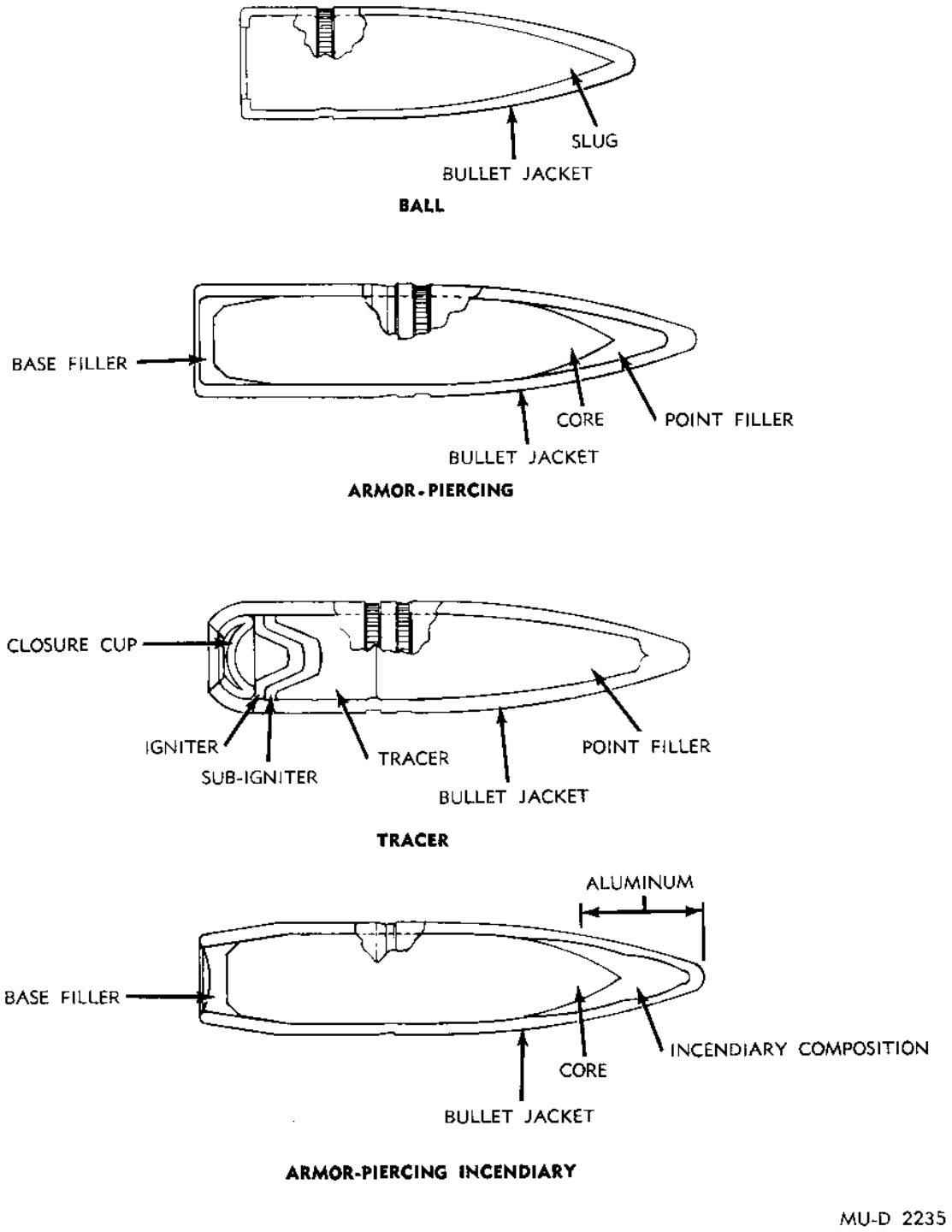


Figure 4. Caliber .30 bullets (sectional).

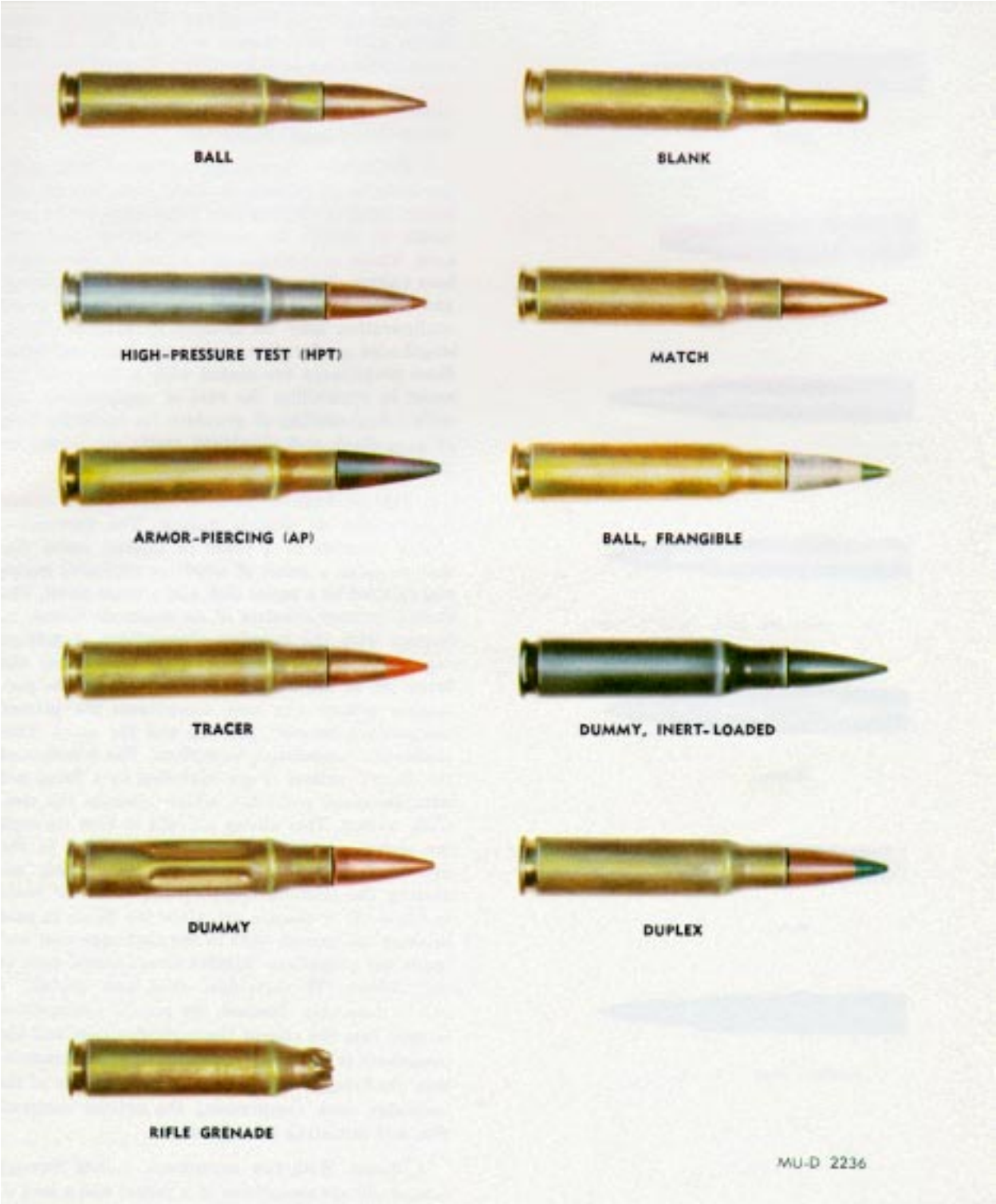


Figure 5. 7.62MM cartridges

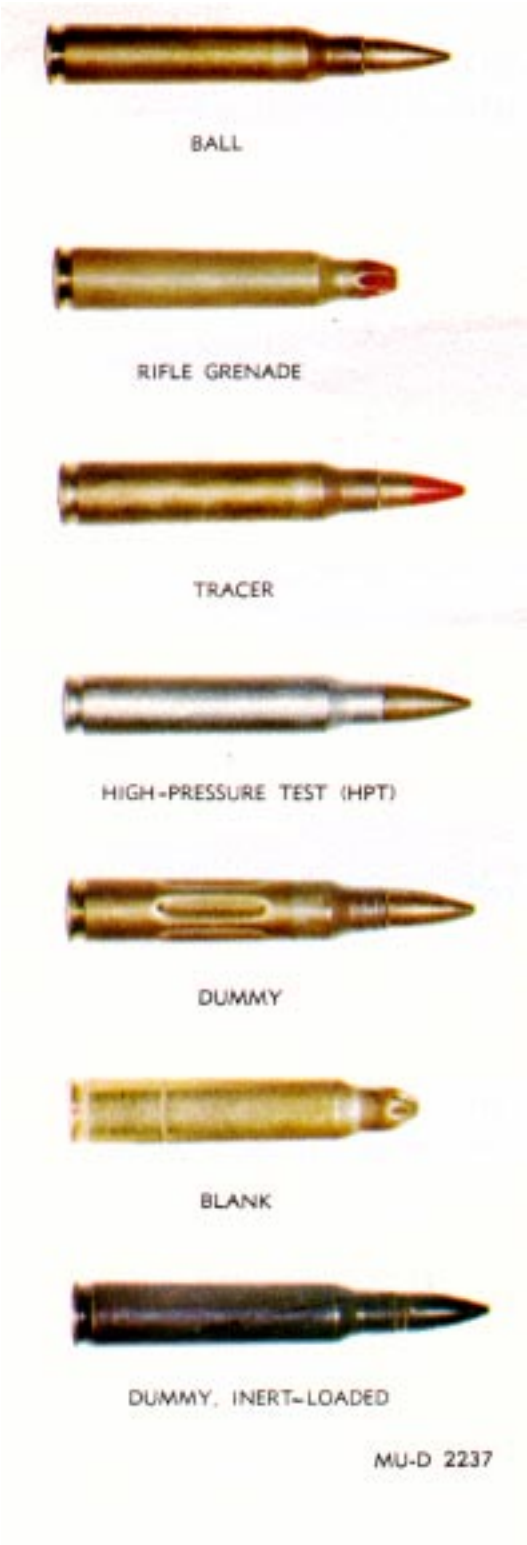


Figure 6. 5.56mm cartridges

b. Propellant Cartridges are loaded with varying weights of propellant. This is to impart sufficient velocity (within safe pressures) to the projectile to obtain the required ballistic performance. These propellants are either of the single-base (nitrocellulose) or double-base (nitrocellulose and nitroglycerine) type. The propellant grain configuration may be cylindrical with a single, lengthwise perforation, spheroid (ball) or flake. Most propellants are coated with a deterrent (to assist in controlling the rate of combustion) and with a final coating of graphite (to facilitate flow of propellant and eliminate static electricity in loading cartridges).

c. Primer Small-arms cartridges contain either a percussion or electric primer. The percussion primer consists of a brass or gilding metal cup that contains a pellet of sensitive explosive material secured by a paper disk and a brass anvil. The electric primer consists of an electrode button in contact with the priming composition, a primer cup assembly and insulator. A blow from the firing pin of the weapon on the center of the percussion primer cup base compresses the primer composition between the cup and the anvil. This causes the composition to explode. The function of the electric primer is accomplished by a firing pin with electrical potential, which contacts the electrode button. This allows current to flow through the energy-sensitive priming composition to the grounded primer cup and cartridge case, exploding the priming composition. Holes or vents in the anvil or closure cup allow the flame to pass through the primer vent in the cartridge case and ignite the propellant. Rimfire ammunition, such as the caliber .22 cartridge, does not contain a primer assembly. Instead, the primer composition is spun into the rim of the cartridge case and the propellant is in intimate contact with the composition. On firing, the firing pin strikes the rim of the cartridge case, compressing the primer composition and initiating its explosion.

d. Bullet With few exceptions, bullets through caliber .50 are assemblies of a jacket and a lead or

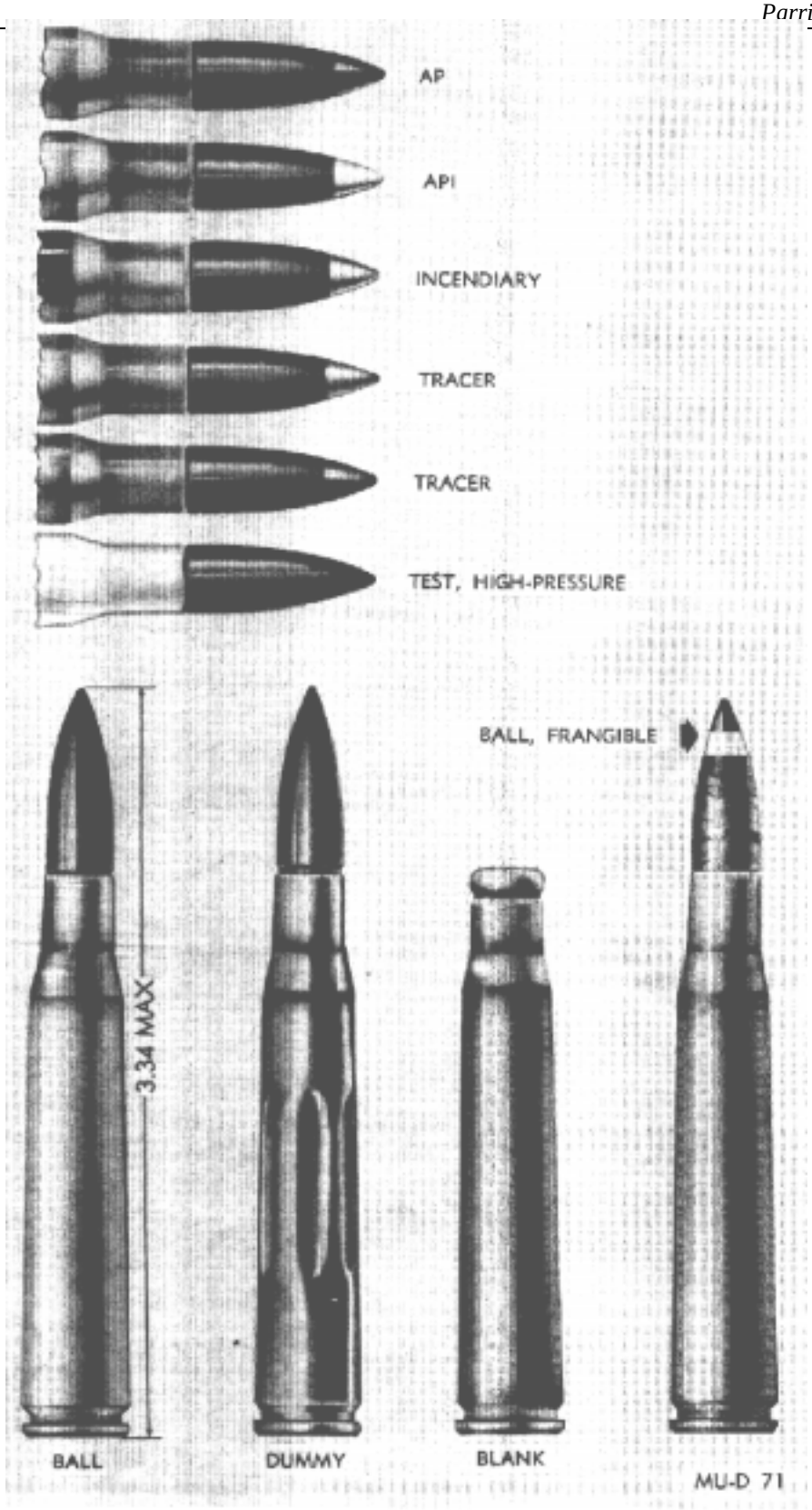


Figure 7. Caliber .30 cartridges

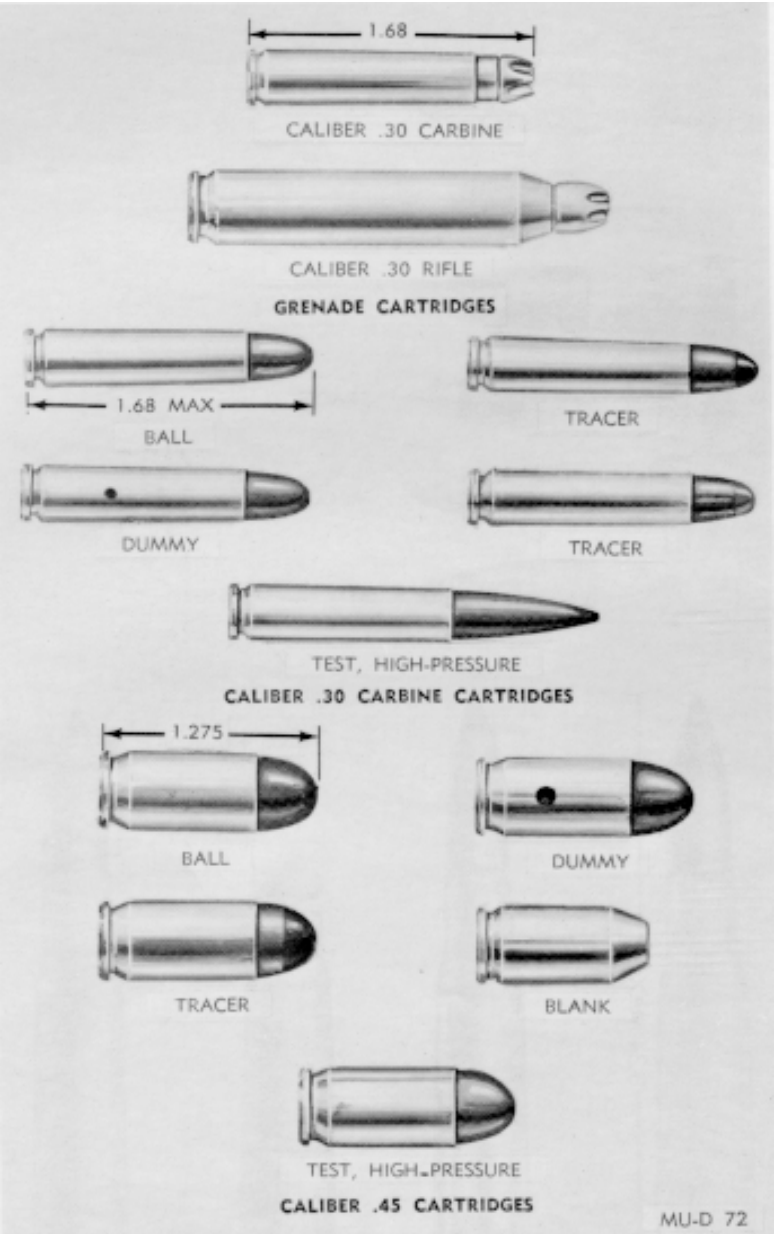


Figure 8. Caliber .30 carbine and caliber .45 cartridges

steel core. They may contain other components or chemicals which provide the terminal ballistic characteristics of the bullet type. The bullet jacket may be either gliding metal, gliding-metal clad steel, or copper plated steel. Caliber .30 and 7.62mm frangible bullets are molded of powdered lead and a friable plastic which pulverizes into dust upon impact with the target. The pellets used in the shotgun shells are spheres of lead alloys varying from 0.08 inch to 0.33 inch in diameter

e. Projectile All 20mm and 30mm projectiles are assemblies of a steel shell containing a brass rotating band and a point-detonating nose fuze or an aluminum, steel or plastic nose plug
.

Figure 9. Caliber .50 cartridges

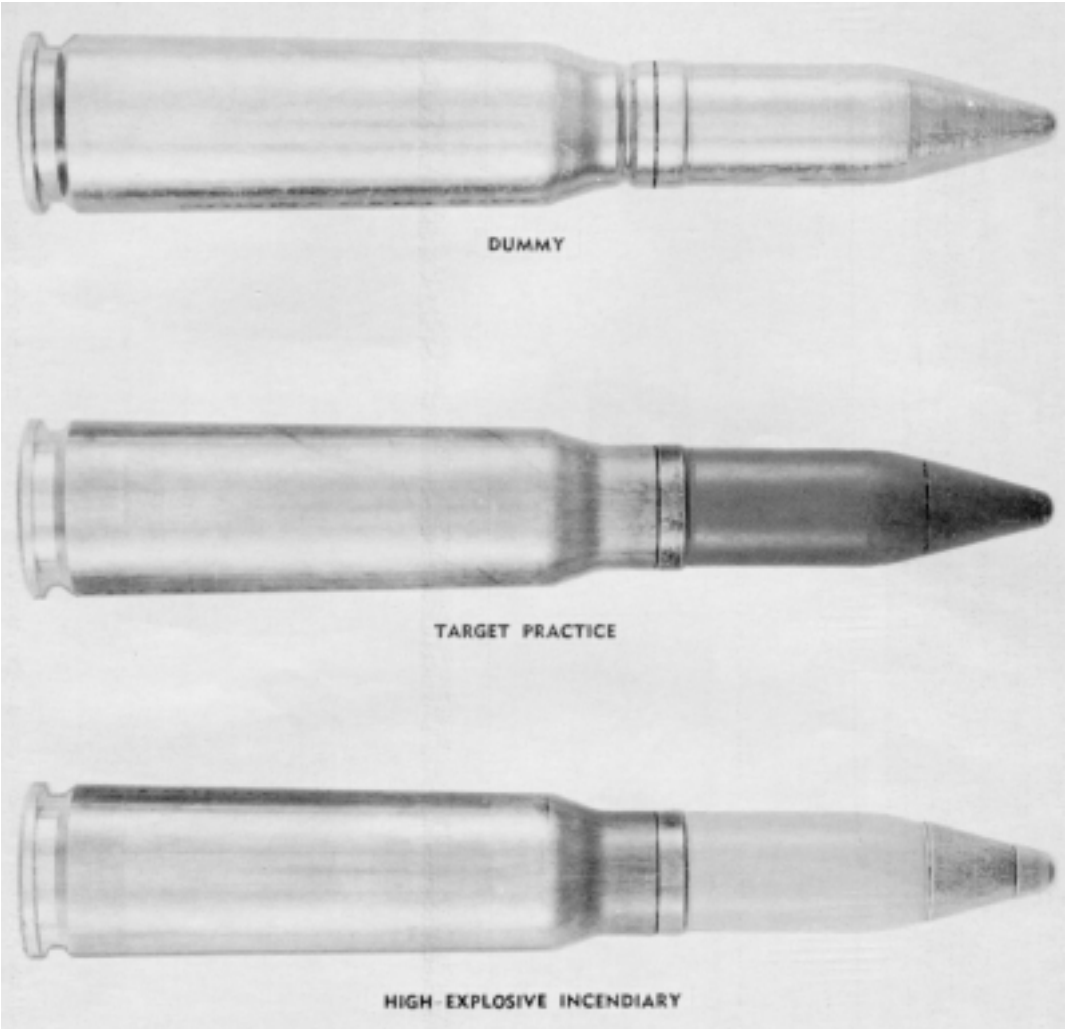
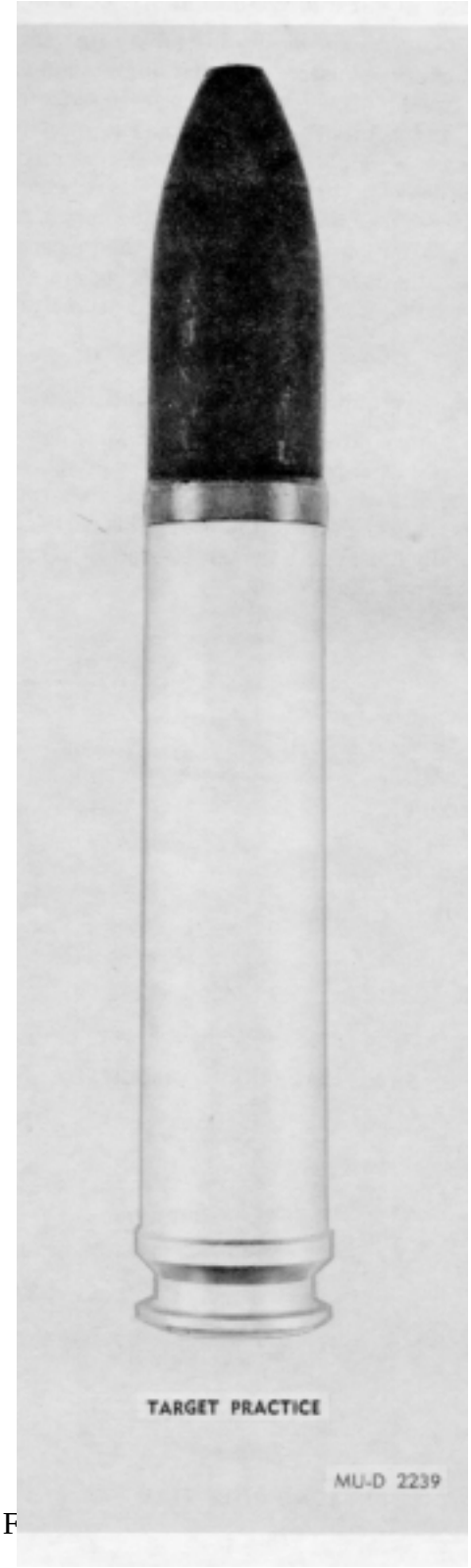


Figure 10. 20MM cartridges

3. Ball Cartridge The ball cartridge is intended for use in rifles, carbines, pistols, revolvers and/or machineguns against personnel and unarmored targets. The bullet, as designed for general purpose combat and training requirements, normally consists of a metal jacket and a lead slug. Caliber .60 ball bullet and 7.62-mm, Ball M59 bullet contain soft steel cores.

4. Tracer Cartridge By means of a trail of flame and smoke, the tracer cartridge is intended to permit visible observation of the bullet's in-flight path or trajectory and the point of impact. It is used primarily to observe the line of fire. It may also be used to pinpoint enemy targets to ignite flammable materials and for signaling purposes. The tracer element consists of a compressed, flammable, pyrotechnic composition in the base of the bullet. This composition is ignited by the propellant when the cartridge is fired. In flight, the bullet emits a bright flame which is visible to the gunner. Trace burnout occurs at a range between 400 and 1,600 yards, depending upon the caliber of ammunition.



F

5. Match Cartridge The match cartridge is used in National and International Match Shooting competitions. The bullet consists of a gliding- metal jacket over a lead slug. The cartridges are identified on the head face with the designation NM (National Match) or Match.

6. Armor-Piercing Cartridges The armor-piercing cartridge is intended for use in machine- guns or rifles against personnel and light armored and unarmored targets, concrete shelters, and similar bullet-resisting targets. The bullet consists of a metal jacket and a hardened steel-alloy core. In addition, it may have a base filler and/or a point filler of lead.

7. Armor-Piercing-Incendiary Cartridge The armor-piercing-incendiary cartridge is used in rifles or machineguns as a single combination cartridge in lieu of separate armor-piercing and incendiary cartridges. The bullet is similar to the armor-piercing bullet, except that the point filler is incendiary mixture instead of lead. Upon impact with the target, the incendiary mixture burst into flame and ignites flammable material.

8. Armor-Piercing-Incendiary Tracer Cartridge The bullet of the armor-piercing-incendiary-tracer cartridge combines the features of the armor-piercing, incendiary, and tracer bullets and may be used to replace those cartridges. The bullet consists of a hard steel core with compressed pyrotechnic mixture in the cavity in the base of the core. The core is covered by a gilding-metal jacket with incendiary mixture between the core point and jacket. This cartridge is for use in caliber .50 weapons only.

9. Duplex Cartridge The duplex cartridge contains two special ball type bullets in tandem. The front bullet is positioned partially in the case neck, similarly to a standard ball bullet. The rear bullet, positioned completely within the case, is held in position by a compressed propellant charge. The base of the rear bullet is angled so that in flight, it follows a path slightly dispersed from that of the front bullet

. **10. Spotter-Tracer Cartridge** The spotter-tracer cartridge is intended for use in coaxially mounted caliber .50 spotting rifles. The bullet trajectory closely approximates that of 106mm projectiles. Thus, this cartridge serves as a fire control device to verify weapon sight settings before firing 106mm weapons. The bullet contains an impact detonator and incendiary composition which identify the point of impact by flash and smoke.

11. Blank Cartridge The blank cartridge is distinguished by absence of a bullet. It is used for simulated fire, in training maneuvers, and for saluting purposes. It is fired in rifles and machineguns equipped with blank firing attachments.

12. Grenade Cartridge The grenade cartridge is used to propel rifle grenades and ground signals from launchers attached to rifles or carbines. All rifle grenade cartridges are distinguished by the rose petal (rosette crimp) closure of the case mouth.

13. Frangible Cartridge The caliber .30 frangible cartridge, designed for aerial target training purposes, is also used in rifles and machineguns for target shooting. Caliber .30 and 7.62mm frangible cartridges are used in tank machineguns, firing single shot, for training in tank gunnery. At its normal velocity, the bullet, which is composed of powdered lead and friable plastic, will completely disintegrate upon striking a 3/16-inch aluminum alloy plate at 100 yards from the muzzle of the gun. These cartridges are not to be used on any but well ventilated indoor ranges to preclude buildup of toxic bullet dust. Inhalation of bullet dust may be injurious to health

14. Incendiary Cartridge The incendiary cartridge was designed for aircraft and ground weapon use to ignite combustible targets (e.g., vehicular and aircraft fuel tanks). The bullet contains a compressed incendiary mixture which ignites upon impact with the target. The incendiary cartridge has been superseded by the API and APIT cartridges because of their improved terminal ballistic effects

15. High-Explosive-Incendiary Cartridge The 20mm high-explosive-incendiary cartridge is a combat round used on aircraft and ground vehicles. It contains a projectile consisting of a steel body and point-detonating fuze. The steel body contains a high-explosive incendiary mixture which is detonated on impact as the fuze strikes the target. The fuze, a high-precision device, arms shortly after leaving the muzzle of the weapon. On impact, the fuze releases a small firing pin which sets off the charge in the fuze and detonates the HEI

16. Target-Practice Tracer Cartridge The 20mm target-practice-tracer cartridge contains a target-practice projectile with a tracer cavity. The cavity, filled with pyrotechnic composition, is in the rear of the body. This cartridge is generally linked with the target-practice cartridge in a ratio of 1 to 7.

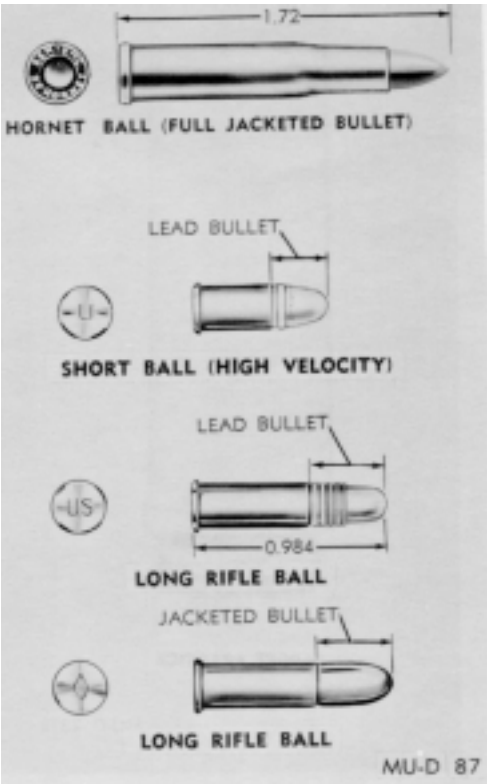


Figure 12. Caliber .22 cartridges

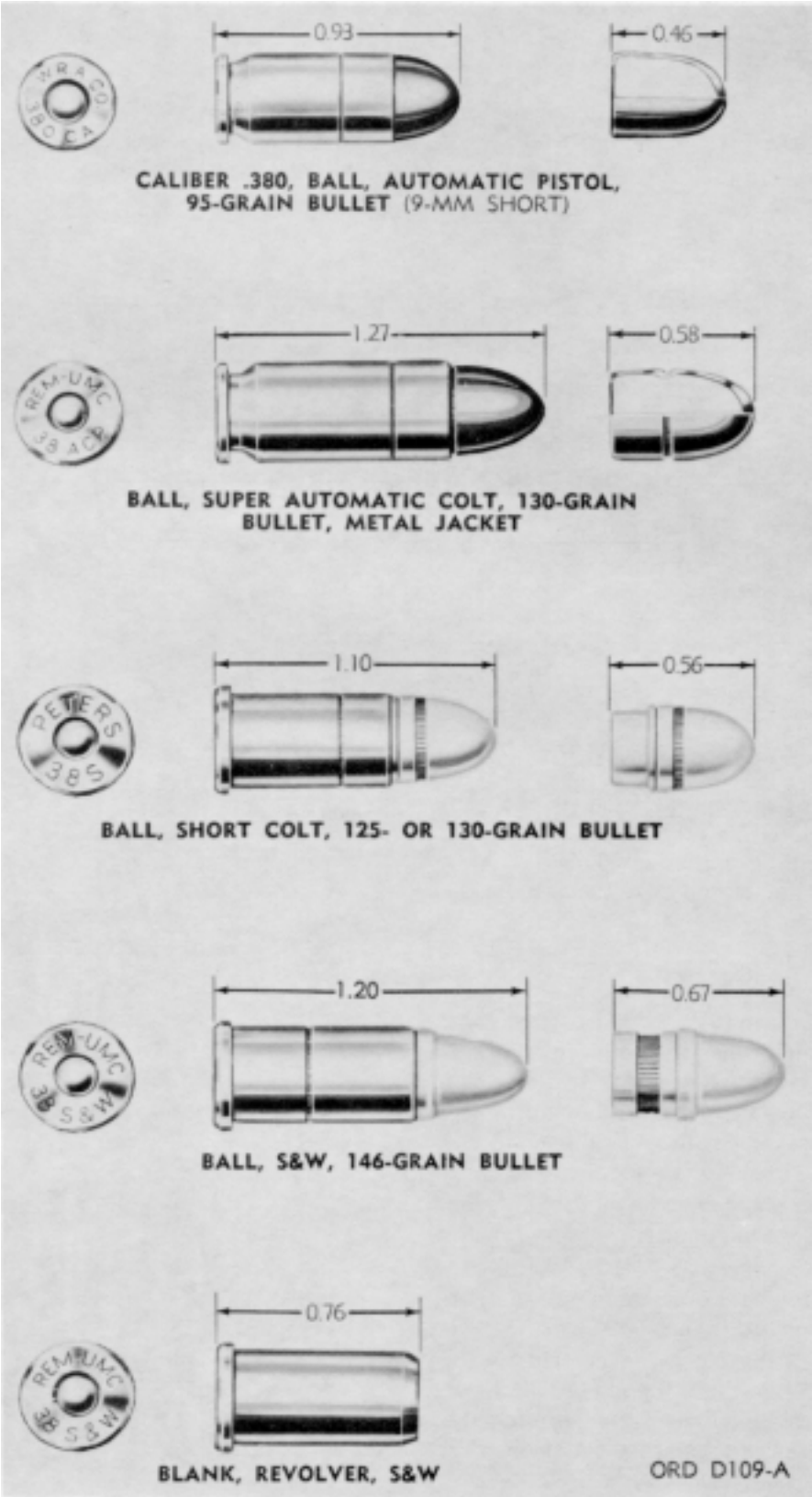


Figure 13. Caliber .38 cartridges.

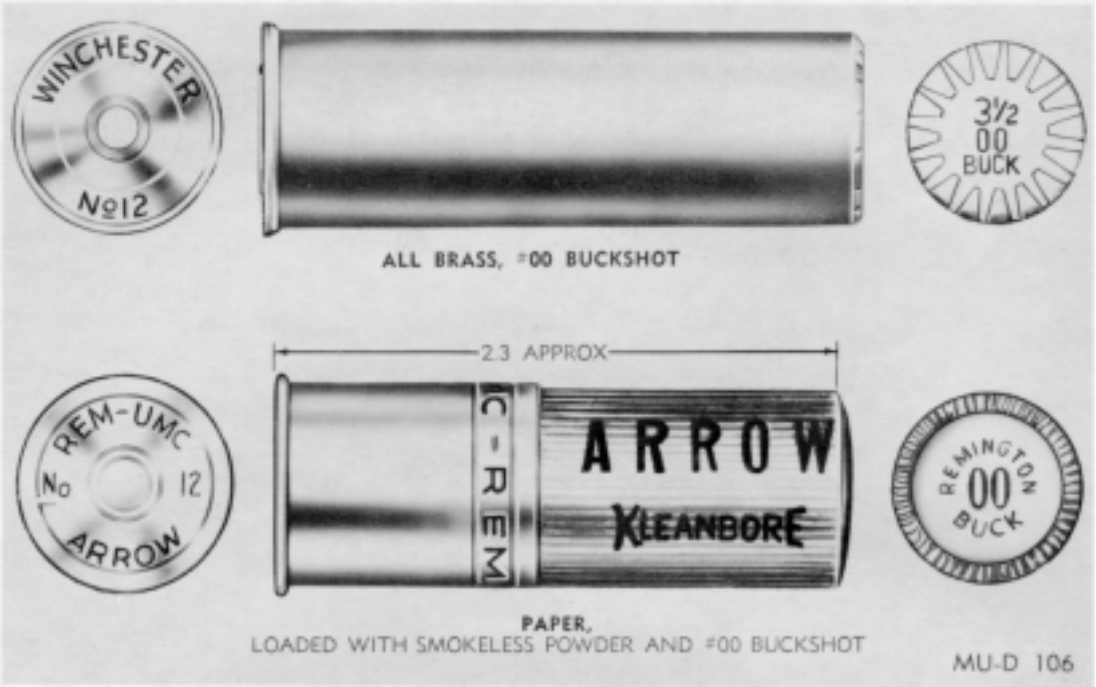


Figure 14. 12 gage shotgun shells.

17. Target-Practice Cartridge The 20mm target-practice cartridge is the conventional steel shell with steel nose plug. It is used primarily for training purposes. This is not a combat cartridge; hence, no fuze is used in the assembly.

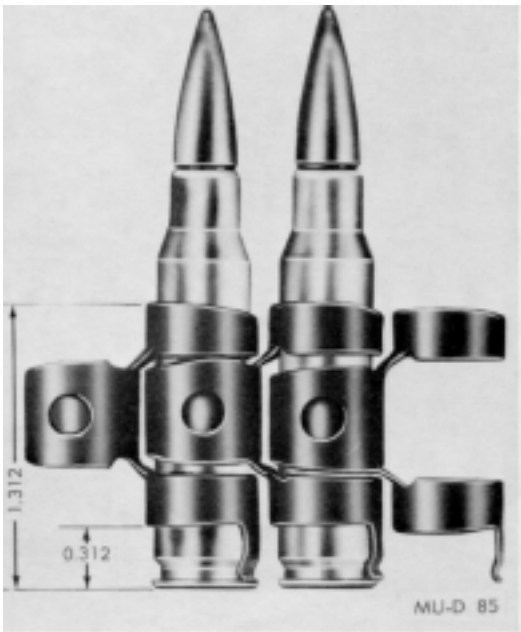


Figure 15. Linked 7.62-mm cartridge

18. Special Purpose Cartridge

a. Cartridges of various calibers (fig. 12 through 14), which consist of different types of projectiles and bullets, are used for training and special purposes. They include the following:

(1) Caliber .22 long rifle and caliber .38 and .45 wad-cutter cartridge for target shooting.

(2) Caliber .45 blank cartridges fired in exercises to condition dogs to gun fire.

(3) Caliber .22 hornet and .410 shotgun cartridges for firing in Air Force combination (survival) weapons for hunting purposes.

(4) Caliber.45 line-throwing cartridges for firing in caliber .45 line-throwing rifles. The Navy uses these for throwing lines from ship-to-ship. The Army Signal Corps uses these for projecting signal wires over elevated terrain

(5) Shotshells containing the designated shot sizes as required for the following:

(a) 12 gage #00 Buck for guard duty
(b) 12 gage #4 Buck for guerrilla purposes.
(c) 12 gage #6, 7½ and 8 shot for clay target shooting for training purposes.
(d) .410 gage #7 shot for caliber .22/.410 survival weapons maintained by aircraft.

b. Special purpose cartridges also include the following types of military cartridges:

(1) Dummy. The dummy cartridge is used for practice in loading weapons and simulated firing to detect flinching of personnel when firing weapons. It consists of a cartridge case and a ball bullet. Cartridge identification is by means of holes through the side of the case or longitudinal corrugations in the case and by the empty primer pocket.

(2) Dummy inert-loaded. This cartridge consists of a cartridge case, a ball bullet and inert granular material in the case simulating the weight and balance of a live cartridge. The exterior of the cartridge is identified by a black chemical finish and by the absence of a primer. This cartridge is used by installations for testing weapon function, linkage and feed chutes.

(3) High-pressure test. High-pressure test ammunition is specially loaded to produce pressures substantially in excess of the maximum average or individual pressures of the corresponding service cartridge. This cartridge is not for field issue. It is used only by armorers and weapons mechanics for proof firing of weapons (rifles, pistols, machine guns) at place of manufacture, test and repair. Because of excessive pressures developed by this type of ammunition, and the potential danger involved in firing, proofing of weapons is conducted only by authorized personnel from fixed and shielded rests by means of a lanyard or other remote control methods.

19. Metallic Links and Clips

a. Metallic links (fig. 15 and 16) are used with caliber .30, caliber .50, 5.56mm, 7.62mm and 20mm cartridges in machine guns. The links are made of steel, surface treated for rust prevention. They are used to assemble cartridges into linked belts of 100 to 750 cartridges per belt. The links must meet specific test and dimension requirements to assure satisfactory ammunition feed and functioning in the machine gun under all training and combat service conditions.

b. Different configurations of cartridge clips permit unitized packages of ammunition. This facilitates transfer of cartridges to appropriate magazines for caliber .30, 7.62mm and 5.56mm rifles. The caliber .30 eight-round clip feeds eight cartridges as a unit into the receiver of the rifle. The caliber .45 clip feeds three cartridges as a unit into the revolver cylinder. Five-round and eight-round clips are used with caliber .30 cartridges; five-round clips with 7.62mm cartridges; ten- round clips with caliber .30 carbine and 5.56-mm cartridges; and three-round clips with caliber .45 cartridges

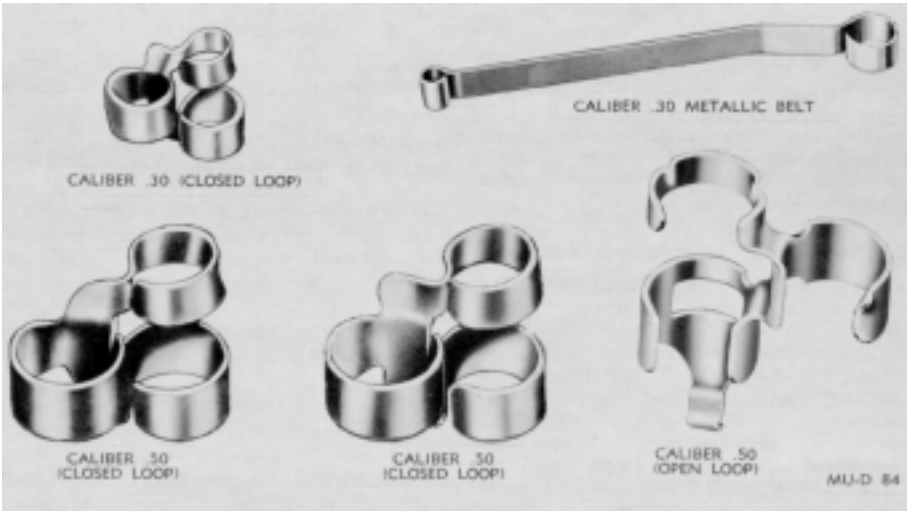


Figure 16. Links for caliber .30 and caliber .50 ammunition

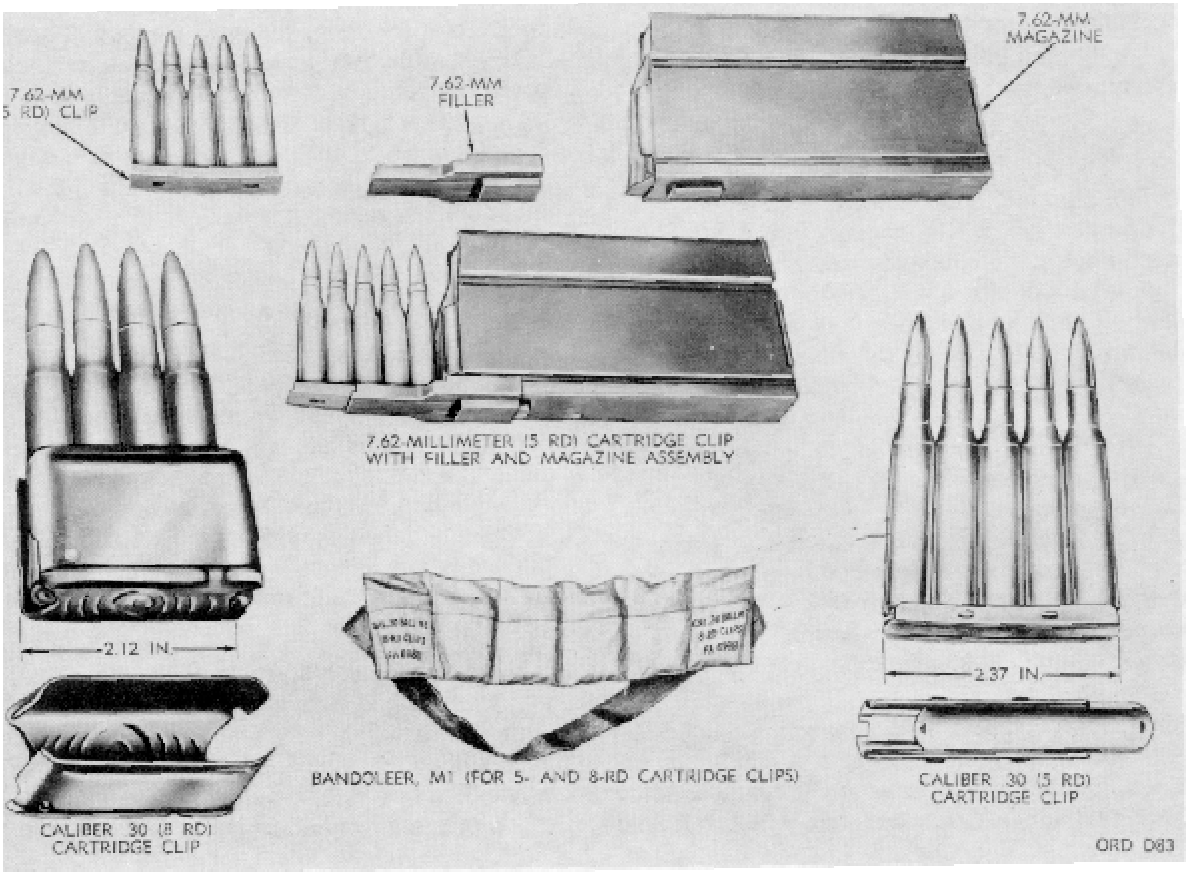


Figure 17. Cartridges in 20-round cartons in ammunition box

20. Packing and Identification Marking

a. Packing Containers and methods for packing military small-arms ammunition are specified in drawings, specifications or, as required, in the procurement contract. Military containers presently being manufactured have been limited to a few standard types designed to withstand all conditions commonly encountered in handling, storage and transportation of ammunition. Military cartridges, except 20mm, are packed in metallic ammunition boxes, over- packed in wooden wire-bound crates. Twenty millimeter cartridges are packed in ammunition boxes only. When commercial cartridges are not packed in a military pack, they are packed in accordance with standard commercial practices.

b. Identification Markings Each outer shipping container and all inner containers are fully marked to identify the ammunition. Wire- bound boxes are marked in black and ammunition boxes are painted olive drab, with markings in yellow. When linked ammunition is functionally packed, component lot numbers are replaced by a functional lot number. Typical packing and identification markings are illustrated in figures 17 and 18.

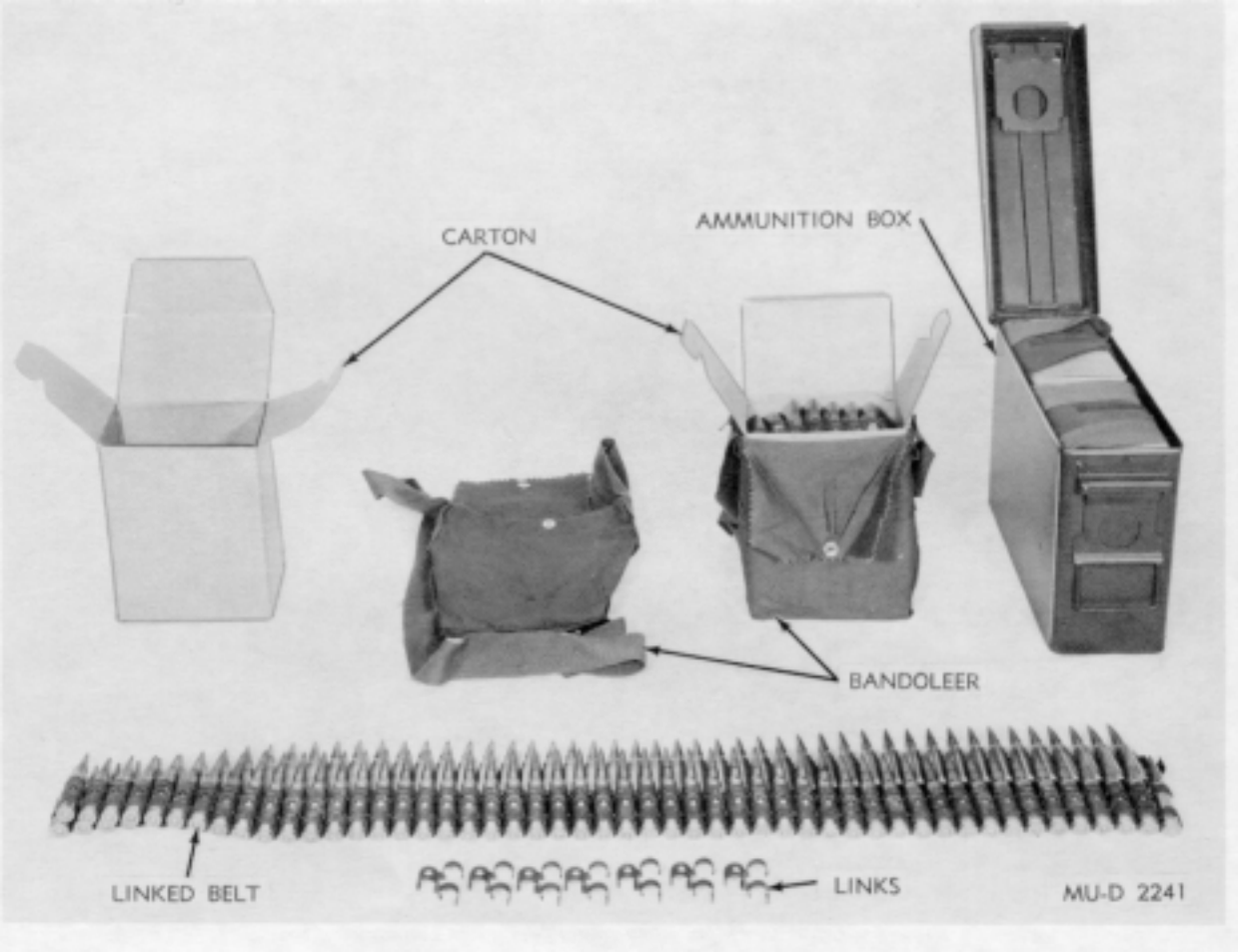
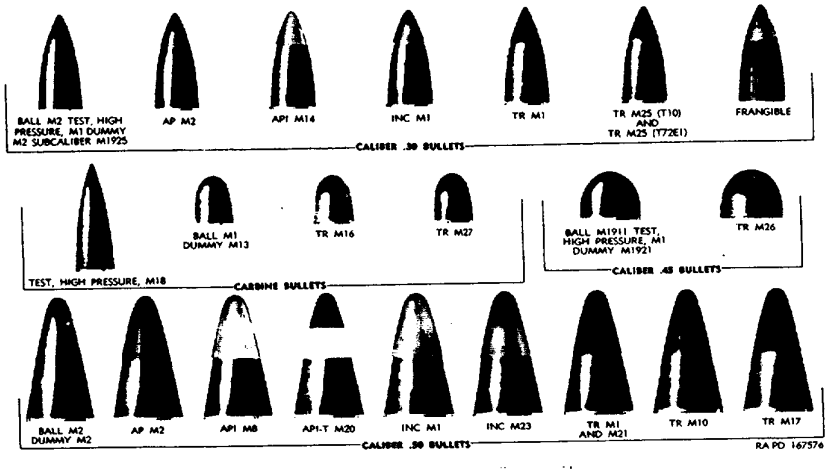


Figure 18. Cartridges, link belt, cartons, bandoleers and ammunition box.

21. Care, Handling and Preservation
Small-arms ammunition is comparatively safe to handle. It is packed to withstand transportation, handling and storage conditions normally encountered in the field. However, consideration should be given to general handling precautions pertaining to ammunition and explosives.

Reference: This data is a reprint of Chapter 3, TM 9-1300-200, *Ammunition General, October 1969*

SMALL ARMS, GENERAL



Identification of bullets of small arm cartridges

Use: Cal, .50 machine guns, Cal, .30, carbines, rifles, semiautomatic rifles, automatic rifles, and machine guns, Cal, .22 pistols, rifles, and machine guns (for gallery practice), Shotguns, 12-gage, Cal, .45 automatic pistols, revolvers, and submachine guns, Subcaliber tubes and adapters for artillery weapons which use ammunition of similar size and type.

Description: A complete round of small-arms ammunition is known as a cartridge, and is made up of the following components:

Bullet: The bullet in general is cylindrical. The nose may be round, as in the cal, .50 bullet, or ogival as in all service rifles and machine gun bullets. The base may be square or boat- tailed. Types are identified by the color of the tip and include the following:

- Armor-piercing bullets contain a core of hardened steel.
- Ball usually contain a slug of antimony hardened lead except in the case of the cal, .50, wherein the outer core is of soft steel.
- Tracer contains a lead slug, and a chemical composition in the rear.
- Incendiary bullets contain an incendiary composition.

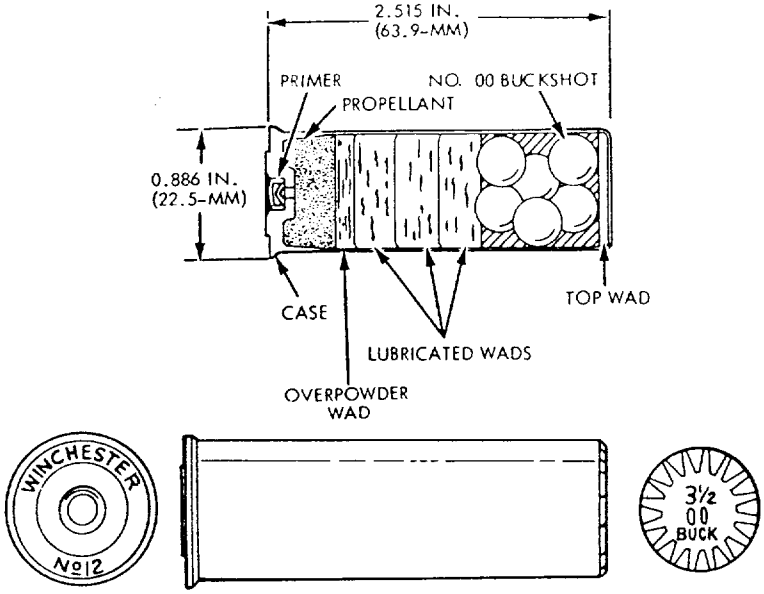
Cartridge case: The cartridge case is the means whereby the other components are assembled into the unit. It also provides a waterproof container for the propelling charge.

Primer: Percussion

Propelling charge: The propelling charge consists of a quantity of smokeless powder. The weight of the charge is not constant. It is adjusted for each powder lot to give the required velocity with pressure within the limits prescribed for the weapon in which it is fired.

Reference: TM 9-1904, Ammunition Inspection Guide, dated 2 March 1944
TM 9-1900, Ammunition General, dated June 1956

SHELL, SHOTGUN, 12 GAGE



General. Shotgun shells are procured by the Ordnance Department from several manufacturers for use in 12-gage sporting and riot-type shotguns. They are intended for guard or combat use and for hunting or trap shooting.

Visual identification Shells for guard and combat use have a brass head extending at least 1-inch along the case. Shells for sporting use have a head extending only 1/2 inch along the case

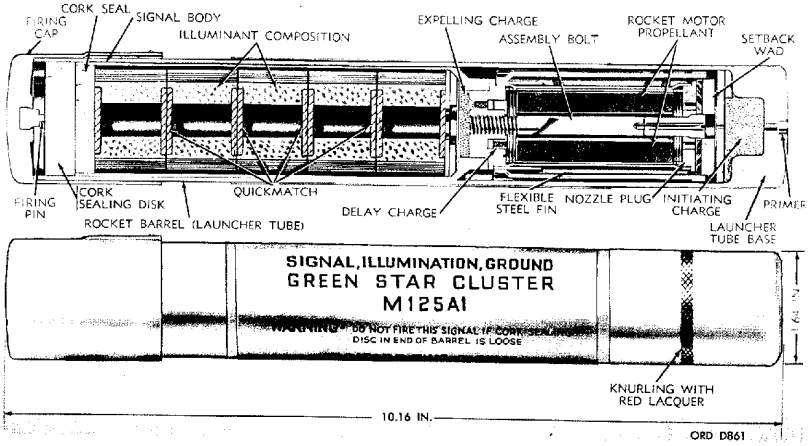
Components. The consists of a case, a primer, several wads, a propelling charge, and a load of lead shot. The case consists of a brass head and a paper or plastic (more recent issue) case or shell body. In guard or combat shells, the head extends a distance of 1 inch along the case. (In some shells, the entire case is of brass.) In sporting shells, the head extends 1/2 inch or less. The head is reinforced by a base of compressed paper in which the primer pocket is formed. Some paper shells have steel reinforcement, called the lining, under the brass head. The shell body is made of paper and waterproofed. The head is attached to the shell body by crimping. The primer is a commercial type suitable for ignition of the smokeless powder used. The size of the leadshot for each type is as follows:

Guard or combat	No. 00 buckshot
	No. 4 chilled shot
Sporting	No. 71/2 chilled shot
	No. 9 chilled shot

Length:..... 2.515 inch
Weight: ..... 930 grains
Propellant:..... Smokeless Powder (26 grains)
Primer:..... Percussion

Reference: TM9-1904, Ammunition Inspection Guide, March 1944

SIGNALS, ILLUMINATION, GROUND, STAR CLUSTERS, GREEN, M125A1; RED, M158; WHITE, M159



Use: Hand held rocket launching mechanism. For day or night signalling.

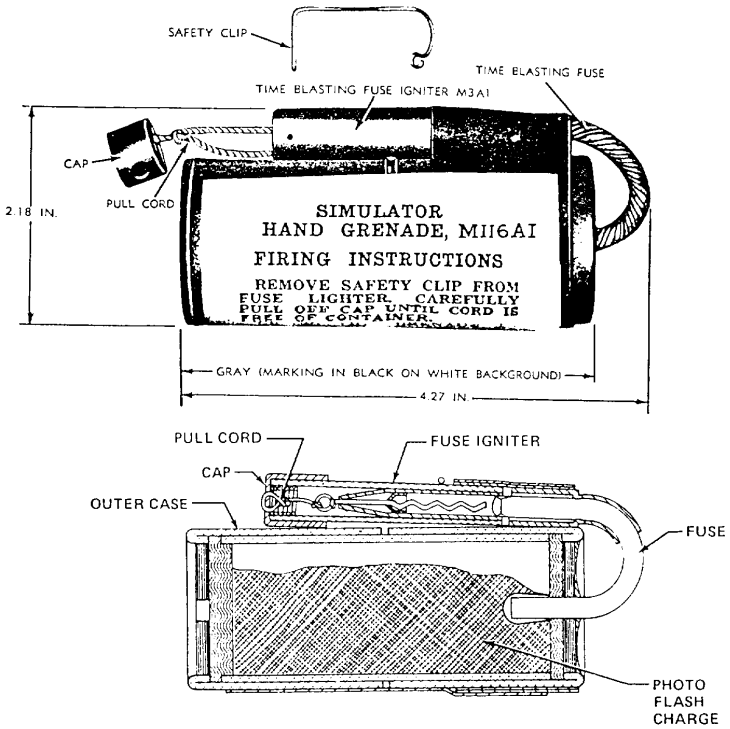
Description: Star cluster signals consist of five-star illumination assemblies and a rocket motor propulsion assembly contained in a hand-held aluminum launching tube. The base of the launching tube contains a primer and an initiating charge. As shipped, the firing pin cap is assembled to the forward end and must be reversed for firing. Stabilizing fins on the tail assembly of rocket are folded parallel to the axis of the signal. A bolt, which also transfers the initiating charge flash to the propellant, extends into the center of the solid propellant which fills the propulsion assembly. The illumination assembly is mounted on top of the propulsion with a delay assembly and an expelling charge between. A label specifying firing procedures is secured to the body of the signal.

Functioning: Striking the primer with the firing pin fires the initiating charge to ignite the rocket propellant. As the rocket emerges from the launching tube, the fins extend for flight stability. Before rocket motor burnout the black powder expelling charge is ignited performing the two fold function of expelling and igniting the 5-star illuminant assemblies.

Length	10.16 inches
Diameter (body)	1.67 inches
Weight	1.3 pounds
Pyrotechnic charge	Illuminant composition 2.5 to 3.75 oz
Initiating charge	Black powder, 0.725 grams
Expelling charge	Black powder, 0.75 grams
Propelling charge	91% Black powder, 9% calcium carbonate, 39.0 grams
Color	White label with black markings Each signal has a cork seal the color of the signal

Reference TM 43-0001-37, Army Ammunition Data Sheets Military Pyrotechnics, April 1977

SIMULATOR, HAND GRENADE, M116A1



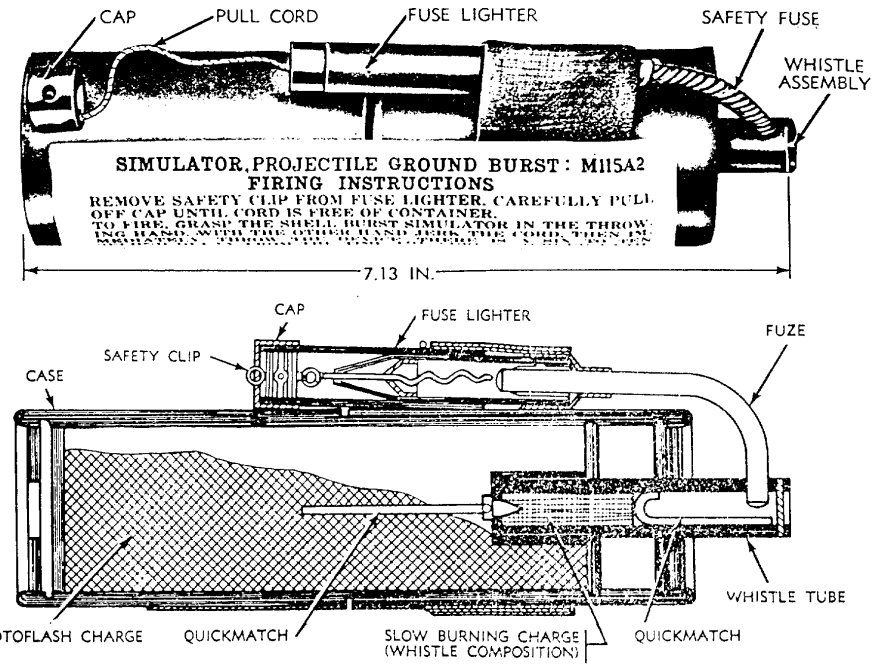
General: This simulator is used to provide battle noises and effects during troop maneuvers. This simulator is ignited by the action of a time blasting fuse igniter (fuse lighter) M3A1 and is thrown like a hand grenade. The time blasting fuse (safety fuse) burns for 5 to 10 seconds after ignition, followed by a flash and accompanying loud report.

Description: The body of the hand grenade simulator consists of a cylindrical paper tube (closed at both ends), containing one and one quarter ounces of photoflash powder. The simulator body is 1.6 inches in diameter (2.18 inches across time blasting fuse igniter) and 3.75 inches long (4.27 inches with time blasting fuse). A length of time blasting fuse extends from the center of one end of the body and, after a 180° bend, is inserted into time blasting fuse igniter M3A1 taped to the side of the simulator. The time blasting fuse igniter contains a double pull coed, a ripple wire coated with a phosphorous friction composition, a small metal cup filled with ignition composition. There is a cellulose nitrate coating on the phosphorous coating and on the ignition composition. The sealing cap is held in place during shipment and handling by a spring type wire safety clip.

M116 Simulator: This simulator is similar to the M116A1, except that the time blasting fuse igniter M3, which has a single pull cord and no cellulose nitrate coating on the phosphorous coated friction wire and ignition composition, is used in place of the time blasting fuse igniter M3A1.

Reference: TM 43-0001-37, Military Pyrotechnics, February 1977
TM 91370-200, Military Pyrotechnics, September 1966

SIMULATOR, PROJECTILE, GROUND BURST, M115A2

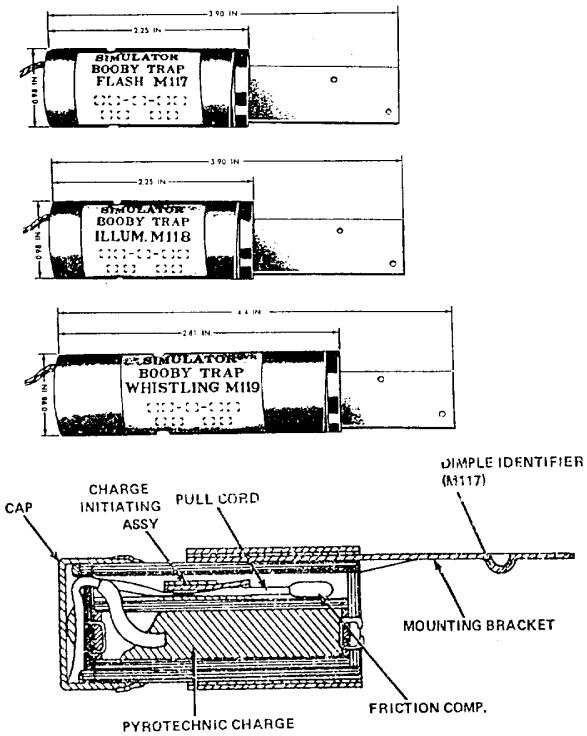


General: This simulator is a pyrotechnic device used to provide battle noises and effects during troop maneuvers. The simulator is ignited by the action of time blasting fuse igniter M3A1. Following a delay of 6 to 10 seconds after ignition, the simulator produces a high pitch whistle which lasts two to four seconds. After a fraction of a second, the simulator explodes, producing a flash and loud report.

Description: The body of the simulator consists of a cylindrical paper tube (closed at both ends) containing approximately 2 ounces of photoflash powder and whistle assembly which extends from one end of the tube. The simulator is 2.38 inches in diameter (including fuse lighter) and 7.13 inches long. The whistle assembly is a paper tube containing a pressed, slow burning powder charge, (2.0 grams). Extending from the side of this assembly is a length of safety fuse which, after a 90° bend, is inserted in a fuse lighter M3A1 taped to the side of the simulator. The fuse lighter contains a double pull cord and a cellulose nitrate coating on the phosphorous-coated friction wire and ignition composition.

Reference: TM 43-0001-37, Military Pyrotechnics, February 1977
TM 9-1370-200, Military Pyrotechnics, September 1966

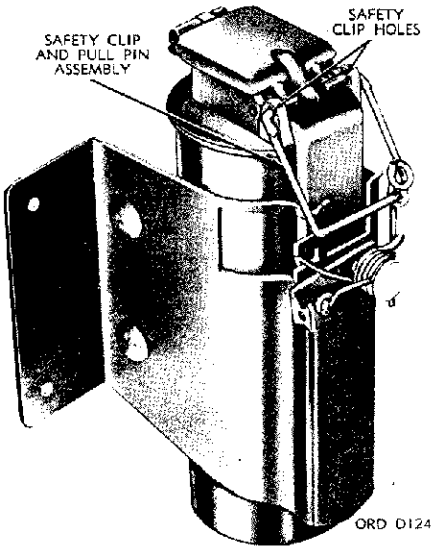
SIMULATOR, BOOBYTRAP, FLASH, M117; ILLUMINATING, M118; WHISTLING, M119

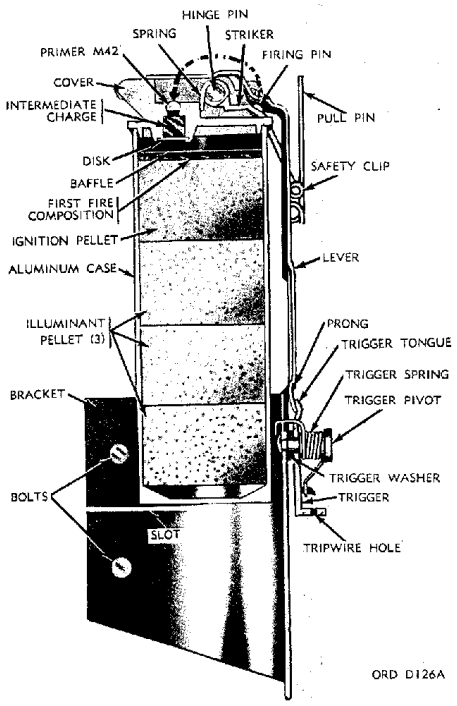


Description: The flash simulator M117 consists of a cylindrical outer tube (kraft paper) and a flat, metal nailing bracket which extends from one end of the tube. The body is 0.98 inch in diameter and, without nailing bracket, 2.25 inches long. The nailing bracket increases the length to 3.90 inches. Located within the outer tube is a charge initiating assembly and an inner tube containing a pyrotechnic charge. The assembly used for initiating the charge is located in the space between the inner and outer tubes. This assembly consists of a strip of paper coated with a friction-sensitive composition and folded into a pad so that the coated surfaces are face to face. The pad is attached to the inner tube. Over the top of the pad is a strip of felt held in place, under light pressure, by adhesive tape wrapped around the inner tube. A length of pull cord runs between the coated surfaces of the pad. One end of the pull cord is covered with friction composition; the other end is coiled and placed in the end of the body opposite the nailing bracket. A paper cap, held on by a strip of tape, covers this end of the simulator.

M117	Flash composition, (0.09 ounces)
M118	Illumination composition, (0.18 ounces)
M119	Whistle composition, (0.12 ounces)
Reference:	TM 43-0001-37, Military Pyrotechnics, February 1977
	TM 9-1370-200, Military Pyrotechnics, September 1966

SURFACE TRIP FLARE, M49A1





Use: To give warning of infiltrating troops by illuminating the field of the advancing enemy.

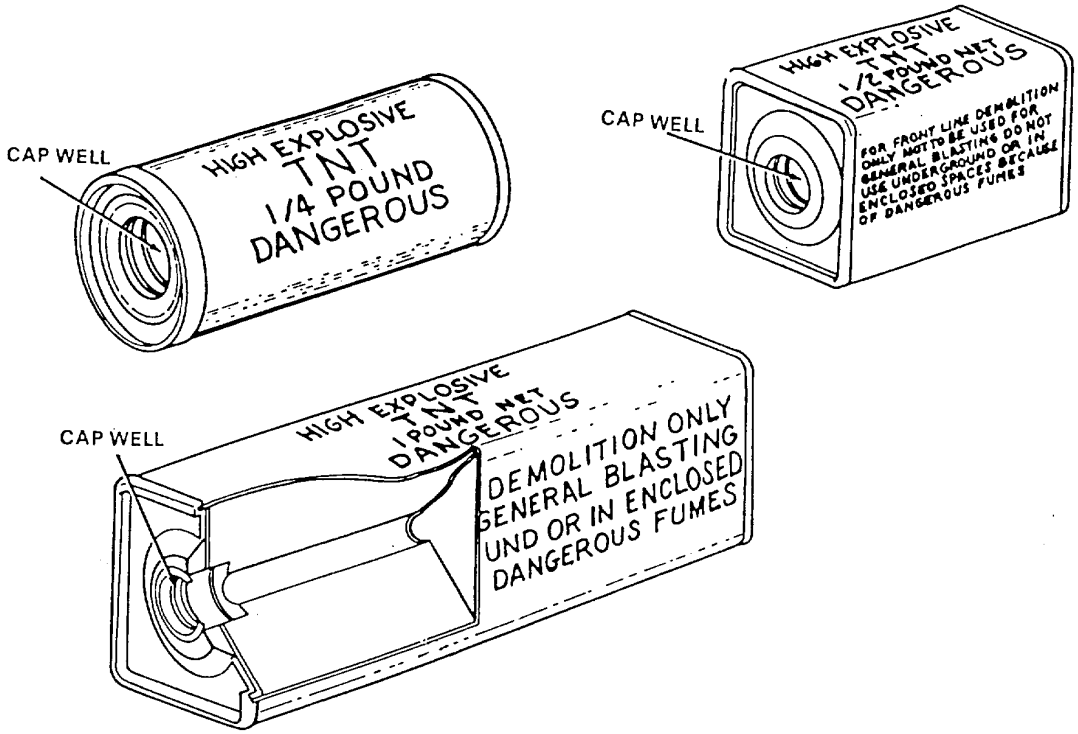
Description: The trip flare consists of an illuminant assembly, cover loading assembly, and mounting bracket assembly. The illuminating assembly is an aluminum case containing an ignition increment and three illuminant increments. The waterproof cover loading assembly contains a percussion primer, intermediate charge and a springloaded striker. The mounting bracket holds the illuminant assembly in the position desired. The lever is hinged to the cover and is held in position by the safety clip when armed. The flare is armed by attaching a trip wire to either the trigger or pull pin.

Functioning: A pull on the trip wire causes either the trigger tongue or pull pin to release the lever, which in turn permits the firing pin to strike the primer. The primer sets off the intermediate charge, which ignites the first-fire composition on the ignition increment of the flare. The flare will provide a light intensity exceeding 35,000 candlepower for approximately one minute.

Length .....4.85 inches
Diameter .....3.10 inches
Weight loaded .....0.75 pounds
Pyrotechnic charge .....Illuminant composition, 5 oz
Primer .....Percussion M42
Color .....Olive drab w/black markings

Reference: TM 9-43-0001-37, Military Pyrotechnics, February 1977

TNT, (TRINITROTOLUENE)



Description: TNT (trinitrotoluene) block demolition charges are standard demolition charges used for all types of demolition work. However, the ¼-pound charge is used primarily for training purposes. TNT is manufactured in the form of light yellow crystals from the successive nitration of toluene. Toluene is produced by byproduct coke ovens as a byproduct in manufacture of illuminating gas in the manufacture of kerosene from crude petroleum. TNT as issued to the service has a density of 1.46 and melts at 176° F. TNT is issued in three sizes. The ¼-pound block is issued in a cylindrical waterproof olive-drab cardboard container. The ½-pound and 1-pound blocks are issued in similar rectangular containers. All of the three charges have metal ends with a threaded cap well in one end. TNT is insensitive in all forms and requires a powerful detonating agent. It will not detonate even under strong pressure or severe blows. It is detonated by the special issue tetryl caps and by detonating cord. The detonation of TNT produces poisonous gases, but in open air these are rapidly dissipated as to be harmless.

Reference: FM 5-25, Explosives and Demolitions, January 1942
FM 5-25, Explosives and Demolitions, May 1967
FM 5-25, Explosives and Demolitions, March 1986

CHEMICAL AGENT IDENTIFICATION SET (CAIS) SET GAS IDENTIFICATION, DETONATION M1

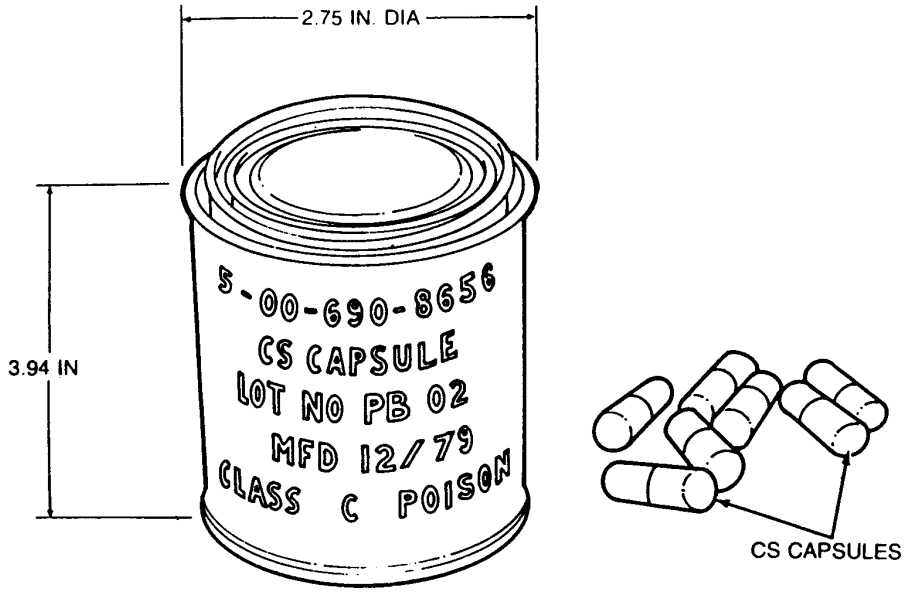
Use: Designed to be used outdoors. The gas tubes would be detonated, creating an agent cloud. Soldiers would then try to identify the agent based on its odor and other characteristics.

Description: The K951/952 CAIS contained 48 Pyrex, flame sealed ampules, 12 each containing 1.4 ounce solution of Mustard (H, 5% in chloroform) Lewisite (L, 5% in chloroform), Chloropicrin (PS, 50% in chloroform), and Phosgene (CG) for a total of 26 fluid ounces of agent, less the chloroform, per set. Each ampoule is 1 inch in diameter and 7½ inches long. Each ampoule is packed in a cardboard screw cap container with agent type indicated by letters on the cardboard container. Twelve cardboard containers each are packaged into 4 press fit metal cans which are 9¼ inches high. The cans are packed into a steel cylinder 6-inches in diameter, approximately 38 inches long and 0.145 inches thick. The open end of the cylinder is closed by a flanged end cover which is secured by eight bolts. The only difference between the K951 and K952 is that the K951 was issued with blasting caps that were packed and shipped in a separate container.

Old Stock Number:..... FSN 1365-025-3273 (K951)
FSN 1365-025-3783 (K952)

Reference: Chemical Agent Identification Set Information Package, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

Capsule, Riot Control Agent: CS



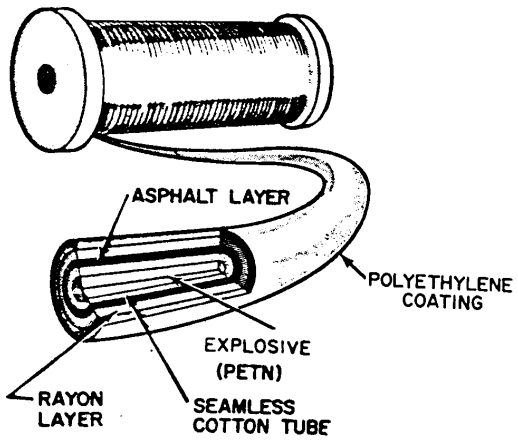
Use: These capsules are used to demonstrate the protection afforded by properly fitted chemical-biological masks, and to demonstrate to unmasked trainees the effects of CS riot control agent.

Description: The capsule consists of a size 00 gelatin capsule filled with ground CS riot control agent (ortho-chlorobenzylidene malon-nitrile). The filled capsule weighs about .82 grams. Fifty CS capsules are packed in a resealable metal can. The CS is aerosolized by placing the capsule on an upened empty tin can that is placed over a burning candle. The CS particles sting and irritate the skin, eyes, nose and throat and have a powerful lachrymatory effect on exposed personnel.

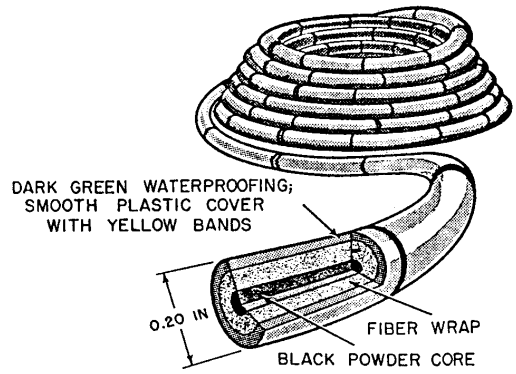
Filler in capsules ..... .82 grams of CS (ortho-chlorobenzylidene malono-nitrile).

References: TM43-0001-26-2, *Chemical Weapons and Munitions,* 29 April, 1982

Cord, Detonating and Fuse, Blasting: Time M700



Detonating cord



Time blasting fuse

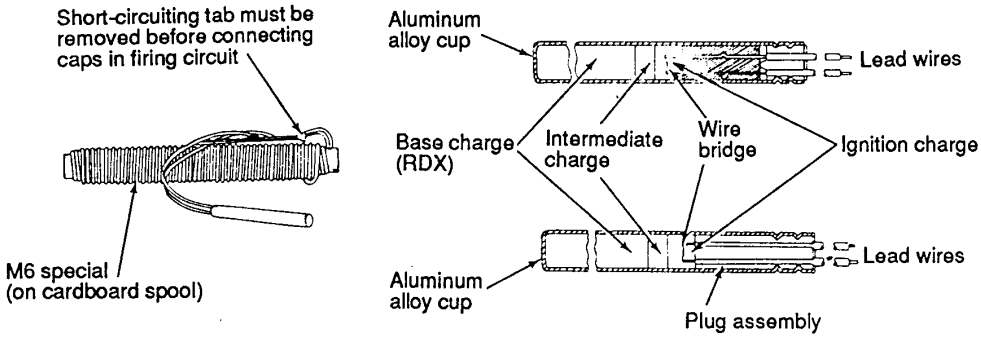
Use: Detonating cord is used to prime and detonate other explosive charges. Time blasting fuse is used to ignite nonelectric blasting caps.

Description: Both of these demolition materials are sheathed in an olive drab plastic cover that resembles thick clothesline, but each has a very different filler. Detonating cord contains a central core of PETN high explosive, while the time blasting fuse contains black powder. The important differnce is that detonating cord explodes at a velocity of 5,000 feet per second, while time blasting fuse burns at around 40 seconds per foot. Detonating cord can be initiated by either electric or nonelectric blasting caps and can transmit an explosive wave from one demolition charge to another. Time blasting fuse is initiated by either a fuse igniter or match and can itself initiate nonelectric blasting caps.

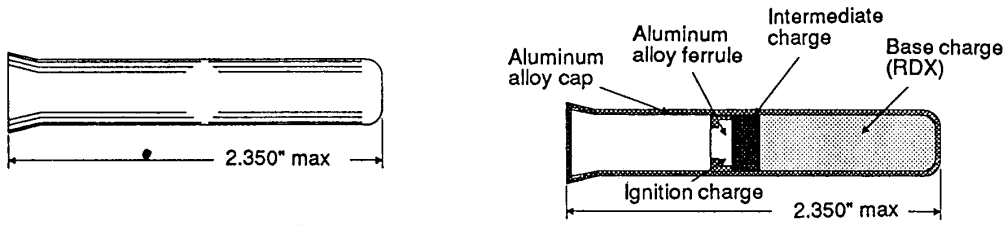
Overall length ..... Detonating cord can be cut to any length from 500-foot or 1,000-foot spools; Time blasting fuse can be cut to any length from 50-foot spools
Diameter ..... approx. 0.20 - 0.23"
Filler ..... Detonating cord: PETN; Time blasting fuse: black powder

References: TM 43-0001-38, Army Ammunition Data Sheets for Demolition Materials, June 1981; FM 5-250, Explosives and Demolitions, 15 June 1992

Cap, Blasting: Electric, M6 and Nonelectric, M7



Electric blasting cap



Nonelectric blasting cap

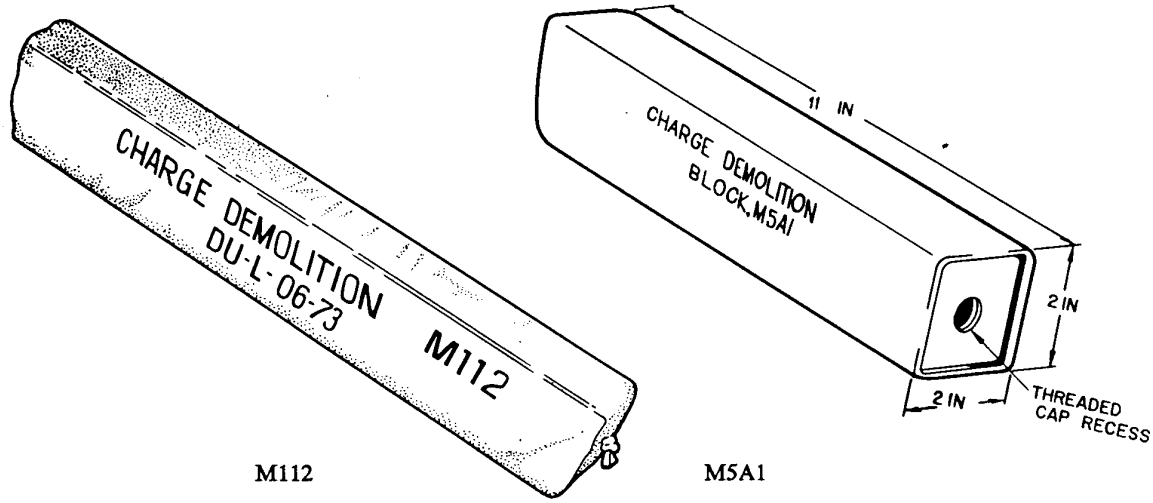
Use: Blasting caps are used to initiate high explosive demolition charges. Electric caps utilize a blasting machine or other source of electric power, while nonelectric caps are used in conjunction with time blasting fuse or a firing device base coupling.

Description: Blasting caps are small, thin aluminum (sometimes copper) tubes containing minute amounts of initiating explosives and a base charge, usually of RDX. Electric caps have two lead wires connected to a bridge wire, which is inside the tube. Nonelectric caps also contain initiating explosives and a base charge, but have a flared opening to accept either time blasting fuse or the base coupling of a firing device. Initiation of these blasting caps will detonate all military explosives.

Overall length ..... 2.35"
Diameter ..... approx. 0.24 - 0.26"
Filler ..... electric: lead styphnate, special mix (smokeless powder) and RDX;
nonelectric: lead styphnate, lead azide, RDX

References: TM 43-0001-38, Army Ammunition Data Sheets for Demolition Materials, June 1981; FM 5-250, Explosives and Demolitions, 15 June 1992

Charge, Demolition: Block M112 and Block M5A1 (Composition C4)



M112 M5A1

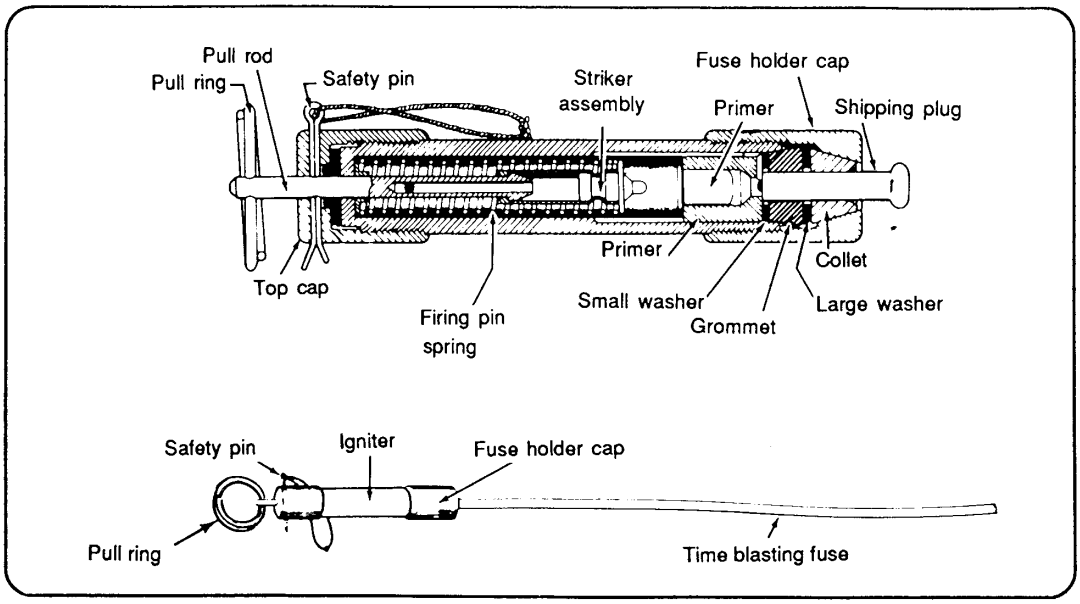
Use: These demolition charges are plastic explosives and are used in all types of demolition work, particularly cutting and breaching.

Description: Both of these demolition charges are made of Composition C4, which is a plastic explosive containing RDX and oily plasticizers. Composition C4 of recent manufacture is white, but older lots may be gray or off-white in color. Charge M112 consists of 1¼ pounds of explosive in a mylar film bag backed with pressure sensitive adhesive tape for adhering to flat, dry surfaces. Charge M5A1 consists of 2½ pounds of explosive in a clear plastic container that has a threaded cap well in each end. These charges can be initiated with electric or nonelectric blasting caps, and when detonated, release large amounts of compressed gas which exerts force in the form of a shock wave. The velocity of detonation for C4 is approximately 26,400 feet per second (8,040 meters per second). Composition C4 is rated as being 1.34 times as effective as TNT, which is the standard by which other explosives are measured.

Dimensions ..... M112 - 11.25" x 2.06" x 1.06"; M5A1 - 12" x 2" x 2"
Filler ..... 91% RDX and 9% non-explosive plasticizers

References: TM 43-0001-38, Army Ammunition Data Sheets for Demolition Materials, June 1981; FM 5-250, Explosives and Demolitions, 15 June 1992; TM 9-1300-214, Military Explosives, 20 September 1984

Igniter, Time Blasting Fuse: M60, Weatherproof



Use: To initiate time blasting fuse in all weather conditions and under water.

Description: This device is a pull-type assembly consisting of three major subassemblies: a firing mechanism, a fuse holder and a primer base. These subassemblies are contained within an olive drab nylon tube. Once a length of time blasting fuse is inserted into the fuse holder cap, the safety cotter pin is removed. A 10 to 30 pound pull on the pull ring brings the spring-loaded firing pin back to the release washer, which spreads the firing pin's jaws. This releases the firing pin from the knobbed end of the pull rod. Once released, the firing pin is driven by the compressed spring into the primer, which fires and ignites the end of the time blasting fuse.

Length . . . . . 4.75"
Diameter . . . . . .75"
Filler . . . . . primer mixture (in primer)

Reference . . . . . TM 43-0001-38, Army Ammunition Data Sheets for Demolition Materials, June 1981; FM 5-250, Explosives and Demolitions, 15 June 1992

APPENDIX D

INTERVIEWS / POC

INTERVIEWS

The following individuals provided pertinent information through interviews concerning Marine Corps Recruit Depot Eastern Recruiting Region Parris Island. A summary of these cited conversations is included in Section 4.3. Details of the conversations are recorded as Telephone Conversation Record for the following:

Individual Contacted	Date Interviewed	Position	Conversation Documented
Thomas Swearengen	9 February 1999	retired Chief Warrant Officer (CW04)	D-3

The archive search team also contacted the following individuals in preparation of this ASR. Conversation with these people yielded information of three general sorts:

- background data contained in written documents
- negative information (i.e. no pertinent knowledge of the site)
- coordination of efforts for various interested parties

While valuable, conversations with these individuals did not yield information cited in this report and hence Telephone Conversation Records have not been included. (See additional Points of Contact under section 4.2 Records Review):

Individual	Telephone Number	Position
Headquarters U.S. Marine Corps (DSN: 225)		
Commandant of the Marine Corps		
2 Navy Annex (LFL-6)		
Washington, D.C. 20380-1775		
CMC (LFL) Environmental Management Section		
Craig Sakai	703-695-8517	Head, Environmental Management Program
Kelly Dreyer	703-695-8302	Installation Restoration Program Manager
CAPT Dave Cook	703-695-8302	
FAX	703-695-8550	
CMC (LFL) Real Estate and Base Structure Section		
Richard Anderson	703-695-8240	
CMC (LFL)		
Kim Weirick	703-695-8202	Deputy Chief, Land Use and MILCON Branch CMC (LFL)
Other		
MAJ Lehmann	703-614-2544	HQMC PP&O (Office, Deputy Chief of Staff for Plans, Policy and Operations)
MAJ Shannon Shy	703-614-2150	HQMC-CL (counsel?)
Marine Corps Recruit Depot Eastern Recruiting Region Parris Island		
Tim Harrington	843-525-3423	Natural Resources and Environmental Affairs Office
	harringtont@pik.usmc.mil	

Sharad Thakar	843-525-2604	Civil Engineer, Public Works
1stLT Ed Power	843-525-3322	Weapons and Field Training Battalion
CW03 Bob Ledyard	843-525-2466	Chief Range Officer
Steven Wise	843-525-3765 wise@clb.usmc.mil	Director, Parris Island Museum
Gloria McGonnel	843-525-2597	Plant Property Manager

Marine Corps Base Quantico (DSN: 278)
Marine Corps Air Ground Museum

Mike Starn	703-784-2606	Aviation Curator

U.S. ARMY CORPS OF ENGINEERS POINT OF CONTACTS (POC)

The following individuals prepared the Archive Search Report or are involved in the process:

U.S. Army Corps of Engineers
St. Louis District
Engineering Division - Ordnance and Technical Services Branch (CEMVS-ED-P)
1222 Spruce Street
St. Louis, MO 63103-2833

Individual	Telephone Number	Position
Kenneth J. Brimm	314-331-8797	ED-P, Historian
Brian Colgate	314-331-8744	ED-S, CADD Specialist
Randal Curtis	314-331-8786	ED-P, ASR Project Manager
Michael Dace	314-331-8036	ED-P, Chief of Ordnance and Technical Service Branch
Shirley Hamilton	314-331-8848	ED-P, Project Assistant
Jennifer James	314-331-8897	ED-P, Quality Assurance Specialist Ammunition Surveillance (QASAS)
Gregg E. Kocher	314-331-8790	ED-P, Safety Specialist
Shelia Thomas	314-331-8793	ED-P, Historian
Rick Webster	314-331-8639	ED-S, Aerial Photography Interpretation

U.S. Army Engineering and Support Center Huntsville
Center of Expertise and Design Center of Ordnance and Explosives
CEHNC-ED-SY-O
P. O. Box 1600
Huntsville, AL 35807-4301

Individual	Telephone Number	Position
Danny Mardis	205-895-1797	ASR Project Manager

TELEPHONE OR VERBAL CONVERSATION RECORD DATE: 9 February 1999
For use of this form, see AR340-15; the proponent agency is the Adjutant General's Office.

SUBJECT OF CONVERSATION UXO and ordnance use at MCRD Parris Island		
PERSON CALLING Randal S. Curtis	ADDRESS CEMVS-ED-P	PHONE NUMBER AND EXTENSION 314-331-8786
PERSON CALLED Thomas F. Swearengen	OFFICE retired Chief Warrant Officer (CW04)	PHONE NUMBER AND EXTENSION 843-525-1464

SUMMARY OF CONVERSATION:

At the suggestion of the installation I spoke with retired Chief Warrant Officer (CW04) Thomas F. Swearengen. We spoke for approximately about 70 minutes as he described his knowledge of UXO and ordnance use at Parris Island. He retired in 1974 with 27 years in EOD and 30 years with the USMC. Once I explained the purpose of my phone call, he provided almost all of this information with little questioning from me (i.e. I wasn't putting words or ideas in mind). On 24 March 1999, the ASR team met personally with him and reconfirmed this information and the locations of items of interest.

His familiarity with Parris Island comes from living there three times: as a youth in the 1930s, boot camp in 1943 and as an EOD officer at MCAS Beaufort from 1965-74 (except for two years in Vietnam). After retiring, he returned to the Port Royal area. His father was SGT. Major at Parris Island, and he was there from 1932-38, when they left for Quantico. He returned during World War II to complete his basic training and act as a drill instructor.

ARTILLERY-PARRIS ISLAND

As he recalled, there was no established artillery ranges at Parris Island in the 1930s. However, he remembered that the 75mm pack howitzers would come down from Quantico and set up near where the current senior enlisted quarters are (in the obstacle courses area). Marines would fire toward Elliot's Beach with Zone 1(i.e. short range) charges. He was unaware of any charge greater than that or any rounds larger than the 75mm being used. Periodically, about 2 dozen times, while he was at MCAS Beaufort, the EOD unit would respond to incidents in the vicinity of trailer park. They found pieces of fuze and shrapnel, but never a complete UXO dud round that he remembered. They also found portions of 75mm projectiles lodged in trees in the Elliot's Beach Area.

He also recalled a reinforced concrete bunker in the woods behind the Weapons Training Battalion. He was fairly certain it still exists but he didn't know what its specific use was but it looked like an observation post (I reported on our research indicating its use for artillery ranges). He never was called to recover UXO in that area but it was covered up with vegetation.

He doesn't know anything about WWII era Defense Battalion 3" and 5" guns, reportedly at Parris Island.

BOMBING RANGES-PARRIS ISLAND

In the 1930's, the bombing range was at what's currently the main parade ground. He recalled watching Marine pilots drop the 5-pound bomblets there as a kid. After the runs were

completed, he and his buddies would dig them up, clean them and then sell them to Marines looking for souvenirs of the lamp variety. He thought they may have been made of zinc or pewter. They made the bombs at the Navy Yard in DC, as his Dad worked there after he was transferred from Parris Island. The parade ground was covered with asphalt by his time in boot camp.

Another bombing range was located near the current golf course. An exact description of the location was difficult to ascertain over the phone but he thought the remnants of the target were still there. The target consisted of welded railroad ties, covered with canvas. The area had lots of debris from the water and sand filled bombs.

STRAFING RANGE-PARRIS ISLAND

He remembered a strafing range in the 1937-38 time frame. The location of the strafing range can be located by "positioning one's self at the entrance to the rappelling tower and facing east toward the swamp". They built a runway over the spot in WWII. Planes would come down from Quantico and land at Page Field, which at the time was nothing but an open field (i.e. no distinct runways). They had built a large wooden platform/deck approximately 100 by 100 feet, which fighters would shot at. Each pilot's ammunition had different color printers ink on it/in it, which was used to score the individual pilots. The biggest ammo that he was aware of them using was caliber .50. However, he remembered recovering 20mm cartridge cases and TP projectiles at places on the island, but not necessarily specifically at this location.

ROCKET RANGE-PARRIS ISLAND

Based on OE debris he collected while with the EOD unit, he thought the 2.36-inch and 3.5-inch rocket range was on the Broad River beach area. The impact area was on the beach, as far north of the pistol range as you could go by vehicle and then some (i.e. it was past the most distant berm for A Range). They cleared out at least a weapons carrier load of WWII and Korean era rocket residue from this area. As he recalled, it was all essentially practice rounds. He felt that with the tidal action in the area, we might still locate some debris. He suspects that the impact area for the rifle grenade range and 60mm mortar range must have been in the same area as the rocket range.

HAND GRENADE RANGES-PARRIS ISLAND

He described a WWII era hand grenade range, located behind the Weapons Battalion HQ in what is now a cleared field. It was near, but well behind, the old indoor swimming pool, which is now gone. It was used for both practice and HE hand grenades but mostly inert training grenades. The range was made up of 2 by 4-inch wood framing, simulating building windows.

The new hand grenade range, which is now closed, is at the extreme east end of the old airfield on the Beaufort River side.

MORTAR RANGES-PARRIS ISLAND

He felt certain that there had been a 60mm range on Parris Island but couldn't say for certain where it was located. He suspected it was in the area of the rocket range (see above) having found mortar OE debris there. To the best of his knowledge the 60mm rounds the recovered were practice rounds. He didn't recall any 81mm rounds except maybe flares.

SMALL ARMS RANGES-PARRIS ISLAND

He remembered that during WWII, the Marines had built pistol and small ranges along Broad River shoreline to the northwest. The pistol range and rifle ranges fired directly into the an impact area in the water. He personally shot rising submachine guns, sub-caliber carbines and pistols there.

He remembered another pistol range near the current marina and O club in the 1930s. It had about 5 berms, about 10-12 feet tall. They were gone by the time he was there for boot camp.

CHEMICAL WARFARE MATERIAL-PARRIS ISLAND

In the 1965-67 time frame, they opened up the old CW warehouse. Located by the gas chamber, it was approximately 100 by 20-30 feet wide galvanized metal building, with a concrete deck. They found a bunch of chemical gas identification kits from WWII. They collected about dozen of the 8-inch diameter metal containers filed with glass tubes. They destroyed the items at MCAS Beaufort by burning them, the standard, prescribed method at the time. The tested the demolition area following the disposal but found no traces of chemical warfare gas residue.

However, in vicinity of the old WWII gas chamber, they tested and detected mustard gas residue, and to a lesser extent lewisite. They determined this by using the glass tube inhaler type detection kits, where material changed color in the presence of different chemical warfare gases.

EOD RANGE-PARRIS ISLAND

There was no EOD or demolition range at Parris Island to his knowledge. The EOD team at Parris Island in the early 1970s, was there primarily for the hand grenade range. They generally destroyed items in place or took them to the EOD range at MCAS Beaufort. The unit at the air station gained the EOD support mission for Parris Island in the early 1970s.

MCAS BEAUFORT

While at MCAS Beaufort, the EOD unit kept the EOD area meticulously clean. However, he did know that the air station had designated an area for burial of radioactive material, generated by different units and/or aircraft. The radiological disposal yard was located on a dirt road past the hobby shop but before the picnic area. A barbed wire fenced area enclosed the area, with a lock on it and appropriate signage.

MCB QUANTICO

He was at Quantico from 1939-43. He recounted a tale of a prank he played on the Marmon-Herrington (CTL3 and 3A), 2 man tank crews. The tanks were tiny, fast, rubber tracked, vehicles that ran around the woods. The Marines had constructed trenches and log walls as obstacles to maneuver over and across but just barely. Prior to some HQ types coming down, he and his buddies increased the depth of the trenches and the height of the log walls, so the tanks could no longer maneuver through them. His pop gave him the expected disciplinary measures of a Marine Corps father of the time.

FUDS RANGES

On the northeastern beach of Hilton Head, he felt there was a bombing range. When he was at MCAS Beaufort, they responded to complaints from the private landowners (Broad River Beach/ Port Royal Plantation Beach) about the OE debris. The OE was primarily HE fragment bombs, with “mushroom head” fuzes but it also included water and sand filled bombs and 2.25-

inch SCAR (sub-caliber aerial rockets). They collected up to 5 dump trucks of OE scrap off the beach, which they buried out in big holes at MCAS Beaufort's demolition range
He knew that prior to WWII, there was a Marine Corps detachment at Hilton Head. They had a small arms range in use there but they came back to Parris Island for yearly qualification. He was not aware of any artillery firing occurring at Hilton Head in the 1930s.

He also suspected that there was some kind of facility at Hunting Island. .The ranger for the State Park would frequently call them out to collect caliber .50 cartridge cases and complete rounds. It was obviously used as some kind of impact area. He also suspected that there may have been some kind of range at Land's End/Bay's Point.

WATER RANGES

As for water targets, he heard rumors of them taking the covered landing craft ("kicker"), which was about 40-50 feet long out, and placing 55 gallon drums in the ocean for aerial target practice.

SITE VISIT

I inquired if CW04 Thomas F. Swearengen would be able to join us during the site visit to help locate some of these areas but he begged off. He's due to go in for chemotherapy for leukemia, next Monday and wasn't sure if he would be out of the hospital by the week of 22 March.

B5

REFERENCES

References

Brown & Root Environmental, 1998a. Master Work Plan for MCRD Parris Island, South Carolina, Volumes I, II and III, March.

CH2MHill, 2009. Sediment Characterization Report Marine Corps Recruit Depot Parris Island, Parris Island, South Carolina. April.

Marine Corps Recruit Depot (MCRD) Eastern Recruiting Region (ERR), Parris Island, South Carolina. 2008. Strategic Plan 2008 – 2013. February 2008.

Naval Energy and Environmental Support Activity (NEESA). September 1986. Initial Assessment Study of MCRD Parris Island, South Carolina, NEESA13-095.

Talmage, S.S., et al. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Reviews of Environmental Contamination and Toxicology*, 161, 1-156.

Tetra Tech (TtNUS), 1999. Parris Island Background Study for Site 3 Causeway Landfill RFI.

United States Army Corps of Engineers (USACE). 1999a. Draft Archive Search Report, Marine Corps Recruit Depot Eastern Recruiting Region Parris Island, Beaufort County, South Carolina. Prepared by USACE, St. Louis District.

USACE. 1999b. Draft Range Identification and Preliminary Range Assessment, Marine Corps Recruit Depot Eastern Recruiting Region Parris Island, Beaufort County, South Carolina. Prepared by USACE, St. Louis District. May.

USACE, Best, et al. 2004. Toxicity and Metabolites of 2,4,6-Trinitrotoluene (TNT) in Plants and Worms from Exposure to Aged Soil. October.

U.S. Environmental Protection Agency (USEPA), 1996. Office of Solid Waste and Emergency Response, ECOTOX Threshold. January.

USEPA, 2001. Region 4 Waste Management Division Soil Screening Valued for Hazardous Waste Sites. November.

USEPA, 2001. Region 4 Waste Management Division Sediment Screening Valued for Hazardous Waste Sites. November.

USEPA, 2002. Guidance for Quality Assurance Project Plans, QA/G-5, EPA/240/R-02/009. December.

USEPA, 2003. Region 5 Ecological Screening Levels for All Media.

USEPA. 2004. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. OSWER 9240.1-45. EPA 540-R-04-004. October.

USEPA, 2005. Ecological Soil Screening Levels for Lead, Interim Final, OSWER Directive 9285.7-70. March.

USEPA, 2005. Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP), Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs (Final Version 1), EPA-505-B-04-900A. March.

USEPA. 2006. Region 3 Freshwater Sediment Screening Benchmarks. August.

USEPA. 2006. Region 3 Marine Sediment Screening Benchmarks. August.

USEPA, 2008. Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. EPA-540-R-08-01. June.

USEPA. 2009. Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. April.

APPENDIX C

MC FIELD STANDARD OPERATING PROCEDURES

APPENDIX C

SOP TABLE OF CONTENTS

SOP-01	Sample Labeling
SOP-02	Sample Identification Nomenclature
SOP-03	Sample Custody and Documentation of Field Activities
SOP-04	Decontamination of Field Sampling Equipment
SOP-05	Soil Coring and Sampling Using Hand Auger Techniques
SOP-06	Sediment Sampling
SOP-07	Borehole and Soil Sample Logging
SOP-08	Sample Preservation, Packaging, and Shipping
SOP-09	Management of Investigation Derived Waste
SOP-10	Field Portable X-Ray Fluorescence Analysis of Soil and Sediment Samples Using the INNOV-X-Alpha Series Instrument
SOP-11	Large Water Body Sediment Sampling
SOP -12	MIS Sampling
MRP SOP 02	MEC Management and Accountability
MRP SOP 05	Global Positioning System

STANDARD OPERATING PROCEDURE

SOP-01

SAMPLE LABELING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures to be used for labeling sample containers. Sample labels are used to document the sample ID, date, time, analysis to be performed, preservative, matrix, sampler, and the analytical laboratory. A sample label will be attached to each sample container.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Writing utensil (preferably black pen with indelible ink)
Disposable medical-grade gloves (e.g. latex, nitrile)
Sample log sheets
Required sample containers: All sample containers for analysis by fixed-base laboratories will be supplied and deemed certified clean by the laboratory.
Sample labels
Chain-of-custody records
Sealable polyethylene bags
Heavy-duty cooler
Ice

3.0 PROCEDURES

3.1 The following information will be electronically printed on each sample label prior to mobilizing for field activities. Additional “generic” labels will also be printed prior to mobilization to be used for field QC and backups.

- Project number (CTO 0089)
- Sample location ID
- Contract Task Order number
- Sample ID

- Matrix
- Preservative
- Analysis to be performed
- Laboratory name

3.2 Select the container(s) that are appropriate for a given sample. Select the sample-specific ID label(s), complete date, time, and sampler name, and affix to the sample container(s).

3.3 Fill the appropriate containers with sample material. Securely close the container lids without overtightening.

3.4 Place the sample container in a sealable polyethylene bag and place in a cooler containing ice.

Example of a sample label is attached at the end of this SOP.

4.0 ATTACHMENTS

1. Sample Label

ATTACHMENT 1

SAMPLE LABEL

Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090	**Project:** **Location:** **CTO:**	
Sample No:		**Matrix:**
Date:	**Time:**	**Preserve:**
Analysis:		
Sampled by:	**Laboratory**	

STANDARD OPERATING PROCEDURE

SOP-02

SAMPLE IDENTIFICATION NOMENCLATURE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish a consistent sample nomenclature system that will facilitate subsequent data management at the MCRD Parris Island. Surface soil and sediment samples are proposed for collection at the UXO sites, additional sampling media are included in this SOP for reference. The sample nomenclature system has been devised such that the following objectives can be attained.

- Sorting of data by site, location, or matrix
- Maintenance of consistency (field, laboratory, and database sample numbers)
- Accommodation of all project-specific requirements
- Accommodation of laboratory sample number length constraints
- Ease of sample identification

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Writing utensil (preferably black pen with indelible ink)
Sample container labels

3.0 SAMPLE IDENTIFICATION NOMENCLATURE

3.1 <u>Samples</u>

All samples will be properly labeled with a sample label affixed to the sample container. Each sample will be assigned a unique sample tracking number.

3.1.1 Sample Numbering Scheme

The sample tracking number will consist of a four- or five-segment alpha-numeric code that identifies the sample's associated Unexploded Ordnance (UXO) site, sample type, location, and for aqueous samples, if applicable, whether a sample is filtered, and/or the sample round number. For soil samples, the final

four tracking numbers will identify the depth in units of feet below ground surface (bgs) at which the sample was collected. For sediment samples, the final four tracking numbers will identify the depth in units of inches bgs at which the sample was collected.

The alphanumeric coding to be used is explained in the following diagram and subsequent definitions:

ANN	**AA**	**NNN**	**NNNN (Soil and Sediment only)**
UXO Number	Matrix	Sample Location Number and Grab or Composite	Sequential depth interval from freshly exposed surface

Character Type:

A = Alpha

N = Numeric

UXO Number (ANN):

X02 = UXO 02

X04 = UXO 04

X05 = UXO 05

X06 = UXO 06

Matrix Code (AA):

SS = Surface Soil Sample

SD = Sediment Sample

Location Number (NNN):

Sequential number beginning with “001” for each matrix, followed by a letter indicating grab (G) (or composite [C] sample, if appropriate).

Depth Interval:

This code section will be used for soil and sediment samples only.

The depth code is used to note the depth bgs at which a soil or sediment sample is collected. The first two numbers of the four-number code specify the top interval, and the third and fourth specify the bottom interval. The surface soil sample intervals will be in inches or feet (ie: 0- to 6-inches for composite/IS

samples and 0- to 1-foot for discrete/grab samples). The interval for sediment samples will be in inches (0- to 6-inches and 24- to 36-inches). The depths will be noted in whole numbers only; further detail, if needed, will be recorded on the sample log sheet, boring log, logbook, etc.

3.1.2 Examples of Confirmation Sample Nomenclature

A composite surface soil sample collected from UXO 04, sample location 003, at the depth interval of 0 to 1 foot would be labeled as “X04SS03G0001”. A grab sediment sample collected from UXO 06, sampling location 010, to a depth of 6 inches bgs would be labeled as “X06SD10G0006”.

3.2 Field Quality Assurance/Quality Control (QA/QC) Sample Nomenclature

Field QA/QC samples are described in this UFP SAP. They will be designated using a different coding system than the one used for regular field samples.

3.2.1 QC Sample Numbering

The QC code will consist of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AA	NNNNNN	NN
QC Type	Date	Sequence Number (per day)

Character Type:

A = Alpha

N = Numeric

QC Types:

FD = Field Duplicate

FT = Field Triplicate

RB = Rinsate Blank

SB = Source Blank

The sampling time recorded on the Chain-of-Custody Form, labels, and tags for field duplicate samples will be 0000 so that the samples are "blind" to the laboratory. Notes detailing the sample number, time, date, and type will be recorded on the sample log sheets and will document the location of the duplicate sample (sample log sheets are not provided to the laboratory).

3.2.2 Examples of Field QA/QC Sample Nomenclature

The first duplicate of the day at UXO 1 for a surface soil sample collected on March 24, 2008 would be designated as FD03240801.

The third duplicate of the day taken at UXO 08 of a surface soil sample collected on April 12, 2008 would be designated as FD04120803.

STANDARD OPERATING PROCEDURE

SOP-03

SAMPLE CUSTODY AND DOCUMENTATION OF FIELD ACTIVITIES

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes the procedures for sample custody and documentation of field sampling and field analyses activities.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

The following logbooks, forms, labels, and equipment are required.

Writing utensil (preferably black pen with indelible ink)
Site logbook
Field logbook
Sample label
Chain-of-Custody Form
Custody seals
Equipment calibration log
Soil and Sediment Sample Log Sheet
Surface Water Sample Log Sheet

3.0 PROCEDURES

This section describes custody and documentation procedures. All entries made into the logbooks, custody documents, logs, and log sheets described in this SOP must be made in indelible ink (black is preferred). No erasures are permitted. If an incorrect entry is made, the entry will be crossed out with a single strike mark, initialed, and dated.

3.1 <u>Site Logbook</u>

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major on-site activities are documented. At a minimum, the following activities and events will be recorded (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of sampling activities
- Daily on-site activities performed each day
- Sample pickup information
- Health and safety issues
- Weather conditions

The site logbook is initiated at the start of the first on-site activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that on-site activities take place.

The following information must be recorded on the cover of each site logbook:

- Project name
- Project number
- Book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). At the completion of each day's entries, the site logbook must be signed and dated by the field operations leader (FOL).

3.2 Field Logbooks

The field logbook is a separate dedicated notebook used by field personnel to document his or her activities in the field. This notebook is hardbound and paginated.

3.3 Sample Labels

Adhesive sample container labels must be completed and applied to every sample container. Information on the label includes the project name, location, sample number, date, time,

preservative, analysis, matrix, sampler's initials, and the name of the laboratory performing the analysis.

3.4 Chain-of-Custody Form

The Chain-of-Custody Form (COC) is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as it is transferred from person to person. Each COC is numbered. This form must accompany any samples collected for laboratory chemical analysis. A copy of a blank COC form is attached at the end of this SOP.

The FOL must include the name of the laboratory in the upper right hand corner section to ensure that the samples are forwarded to the correct location. If more than one COC is necessary for any cooler, the FOL will indicate "Page __ of __" on each COC. The original (top) signed copy of the COC will be placed inside a sealable polyethylene bag and taped inside the lid of the shipping cooler. Once the samples are received at the laboratory, the sample custodian checks the contents of the cooler(s) against the enclosed COC(s). Any problems are noted on the enclosed COC Form (bottle breakage, discrepancies between the sample labels, COC form, etc.) and will be resolved through communication between the laboratory point-of-contact and the Task Order Manager (TOM). The COC form is signed and retained by the laboratory and becomes part of the sample's corresponding analytical data package.

3.5 Custody Seal

The custody seal is an adhesive-backed label, and it is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transit to the laboratory. The custody seals are signed and dated by the samplers and affixed across the opening edges of each cooler (two seals per cooler) containing environmental samples. The laboratory sample custodian will examine the custody seal for evidence of tampering and will notify the Tetra Tech PM if evidence of tampering is observed.

3.6 Equipment Calibration Log

The Equipment Calibration Log is used to document calibration of measuring equipment used in the field. The Equipment Calibration Log documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device requiring calibration. Entries must be made for each day the equipment is used.

3.7 Sample Log Sheets

The Soil Log Sheets are used to document the sampling of soils and sediments.

4.0 ATTACHMENTS

1. Chain-of-Custody Record
2. Equipment Calibration Log
3. Soil and Sediment Sample Log

ATTACHMENT 1
CHAIN-OF-CUSTODY RECORD

CHAIN OF CUSTODY | NUMBER | PAGE ____ OF _____

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
		CARRIER/WAYBILL NUMBER	CITY, STATE

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

TYPE OF ANALYSIS

DATE YEAR ____	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS									COMMENTS

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

ATTACHMENT 2
EQUIPMENT CALIBRATION LOG

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

PROJECT NAME : _____

SITE NAME: _____

PROJECT No.: _____

INSTRUMENT NAME/MODEL: _____

MANUFACTURER: _____

SERIAL NUMBER: _____

Date of Calibration	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot No.)	Remarks and Comments
			Pre-calibration	Post-calibration	Pre-calibration	Post-calibration		

ATTACHMENT 3

SOIL AND SEDIMENT SAMPLE LOG SHEET

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

STANDARD OPERATING PROCEDURE

SOP-04

DECONTAMINATION OF FIELD SAMPLING EQUIPMENT

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes the procedures to be followed when decontaminating non-dedicated field sampling equipment during the field investigations.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Writing utensil (preferably black pen with indelible ink)
Non-latex rubber or plastic gloves
Cotton gloves
Field logbook
Potable water
Deionized water
Isoproponal (optional)
LiquiNox detergent
Brushes, spray bottles, paper towels, etc.
Container to collect and transport decontamination fluids

3.0 DECONTAMINATION PROCEDURES

3.1 Don non-latex and/or cotton gloves and decontaminate sampling equipment (in accordance with the following steps) prior to field sampling and between samples.

3.2 Rinse the equipment with potable water. Rinsing may be conducted by spraying with water from a spray bottle or by dipping. Collect the potable water rinsate into a container.

3.3 Wash the equipment with a solution of LiquiNox detergent. Prepare the LiquiNox wash solution in accordance with the instructions on the LiquiNox container. Collect the LiquiNox wash solution into a container. Use brushes or sprays as appropriate for the equipment. If oily residue has accumulated on the sampling equipment, remove the residue with an isopropanol wash and repeat the Liquinox wash.

3.4 Rinse the equipment with potable water. Rinsing may be conducted by spraying with water from a spray bottle or by dipping. Collect the potable water rinsate into a container.

3.5 Rinse the equipment with deionized water. Rinsing may be conducted by spraying with water from a spray bottle or by dipping. Collect the deionized water rinsate into a container.

3.6 Remove excess water by air drying, shaking, or by wiping with paper towels as necessary.

3.7 Document decontamination by recording it in the field logbook.

3.8 Containerized decontamination solutions will not be necessary for this project. Decontamination solutions/rinse fluids will be applied to the ground at each individual site before leaving the site.

STANDARD OPERATING PROCEDURE

SOP-05

SOIL CORING AND SAMPLING USING HAND AUGER TECHNIQUES

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures for collecting surface and subsurface soil cores from unconsolidated overburden materials using hand augering techniques.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Disposable medical-grade gloves (e.g., latex, nitrile)
Writing utensil (preferably black pen with indelible ink)
Indelible marker
Stainless Steel Auger Buckets
Stainless Steel Extension Rods
Cross Handle
Required decontamination materials
Bentonite pellets
Sealable polyethylene bags
Sample labels
Shipping containers (containing ice)
Disposable plastic trowels or stainless steel trowels
Stainless steel mixing bowls
Sample containers: Sample containers are certified clean by the laboratory supplying the containers.
Soil Sample Log Forms
Daily Activity Logs
Chain-of-Custody Form
Soil Boring Log

3.0 BOREHOLE ADVANCEMENT AND SOIL SAMPLING USING A HAND AUGER

Hand Augers may be employed to collect the soil cores. A hand augering system generally consists of a variety of all stainless steel bucket bits (i.e. cylinders 6-1/2" long and 2-3/4", 3-1/4", and 4" in diameter), a series of extension rods (available in 2', 3', 4' and 5' lengths), a cross handle.

3.1 The hand auger can be used in a wide variety of soil conditions. It can be used to sample soil, both from the surface, or to depths in excess of 12 feet. However, the presence or rock layers and the collapse of the borehole normally contribute to its limiting factors.

Attach a properly decontaminated bucket bit into a clean extension rod and further attach the cross handle to the extension rod.

3.2 Clear the area to be sampled of any surface debris (vegetation, twigs, rocks, letter, etc.)

3.3. Turn the hand auger sampler into the ground to a depth of 1 foot. The 0- to 1-foot depth soil interval is considered to be the surface soil.

3.4 After reaching the desired depth, slowly and carefully withdraw the apparatus from the borehole.

3.4 Utilizing a properly decontaminated stainless steel trowel or disposable trowel, remove the sample material from the bucket bit and place into a sealable polyethylene bag. Note in a field notebook or on a standardized data sheet any changes in the color, texture or odor of the soil.

3.5 Thoroughly homogenize the sample material and write sample ID, date, and time on the bag with an indelible marker.

3.6 Complete required information on the Soil Sample Log Sheet (copy attached at the end of this SOP). Update the Chain-of-Custody (COC) Form.

3.7 Excess soil core materials will be returned to the hole and tamped. If insufficient soil is available to fill the hole to the ground surface, then bentonite pellets mixed with the soil will be used to backfill the hole, and hydrated with potable water.

3.8 Decontaminate all soil sampling equipment in accordance with SOP-04 before collecting the next sample.

3.9 Soil samples shipped to a fixed-base laboratory for analysis will be in sample containers supplied by the laboratory. The sample labels will be completed and affixed to the sample container. The samples will then be packaged and shipped to the fixed-base laboratory in accordance with SOP-06.

4.0 ATTACHMENTS

1. Soil and Sediment Sample Log Sheet
2. Soil Boring Log Sheet

ATTACHMENT 1

SOIL AND SEDIMENT SAMPLE LOG SHEET

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

STANDARD OPERATING PROCEDURE

SOP-06

SEDIMENT SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes the procedure for sediment sampling in streams and other waterways.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

The following field forms and equipment are required for sediment sampling.

Sediment Sample Log Forms: A copy of this form is attached at the end of this SOP.
Writing utensil (preferably black pen with indelible ink)
Indelible marker
Bound field logbook
Disposable plastic trowels
Survey stakes and flagging: Used to mark sampling locations after completion of sampling.
Labeled sample containers: See SOP-01 for sample labeling procedures. Sample containers are certified clean by the laboratory supplying the containers.
Sealable polyethylene bags
Shipping containers (containing ice)
Disposable medical-grade gloves (e.g., latex, nitrile)
Chain-of-Custody Form

3.0 SEDIMENT SAMPLE LOCATION SELECTION

In general, sediments composed of fine-grained materials with greater surface area available for adsorption are more desirable for sample selection. The fined-grained materials may act as a sink or reservoir for adsorbing heavy metals and organic contaminants even if surface runoff concentrations are below detection limits. Therefore, it is important to locate the specific sampling points where the sediment has the greatest percentage of fine particles. The sampling personnel will determine specific sampling locations with these goals in mind.

4.0 SEDIMENT SAMPLING PROCEDURES

4.1 The sampler will wear clean, disposable medical-grade gloves. Clear vegetative matter or debris, if present, from the sample location using a disposable sampling trowel or spoon. Use the trowel to dig up and homogenize the sediment in an 18-inch-diameter circular area that is 6 inches deep. Stir the sediment within the circular area; do not move the sediment outside the circle. Also, do not dig or stir sediment that is deeper than 6 inches below the ground surface, until the next depth interval is sampled.

- Use the same trowel to scoop the homogenized sediment into the requisite labeled sample container(s).

4.2 Record the sample time (using military time) on the Sediment Sample Log Form and sample container labels. Record all other information required on the labels as specified by SOP-01.

4.3 Place the labeled sample container into a sealable polyethylene bag and then place the bag holding the sample container into a cooler containing ice.

4.4 Record date, sampling site, site conditions, location map, and other information (e.g., presence and flow rate of water in channel) on the Sediment Collection Log Sheet. Enter the sample information onto the Chain-of-Custody Form in accordance with SOP-03.

4.5 Using an indelible marker, write the sample identification on a survey stake, and drive the stake into the ground at the sample location. Tack a piece of brightly colored flagging to the stake. In addition, tie a piece of flagging to an overhead tree branch or other eye-level object to improve the ability to relocate the sampling site in the future.

5.0 ATTACHMENTS

1. Soil and Sediment Sample Log Sheet

ATTACHMENT 1

SOIL AND SEDIMENT SAMPLE LOG SHEET

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

STANDARD OPERATING PROCEDURE

SOP-07

BOREHOLE AND SOIL SAMPLE LOGGING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the standard procedures and technical guidance on the logging of soil cores.

2.0 FIELD FORMS AND EQUIPMENT

Knife
Ruler (marked in tenths and hundredths of feet)
Boring Log: An example of this form is attached.
Writing utensil (preferably black pen with indelible ink)

3.0 RESPONSIBILITIES

A field geologist or engineer is responsible for supervising all boring activities and assuring that each borehole is properly and completely logged.

4.0 PROCEDURES FOR BOREHOLE AND SAMPLE LOGGING

To maintain a consistent classification of soil, it is imperative that the field geologist understands and accurately uses the field classification system described in this SOP. This identification is based on visual examination and manual tests.

4.1 <u>USCS Classification</u>

Soils are to be classified according to the Unified Soil Classification System (USCS). This method of classification is detailed in Figure 1 (attached to this SOP).

This method of classification identifies soil types on the basis of grain size and cohesiveness.

Fine-grained soils, or fines, are smaller than the No. 200 sieve and are of two types: silt (M) and clay (C). Some classification systems define size ranges for these soil particles, but for field classification purposes, they are identified by their respective behaviors. Organic material (O) is a common component of soil but has no distinguishable size range; it is recognized by its composition. The careful study of the USCS will aid in developing the competence and consistency necessary for the classification of soils.

Coarse-grained soils will be divided into categories: rock fragments, sand, or gravel. The terms "sand" and "gravel" not only refer to the size of the soil particles but also to their depositional history. To insure accuracy in description, the term "rock fragments" will be used to indicate angular granular materials resulting from the breakup of rock. The sharp edges that are typically observed indicate little or no transport from their source area; and therefore, the term provides additional information in reconstructing the depositional environment of the soils encountered. When the term "rock fragments" is used, it will be followed by a size designation such as "(1/4 inchΦ-1/2 inchΦ)" or "coarse-sand size" either immediately after the entry or in the remarks column. The USCS classification would not be affected by this variation in terms.

4.2 Color

Soil colors will be described utilizing a single color descriptor preceded, when necessary, by a modifier to denote variations in shade or color mixtures. A soil could therefore be referred to as "gray" or "light gray" or "blue-gray." Because color can be utilized in correlating units between sampling locations, it is important for color descriptions to be consistent from one boring to another.

Colors must be described while the sample is still moist. Soil samples will be broken or split vertically to describe colors. Samplers tend to smear the sample surface, creating color variations between the sample interior and exterior.

The term "mottled" will be used to indicate soils irregularly marked with spots of different colors. Mottling in soils usually indicates poor aeration and lack of good drainage.

4.3 Relative Density and Consistency

To classify the relative density and/or consistency of a soil, the geologist is to first identify the soil type. Granular soils contain predominantly sands and gravels. They are non-cohesive (particles do not adhere well when compressed). Finer-grained soils (silts and clays) are cohesive (particles will adhere together when compressed).

Granular soils are given the USCS classifications GW, GP, GM, SW, SP, SM, GC, or SC (see Figure 1).

The consistency of cohesive soils is determined by performing field tests and identifying the consistency as shown in the following table.

CONSISTENCY FOR COHESIVE SOILS

Consistency	Standard Penetration Resistance (Blows per Foot)	Unconfined Compressive Strength (Tons/Sq. Foot by pocket penetration)	Field Identification
Very soft	0 to 2	Less than 0.25	Easily penetrated several inches by fist.
Soft	2 to 4	0.25 to 0.50	Easily penetrated several inches by thumb.
Medium stiff	4 to 8	0.50 to 1.0	Can be penetrated several inches by thumb with moderate effort.
Stiff	8 to 15	1.0 to 2.0	Readily indented by thumb but penetrated only with great effort.
Very stiff	15 to 30	2.0 to 4.0	Readily indented by thumbnail.
Hard	Over 30	More than 4.0	Indented with difficulty by thumbnail.

Cohesive soils are given the USCS classifications ML, MH, CL, CH, OL, or OH (see Figure 1).

The consistency of cohesive soils is determined by hand by determining the resistance to penetration by the thumb. The thumb determination methods are conducted on a selected sample of the soil, preferably the lowest 0.5 foot of the sample. The sample will be broken in half and the thumb pushed into the end of the sample to determine the consistency. Do not determine consistency by attempting to penetrate a rock fragment. If the sample is decomposed rock, it is classified as a soft decomposed rock rather than a hard soil. One of the other methods will be used in conjunction with it. The designations used to describe the consistency of cohesive soils are shown in the above-listed table.

4.4 Weight Percentages

In nature, soils are consist of particles of varying size and shape and are combinations of the various grain types. The following terms are useful in the description of soil:

Terms of Identifying Proportion of the Component	Defining Range of Percentages by Weight
Trace	0 - 10 percent
Some	11 - 30 percent
Adjective form of the soil type (e.g., sandy)	31 - 50 percent

Examples:

- Silty fine sand: 50 to 69 percent fine sand, 31 to 50 percent silt.
- Medium to coarse sand, some silt: 70 to 80 percent medium to coarse sand, 11 to 30 percent silt.
- Fine sandy silt, trace clay: 50 to 68 percent silt, 31 to 49 percent fine sand, 1 to 10 percent clay.
- Clayey silt, some coarse sand: 70 to 89 percent clayey silt, 11 to 30 percent coarse sand.

4.5 Moisture

Moisture content is estimated in the field according to four categories: dry, moist, wet, and saturated. In dry soil, there appears to be little or no water. Saturated samples obviously have all the water they can hold. Moist and wet classifications are somewhat subjective and often are determined by the individual's judgment. A suggested parameter for this would be calling a soil wet if rolling it in the gloved hand or on a porous surface liberates water (i.e., dirties or muddies the surface). Whatever method is adopted for describing moisture, it is important that the method used by an individual remains consistent throughout an entire field activity.

4.6 Classification of Soil Grain Size for Chemical Analysis

To determine the gross grain size classification (e.g., clay, silt, and sand) from the USCS classification described above, the following table will be used.

Gross Soil Grain Size Classification	USCS Abbreviation	Description
Clay	CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays,.
	CH	inorganic clays of high plasticity, fat clays.
	OH	organic clays of medium to high plasticity, organic silts.
Silt	ML	inorganic silts and very fine sands, rock four, silty or clayey fine sands with slight plasticity.
	OL	organic silts and organic silty clays of low plasticity..
	MH	inorganic silts, micaceous or diatomaceous fine sand or silty soils.
Sand	SW	well graded sands, gravelly sands, little or no fines.

Gross Soil Grain Size Classification	USCS Abbreviation	Description
	SP	poorly graded sands, gravelly sands, little or no fines.
	SM	silty sands, sand-silt mixtures.
	SC	clayey sands, sand-clay mixtures.

4.7 Summary of Soil Classification

In summary, soils will be classified in a similar manner by each geologist/engineer at a project site. The hierarchy of classification is as follows:

- Density and/or consistency
- Color
- Plasticity (optional)
- Soil types
- Moisture content
- Other distinguishing features
- Grain size
- Depositional environment

4.0 ATTACHMENTS

1. Figure 1 - Unified Soil Classification System
2. Boring Log

ATTACHMENT 1

FIGURE 1 - UNIFIED SOIL CLASSIFICATION SYSTEM

Unified Soil Classification System

Coarse Grained Soils (more than half of soil > No. 200 sieve)	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Sandy gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-silt mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
Fine Grained Soils (more than half of soil < No. 200 sieve)	Silts and Clays LL = < 50	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils, elastic silts
		CH	Inorganic silts of high plasticity, fat clays
		OH	Organic clays of high plasticity, organic silty clays, organic silts
Highly Organic Soils		Pt	Peat and other highly organic soils

Grain Size Chart

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size In Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 7.76
coarse	3" to 3/4"	76.2 to 4.76
fine	3/4"to No.4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No.4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

Relative Density (SPT)

SANDS AND GRAVELS	BLOWS/FOOT
VERY LOOSE	0 – 4
LOOSE	4 – 10
MEDIUM DENSE	10 – 30
DENSE	32 – 50
VERY DENSE	OVER 50

Consistency (SPT)

SILTS AND CLAYS	BLOWS/FOOT
VERY SOFT	0 – 2
SOFT	2 – 4
MEDIUM STIFF	4 – 8
STIFF	8 – 16
VERY STIFF	16 – 22
HARD	OVER 32

ATTACHMENT 2

BORING LOG

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING No.: _____
PROJECT NUMBER: _____ DATE: _____
DRILLING COMPANY: _____ GEOLOGIST: _____
DRILLING RIG: _____ DRILLER: _____

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

STANDARD OPERATING PROCEDURE

SOP-08

SAMPLE PRESERVATION, PACKAGING, AND SHIPPING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures for sample preservation, packaging, and shipping to be used in handling soil samples.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Shipping labels
Custody seals
Chain-of-custody (COC) form(s)
Sample containers with preservatives: All sample containers for analysis by fixed-base laboratories will be supplied, with preservatives added (if required) and deemed certified clean by the laboratory.
Sample shipping containers (coolers): All sample shipping containers are supplied by the laboratory.
Packaging material: Bubble wrap, sealable polyethylene bags, strapping tape, etc.

3.0 PROCEDURES FOR SAMPLE PRESERVATION, PACKAGING, AND SHIPPING

3.1 The laboratory provides sample containers with preservative already included (as required) for the analytical parameter for which the sample is to be analyzed. All samples will be held, stored, and shipped at 4°C. This will be accomplished through refrigeration (used to hold samples prior to shipment) and/or ice.

3.2 The sampler shall maintain custody of the samples until the samples are relinquished to another custodian or to the common carrier.

3.3 Check that each sample container is properly labeled, the container lid is securely fastened, and the container is sealed in a polyethylene bag.

3.4 If the container is glass, place the sample container into a bubble-out shipping bag and seal the bag using the self-sealing, pressure sensitive tape supplied with the bag.

3.5 Inspect the insulated shipping cooler. Check for any cracks, holes, broken handles, etc. If the cooler has a drain plug, make certain it is sealed shut, both inside and outside of the cooler. If the cooler is questionable for shipping, the cooler must be discarded.

3.6 Line the cooler with large plastic bag, and line the bottom of the cooler with a layer of bubble wrap. Place the sample containers into the shipping cooler in an upright position (containers will be upright, with the exception of any 40-ml vials). Continue filling the cooler with ice until the cooler is nearly full and the movement of the sample containers is limited.

3.7 Wrap the large plastic bag closed and secure with tape.

3.8 Place the original (top) signed copy of the COC form inside a sealable polyethylene bag. Tape the bag to the inside of the lid of the shipping cooler.

3.9 Close the cooler and seal the cooler with approximately four wraps of strapping tape at each end of the cooler. Prior to wrapping the last wrap of strapping tape, apply a signed and dated custody seal to each side of the cooler (one per side). Cover the custody seal with the last wrap of tape. This will provide a tamper evident custody seal system for the sample shipment.

3.10 Affix shipping labels to each of the coolers, ensuring all of the shipping information is filled in properly. Overnight (e.g., FedEx Priority Overnight) courier services will be used for all sample shipments.

3.11 All samples will be shipped to the laboratory no more than 72 hours after collection. Under no circumstances should sample hold times be exceeded.

STANDARD OPERATING PROCEDURE

SOP-09

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes how investigation-derived waste (IDW) will be collected, segregated, classified, and managed during the field investigations at the MCRD Parris Island. The following types of IDW will be generated during this investigation:

- Decontamination solutions
- Soil sampling residues
- Personal protective equipment and clothing (PPE)
- Miscellaneous trash and incidental items

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Health and safety equipment (with PPE)
Decontamination equipment
Field logbook
Writing utensil (preferably black pen with indelible ink)
Plastic sheeting and/or tarps
Plastic garbage bags

3.0 PROCEDURES

Management of IDW includes the collection, segregation, temporary storage, classification, final disposal, and documentation of the waste-handling activities if necessary.

3.1 Liquid Wastes

Liquid wastes that will be generated during the site activities include decontamination solutions from sampling equipment. These wastes will be returned/applied to the ground before leaving each site.

3.2 Solid Wastes

Solid wastes that may be generated during site activities include soil and sediment sampling residues. Excess soil and sediment core/sampling materials will be returned to the collection hole.

3.3 PPE and Incidental Trash

All PPE wastes and incidental trash materials (e.g., wrapping or packing materials from supply cartons, waste paper) will be decontaminated (if contaminated), double bagged, securely tied shut, and placed in a designated waste receptacle at MCRD Parris Island.

STANDARD OPERATING PROCEDURE
SOP-10

FIELD PORTABLE X-RAY FLUORESCENCE ANALYSIS OF SOIL AND SEDIMENT SAMPLES USING THE INNOV-X ALPHA SERIES INSTRUMENT

1.0 PURPOSE

This procedure is for the semiquantitative analysis of metallic lead particles and chemical compounds of lead in soil using a field portable x-ray fluorescence (FPXRF) spectrometer. This procedure is based on the United States Environmental Protection Agency (USEPA)-approved XRF field screening method for elemental analysis (Method 6200).

2.0 SCOPE, APPLICATION, AND LIMITATIONS

2.1 Scope of Procedure

Analysis of any other elements besides lead using FPXRF may require changes to this Standard Operating Procedure (SOP), and are therefore outside the scope of this SOP.

Although it is possible to use FPXRF to measure analytes in situ, this SOP requires removal of a soil sample from its native environment prior to analysis. By removing, drying, and homogenizing the sample prior to analysis, more precise and accurate results are obtained.

2.2 Analyst Training

Use of this method is restricted to personnel both trained and knowledgeable in the operation of the Innov-X alpha series XRF instrument or under the supervision of a trained and knowledgeable individual. Proper training for the safe operation of the instrument should be completed by the analyst prior to analysis. This training may be obtained directly from INNOV-X, an INNOV-X instrument distributor or lessor, or another trained Tetra Tech person.

3.0 ACRONYMS AND ABBREVIATIONS

FPXRF: Field portable x-ray fluorescence.
mg/kg: milligrams per kilogram.
MDL: Method detection limit.
PQL: Practical quantitation limit.
QC: Quality control.
RPD: Relative percent difference.
USGS: United States Geological Survey.
XRF: X-ray fluorescence.

4.0 RESPONSIBILITIES

Analyst/Chemist - Responsible for all aspects of sample preparation and analysis including equipment maintenance. Also responsible for maintaining chain-of-custody of samples after receipt from sampling personnel.

5.0 PROCEDURES

5.1 Safety

5.1.1 Radiation Safety

Radiation safety practices for the INNOV-X instrument can be found in the operator's manual (typically shipped with unit). Protective shielding should never be removed by the analyst or any personnel other than the manufacturer.

An additional hazard present with x-ray tubes is the danger of electric shock from the high voltage supply. The danger of electric shock is as substantial as the danger from radiation but is often overlooked because of its familiarity.

5.1.2 Protective Equipment

Analysts must wear disposable plastic gloves whenever sample aliquots are being transferred from one vessel to another. Consult the health and safety plan for other protection requirements.

5.2 Apparatus and Materials

Apparatus and materials consist of the following:

INNOV-X Alpha Series FPXRF spectrometer with data processing unit (iPAQ) pocket personnel computer):

INNOV-X Alpha Series XRF instrument manual to match the INNOV-X Alpha Series instrument.

Aluminum drying pans or aluminum foil: Sized suitably to hold as much as 50 grams of sample and fit into the drying oven.

Calibration verification check sample: A National Institute of Standards and Technology (NIST) or other Standard reference material (SRM) that contains lead in a concentration range that is compatible with the project objectives to verify the accuracy of the instrument. SRMs are shipped with the unit. Acceptable limits for SRM percent recoveries are usually provided with the SRMs. In their absence, a limit of ± 30 percent will be used as a guideline.

Instrument Blank: May be silicon dioxide, a Teflon block, a quartz block, "clean" sand, or lithium carbonate and is typically shipped with the unit.

Lead calibration check standard: Supplied by the FPXRF manufacturer.

Method blank material for performing method blank checks: May be lead-free silica sand or lithium carbonate that undergoes the same preparation procedure as the samples.

Battery charger.

Polyethylene sample cups: 31 millimeters (mm) to 40 mm in diameter with collar, or equivalent (appropriate for FPXRF instrument).

X-ray window film: Mylar™, Kapton™, Spectrolene™, polypropylene, or equivalent; 2.5 to 6.0 micrometers (µm) thick.

Sample containers: glass or plastic to store samples.

Sieves: 60-mesh Stainless steel, Nylon, or equivalent for preparing soil and sediment samples if necessary.

Trowels: for collecting soil samples.

Plastic bags: used for collection and homogenization of soil samples. May also be used as sample presentation device.

Drying oven: standard convection or toaster oven, for soil samples that require drying.

Rolling pin (optional): Wooden rolling pin for crushing dried samples.

5.3 Sample Collection, Preservation, and Handling

Samples shall be provided to the FPXRF analyst in plastic bags. The analyst is responsible for maintaining chain-of-custody of all samples until all analyses have been successfully completed. No sample preservation is necessary. All samples shall be handled in accordance with sample handling SOPs in effect for the field event.

5.4 Preventive Maintenance

Refer to the instrument manual for specific manufacturer's recommendations.

5.5 Instrument Start-Up

5.5.1 Ensure the pocket PC (iPAQ) is plugged into the FPXRF instrument body and install a fully charged battery into the instrument.

5.5.2 Press the ON/OFF button on the base of the pistol grip of the instrument. If the iPAQ does not automatically power up, press the Power button in the right corner of the iPAQ.

5.5.3 Tap the Microsoft icon at the upper left corner of the iPAQ.

5.5.4 Choose START.

5.5.5 Tap "Soil Mode" on the menu or choose Mode (bottom of screen) and then choose Soil Mode from the drop down menu.

5.5.6 Allow the instrument to warm up (approximately 3 minutes).

5.5.7 Release the manual trigger lock.

5.5.8 Standardize the instrument in accordance with Section 5.6.

5.6 Standardization/Calibration Check

It is not possible to start an analysis if the instrument has not been standardized. To verify proper calibration of the instrument it is necessary to periodically standardize it using the automated standardization procedure. This must be done anytime the instrument is restarted and every 4 hours of operation, although re-standardization may be done at any other time (e.g., when instrument drift is suspected).

5.6.1 Click the standardization piece (supplied with the instrument) on the front of the instrument, verifying that the solid portion of the standard completely covers the analysis window. If using a manufacturer supplied test stand, lay the standardization plate over the analysis window.

5.6.2 Select "Tap here to Standardize" or select *File* → *Standardize*. The red light on top of the instrument will blink indicating that the instrument is producing x-rays and the shutter is open. The amber light on the rear of the instrument will also be illuminated and a status bar will appear to display the progress of the standardization.

5.6.3 Upon successful standardization the message "Successful Standardization" will appear along with the instrument resolution. In this case tap "ok" to dismiss the completion message. If problems are encountered, either follow the prompts that appear and/or repeat the standardization. Contact the FOL if problems persist. Take note of any error messages that appear as they may be useful if the instrument manufacturer must be contacted. Additional assistance is also available in the manufacturer's instrument manual.

5.7 Quality Control

The quality control (QC) program includes analysis of blanks, calibration verification checks, duplicate analyses, and field duplicate samples. For all the above areas, any identified problems and corrective action must be documented in the instrument run log, analysis narrative report, and instrument

maintenance log or standards log (as applicable). Identical operating conditions will be used for each sample.

5.7.1 Laboratory Blanks

Two types of blank samples shall be analyzed for FPXRF analysis: instrument blanks and method blanks.

5.7.1.1 At the beginning of each day, at the end of each day, and after every 20th sample or when potential contamination of the instrument is suspected, analyze an instrument blank to verify that no contamination exists in the spectrometer or on the probe window.

If the lead concentration in the blank exceeds the method detection limit (MDL, see Section 5.9.3) check the probe window and other potentially contaminated instrument components for contamination. If contamination is not causing the elevated blank readings, “zero” the instrument according to manufacturer's instructions.

5.7.1.2 After every 20th sample analyze a method blank. If the method blank lead concentration exceeds the practical quantitation limit (PQL, see Section 5.9.4), identify the cause of the elevated lead concentration and reanalyze all samples since the last acceptable method blank.

5.7.2 Calibration Verification Checks

5.7.2.1 After performing each blank check (Section 5.7.2), analyze a calibration verification check sample to check the accuracy of the instrument and to assess the stability and consistency of the analysis for the analytes of interest.

5.7.2.2 If the measured lead percent recovery (See Section 5.9.1) is less than 60 percent or greater than 135 percent, reanalyze the check sample. If the value continues to fall outside this acceptance range, the instrument should be recalibrated, or restandardized according to the manufacture instructions and the batch of samples analyzed before the unacceptable calibration verification check must be reanalyzed.

5.7.3 XRF Duplicate Samples

XRF duplicate samples are two portions of the same sample that have been prepared and homogenized together, and then split and analyzed in the same manner by the XRF analyst.

5.7.3.1 Analyze an XRF duplicate at a frequency of 1 per 20 or once per day, whichever is more frequent.

5.7.3.2 If the computed RPD (See Section 5.9.2) exceeds 50 percent reanalyze both samples. If the RPD again exceeds 50 percent RPD consider whether the high degree of imprecision is caused by sample heterogeneity or other causes. This assessment may be aided by repeating the analysis of a sample that was analyzed previously. If the observed imprecision is attributed to sample heterogeneity, increase the number of readings made per sample to try to limit the imprecision and repeat the analyses. If this does not correct the problem notify the FOL.

5.8 Sample Analysis

Note:

This section provides sample analysis instructions, assuming that appropriate instrument start-up and calibration checks have been completed. The longer the instrument count time, the lower the detection limits and the less uncertainty there is with a recorded result. Count time is user-selectable through the instrument's software. Because the XRF data will be used in a screening capacity to make preliminary decisions concerning the soil concentrations relative to 400 mg/kg, it is not necessary to obtain a high degree of accuracy or precision with the instrument. Therefore, count times should be limited to less than 180 seconds unless an usually high degree of precision is expected. To change the count time, select Options → Setup Testing and enter the same value (in seconds) to minimum and maximum count times.

Note:

Section 5.7 identifies the appropriate frequencies for conducting various QC sample analyses and the associated acceptance limits and corrective actions for potentially unsuitable conditions. The specified QC analysis frequencies are minimum frequencies. More frequent QC sample analyses are permitted, especially when diagnosing quality problems.

5.8.1 Ensure that calibration checks and blanks have been analyzed according to Sections 5.6, 5.7.1, and 5.7.2. Count times shall be at least 60 seconds but generally less than 180 seconds.

5.8.2 Acquire enough soil sample to fill an 8-ounce jar and separate from it all particles greater than the size of a pea.

5.8.3 Homogenize the remaining finer grained portion of the sample by simple mixing until it appears as uniform in texture and composition as practicable. Mixing may be done in a beaker or other

suitable lead-free container. If the sample is moist and has high clay content, it may be kneaded in a plastic bag. Mixing shall continue for at least two minutes to ensure that the sample is well mixed. To aid mixing, the sample may be placed into a thick-walled (3 mil or thicker) gallon-sized freezer bag (e.g., ZipLoc®) and rolled flat with a rolling pin to break up large chunks of dirt.

5.8.4 Place approximately 20 to 50 grams (one U.S. nickel weighs about 5 grams) in a suitable container (e.g., aluminum drying pan) for drying.

5.8.5 Dry the homogenized sample from Step 5.8.4 for approximately 20 to 30 minutes in the oven at a temperature not greater than 150°C (a setting of approximately 300°F). If the sample is not visibly dry after this initial drying time, place the sample back into the oven until the sample is dry.

5.8.6 Re-homogenize the dried sample aliquot in a beaker or other suitable lead-free container to obtain a well mixed soil sample. Mixing shall continue for at least one minute.

5.8.7 Place a portion (approximately 1.5 cubic inches) of the dried, homogenized sample aliquot into the instrument manufacturer's recommended sample cup (e.g., a 31.0-mm polyethylene sample cup (or equivalent) or place it in a thin-walled (1.0 mil or thinner) plastic sandwich bag (e.g., ZipLoc®).

5.8.8 If using a disposable plastic sample cup, ensure the cup is at least three-quarters full and cover with mylar (or other) film per the manufacturer's recommendations.

5.8.9 Present a portion of the sample to the instrument in Soil Mode.

5.8.10 Perform a single pull of the trigger to start the count. The count time shall be the same as was used for the calibrations, calibration checks, and blank analyses. The message "Test in progress" will appear on the instrument and the red light on top of the instrument and will illuminate.

5.8.11 When the predetermined count period has expired the message "Test complete" will appear on the instrument. A slight delay may also be incurred during which time the message "calculating" may appear to indicate that results are being computed.

5.8.12 Record the displayed results for lead concentration in mg/kg on Figure 1.

CAUTION

Inconsistent positioning of samples in front of the probe window is a potential source of error because the x-ray signal decreases by the square of the distance from the radioactive source. This error is minimized by maintaining the same distance between the window and each sample. For the best results, the window of the probe should be in direct contact with the sample, which means that the sample surface should be flat and smooth to provide a good contact surface.

5.8.13 Rotate the sample cup approximately one-third of a turn, or if using a thin plastic baggie, read another 1/3 portion of the sample bag. Acquire another measurement by repeating Steps 5.8.10 through 5.8.12.

5.8.14 Repeat Steps 5.8.10 through 5.8.11 a third time, and calculate the average concentration.

5.8.15 Based on the degree of precision demonstrated by the three individual measurements, determine whether additional readings should be acquired on the sample. This determination shall be based on professional judgment of the FPXRF analyst and shall consider the degree of precision observed during calibration checks and previous sample analyses. The objective will be to ensure that the average reading reported for each sample is representative of the true sample concentration. If the analyst feels that non-representative readings are being obtained the analyst shall correct the analytical system or notify the FOL prior to continuing with analyses.

5.8.16 Ensure that measured results are reported to the following standards

- Results < 1000 mg/kg (or parts per million) are reported to two significant figures and results > 1000 mg/Kg are reported to three significant figures.
- All values < MDL shall be reported as the MDL and flagged with the letter “U”.
- All values > MDL and < PQL shall be reported as is and flagged with the letter “B”.

5.9 Calculations

5.9.1 Percent Recovery: The equation for determining percent recovery of calibration verification check standards and standard reference materials is:

$$\%R = \frac{\text{Experimental Concentration}}{\text{Certified or Known Concentration}} \text{ X } 100\,\%$$

5.9.2 Relative Percent Difference: The equation for determining relative percent difference for laboratory and field duplicate samples is:

$$\text{RPD} = \frac{|\text{Amount in Sample 1} - \text{Amount in Sample 2}|}{0.5\,(\text{Amount in Sample 1} + \text{Amount in Sample 2})} \text{ X } 100\,\%$$

5.9.3 Method Detection Limit (MDL): Because the analyses governed by this SOP are semi-quantitative, the manufacturer-specified detection limit will be reported as the MDL unless the specified detection limit is less than 20 mg/kg. Care will taken to ensure that the appropriate count time is consistent with the reported detection limit. However, no value less than 20 mg/kg will be reported as an MDL.

5.9.4 Practical Quantitation Limit (PQL): Multiply the MDL by 3 to obtain the PQL: PQL = MDL*3

6.0 REFERENCES

Innov-X Systems, Inc. Innov-X Systems X-Ray Fluorescence Spectrometers Instruction Manual. Woburn, MA. June 2002.

Stephen Shefsky, NITON Corporation. Comparing Field Portable X-Ray Fluorescence (XRF) To Laboratory Analysis of Heavy Metals In Soil. Presented at the International Symposium of Field Screening Methods for Hazardous Wastes and Toxic Chemicals. Las Vegas, Nevada. January 29-31, 1997.

USEPA (U.S. Environmental Protection Agency), Method 6200: Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment, Office of Solid Waste, Washington, D.C. January 1998.

USEPA, Region I, Northeast Waste Management Officials' Association (NEWMOA) Technology Review Committee Advisory Opinion. Innovative Technology: X-Ray Fluorescence Field Analysis. September 21, 1999.

FIGURE 1

FIELD PORTABLE XRF SAMPLE ANALYSIS LOG SHEET

Page___ of ___

Project Site Name: ______________________ Run Length/Duration: ______________________
Project No.: ______________________ Measurement Units: ______________________
Analyzed By: ______________________ Reference/Calibration: ______________________

SAMPLING AND FIELD PORTABLE XRF RESULTS DATA:

SAMPLE ID	ANALYSIS DATE	ANALYSIS TIME	ELEMENT ANALYSIS	RESULT RUN 1	RESULT RUN 2	RESULT RUN 3	RESULTS AVERAGE	ERROR RUN 1	ERROR RUN 2	ERROR RUN 3	ERROR AVERAGE

STANDARD OPERATING PROCEDURE

SOP-11

LARGE WATER BODY SEDIMENT SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes the procedure for sediment sampling in large water bodies from a motor powered work boat.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

The following field forms and equipment are required for sediment sampling.

Sediment Sample Log Forms: See Attachment to this SOP.
Writing utensil (preferably black pen with indelible ink)
Indelible marker
Bound field logbook
Stainless steel trowels
Large stainless steel bowls
Aluminum Foil
Clamshell dredge 15 pound or 25 pound dredge with rope: If the 25 pound dredge is needed a winch and boom will be required
Global Positioning System (GPS): Used to locate and mark sampling locations.
Labeled sample containers: See SOP-01 for sample labeling procedures. Sample containers are certified clean by the laboratory supplying the containers.
Decontamination equipment: See SOP-04 for decontamination equipment
Sealable polyethylene bags
Shipping containers (containing ice)
Disposable medical-grade gloves (e.g., latex, nitrile)
Otter plastic gloves (e.g., nitrile)
Chain-of-Custody Form
Personal floatation devices (life jackets)
18-ft wide-bodied, flat-bottomed boat powered by an outboard motor

3.0 SEDIMENT SAMPLE LOCATION SELECTION

Sediment samples shall be collected throughout a study area in a grid like pattern or at locations established by the FOL. The sample locations x-y coordinates will be electronically loaded in to a hand held global positioning system. These coordinates are then used to navigate to and locate the sampling locations using the global positioning system.

4.0 SEDIMENT SAMPLING PROCEDURES

4.1 The work boat will be loaded with all necessary equipment in order to find sampling locations, collect the samples, and clean the sampling equipment, minimizing the number of times required to return to shore.

4.2 The sampler will wear clean, disposable medical-grade gloves with outer nitrile type gloves. Attach the clamshell dredge to a tie line or rope, spread the sampling jaws and place the spring loaded keeper pin into the jaw arms of the dredge, thus locking the jaws open. Lower the dredge into the water, and down to the river bottom in one smooth motion allowing the dredge to sink steadily to the river bottom. The jaws will automatically close when the retrieval is initiated. Retrieve the dredge with sediment and before opening place the dredge into a clean stainless steel bowl. Carefully open the jaws and allow the dredge to empty the sediment in to the stainless steel bowl. Use the trowel to homogenize the sediment in the stainless steel bowl. Use the same trowel to scoop the homogenized sediment into the requisite labeled sample container(s).

4.3 Record the sample time (using military time) on the Sediment Sample Log Form and sample container labels. Record all other information required on the labels as specified by SOP-06

4.4 Place the labeled sample container into a sealable polyethylene bag and then place the bag holding the sample container into a cooler containing ice.

4.5 Record date, sampling site, site conditions, location map, and other information (e.g., depth to the river bottom) on the Sediment Collection Log Sheet. Enter the sample information onto the Chain-of-Custody Form in accordance with SOP-03.

4.6 Using the GPS unit, survey in the sample location in order to relocate the sampling site in the future.

5.0 ATTACHMENTS

1. Soil and Sediment Sample Log Sheet

ATTACHMENT 1

SOIL AND SEDIMENT SAMPLE LOG SHEET

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

STANDARD OPERATING PROCEDURE
NUMBER SOP-12

INCREMENT SAMPLING FOR SOIL
FOR THE MILITARY MUNITIONS RESPONSE PROGRAM

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes the procedure for collecting increment surface soil and/or sediment samples (IS) using a hand operated coring device to support the field investigations at MCRD Parris Island.

This technique will assist in estimating mean concentrations which can be used to assess whether potential munitions constituents (MC):

- Are present within the sampled area at an average concentration greater than the analytical method detection limit or reporting limit
- May pose an unacceptable risk to human health, or ecological receptors
- May contribute to significant contaminant concentrations to groundwater
- Concentrations exceed mean background or ambient concentrations unrelated to munitions activities.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

The following field forms and equipment are required for composite soil and sediment sampling.

Disposable medical-grade gloves (e.g., latex, nitrile)

Indelible marker

CRREL Coring device or equivalent

One coring shoe (size predetermined before sampling commences)

Plastic storage bags

Sample tags

Shipping containers (containing ice)

Sample containers: Sample containers are certified clean by the laboratory supplying the containers.

Field Forms: Soil and Sediment Sample Log (SOP-05)

Electronic label maker

3.0 SAMPLING PROCEDURES

Hand coring will be employed to collect soil cores (see SOP-05). The sampler will wear clean, disposable, medical-grade gloves and coring devise will be decontaminated between sample locations.

3.1 INCREMENT COMPOSITE SAMPLING PROCEDURES

3.1.1 Grid off area of concern (7 squares x 7 squares) and create an unbiased pattern of sample collection (49 squares) throughout the sample unit

3.1.2 Clear the area to be sampled of any surface debris (herbaceous vegetation, twigs, rocks, litter, etc.).

3.1.3 Turn the coring device into the ground to the depth of the selected shoe.

3.1.4 Repeat steps 3.1.1–3.1.3 in the designated sampling area for a specific sample until entire sample grid has been collected.

3.1.5 Package the entire lot of collected media (approximately 1-2 kg) in a plastic bag or other suitable container and send to the laboratory for processing and analysis.

3.1.6 Complete the required information on the electronic Soil and Sediment Sample Log Sheet (copy attached at the end of this SOP). Note the location of each aliquot in the "OBSERVATIONS/NOTES" section of the Soil and Sediment Sample Log Sheet. Only the notes added within the sample analysis block on the Soil and Sediment Sample Log Sheet will be visible on the Chain-of-Custody (COC) Form for review by laboratory personnel.

3.1.7 Decontaminate the coring device in the field between each IS decision unit.

Note: Rinseate blanks are unnecessary because the contamination in these blanks is typically negligible.

4.0 REFERENCES

GPL Laboratories, LLC. 2009. SOP No. G.22: General laboratory Multi Incremental Sampling (MIS) sub-sampling procedure. January 2009.

US Army Corps of Engineers. 2009. Interim Guidance 09-02: Implementation of Incremental Sampling (IS) of Soil for the Military Munitions Response Program. 20 July 2009.

5.0 ATTACHMENTS

1. Soil and Sediment Sample Log Sheet

ATTACHMENT 1

SOIL AND SEDIMENT SAMPLE LOG SHEET

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

STANDARD OPERATING PROCEDURE
MRP SOP 02

MEC MANAGEMENT AND ACCOUNTABILITY

A. SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for the management and accountability of Munitions and Explosives of Concern (MEC) encountered during activities performed under the Munitions Response Program (MRP).

B. BACKGROUND

MEC activities will be performed in accordance with all local, State, and federal regulations and will include all applicable DoD requirements. Generally, MEC will be encountered during the performance of Unexploded Ordnance (UXO) detector-aided surface survey operations, subsurface geophysics investigations and UXO Escort operations. UXO detector-aided surface survey operations may be used as a stand-alone method for site survey and assessment or in preparation for geophysical survey and other operations. UXO escort operations may be required during site visits (initial site assessments, planning, and stakeholders meetings), geophysical operations, construction support during subsurface activities, and MC sampling operations.

C. PERSONNEL QUALIFICATIONS

UXO personnel shall be graduates of a military Explosive Ordnance Disposal (EOD) School of the United States, Canada, Great Britain, Germany, or Australia or a graduate of a formal training course of instruction or EOD assistant course as stated in DDESB TP-18.

D. MEC MANAGEMENT AND ACCOUNTABILITY OPERATIONS

<u>UXO Detector-Aided Surface Survey</u>

If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, a tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface survey. Each item will be marked with engineer flagging and given a unique ID number. ID numbers will start with a letter(s) corresponding to

the site or grid in which the item is located. This will be followed by the transect number of the site or grid specific to the location of the item. Lastly, a number will be assigned to the individual items within the transect. These numbers will start at 01 and run consecutively. For example:

*The site name is **UXO 4**. The first transect within the UXO 4 is **X4**. The first item encountered in transect X4 is item **01**. The ID number assigned to the item is **X4-A1-01.***

All available information about the item will be recorded in the logbook/MEC Tracking Log as presented in Attachment 1 to this SOP, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface survey.

Every effort will be made to identify each suspect MEC item located. Under no circumstances will any suspect MEC be moved in an attempt to make a definitive identification. The MEC item will be visually examined for markings and other external features such as shape, size, and external fittings. Prior to any documentation being developed on an MEC item, all fusing will be definitively identified if it is possible to safely do so visually without disturbing the ordnance item. This identification will consist of fuse type by function and condition (armed or unarmed) and the physical state/condition of the fuse, i.e., burned, broken, parts exposed/sheared, etc.

Only UXO-qualified personnel will perform MEC identification procedures. As an exception, a UXO Technician I may assist in the performance of MEC identification procedures when under the supervision of a UXO Technician III or higher. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III or higher. All suspect MEC items will be recorded following the requirements of this SOP, the site-specific Work Plan/QAPP, the project site-specific HASP, applicable ordnance operations procedural safety guidelines, and industry-accepted safe work practices and procedures.

Detector-Aided Surface Survey for Geophysical Survey

The UXO Technician will conduct a detector-aided surface survey of the grid or transect to be surveyed and record the location of each MEC item discovered, if any. Each item will be marked and recorded as described above. UXO avoidance will be practiced during the geophysical survey.

When allowed by the conditions of the Explosive Safety Submission (ESS) determination, any non-munitions debris may be moved to facilitate a more effective geophysical survey. Non-munitions debris may be collected and stockpiled in a designated area within the boundaries of the site. The facility must agree to take possession of this non-munitions debris and arrange the proper disposition of the material before any items may be moved or disturbed.

UXO Escort Operations

One UXO Technician, qualified as a UXO Technician II or higher, will be required to support each field team engaged in operations in areas that might contain MEC. If any MEC is encountered, the item will be avoided during this phase of the project.

The UXO Technician will not attempt to identify the type or condition of the ordnance during escort operations. Any area with visible ordnance or MEC will be clearly marked, and the area will be avoided. The location of visible ordnance or MEC will be recorded and noted in the field logs. If more senior level personnel are present on site, MEC findings will be reported to the UXO Team Leader. No ordnance, munitions, explosives, or ordnance-related materials will be moved, removed, or disposed of during UXO Escort duties.

E. NOTIFICATIONS IF MEC IS ENCOUNTERED

Any MEC item discovered during a detector-aided surface survey, geophysical survey, or UXO escort operation will be left in place and will not be moved. Should MEC be encountered, the following scenarios should be addressed as follows:

(1) If a complete MEC item or ordnance related material is encountered that is believed to pose a hazard, is unexpectedly encountered at a given site, is encountered outside of the current established site boundaries, or is unknown, the UXO Team Leader, with support by UXO Technicians on site as necessary, will document the following information, as provided on Attachment 1, for notification purposes:

- Site Name
- Date/Time Encountered
- Name and UXO category of Person providing Notification
- Location of Item (provide coordinates)
- Type of Item (provide digital photograph)
- Apparent Fuze Condition (armed or unarmed)

- Physical Condition (burned, broken, parts exposed/sheared, etc)
- Physical Appearance (buried, staged, etc.)
- Activity in Progress

The UXO Team Leader will attempt to identify the type and/or condition of the ordnance and its location, as described above, and will immediately report this information to the client point of contact at the facility and the Tetra Tech UXO Manager. Prior to any documentation being performed on a suspect MEC item, all fuzing will be definitively identified only if it is possible to safely do so visually without disturbing the item. If directed by the point of contact at the facility, UXO personnel may take emergency non-invasive action such as securing the area until the appropriate exclusion and safety zones have been determined.

The Navy point of contact at the facility will be responsible for notifying appropriate EOD personnel or for designating this notification task to the Tetra Tech UXO Team Leader. The notification to EOD personnel should be immediate if a live MEC item is encountered which could be a hazard to personnel, or if the item is unknown so that arrangements may be made through the facility for proper disposition of the item(s). If the facility initiates an emergency response or disposal action, follow-up documentation should be obtained to detail the date and method of disposition. This information is also needed to ascertain the actual type and condition of the item (live or inert filled) to aid in future classification of the site.

(2) If the MEC item cannot be identified by type as a conventional munition, and/or if in the unlikely event that the MEC is suspected to be potential Chemical Warfare Material (CWM), personnel will withdraw upwind from the area, assemble at a pre-designated rally point, secure the site, and immediately request assistance from the point of contact at the facility and notify the Tetra Tech UXO Manager. If so directed, UXO personnel will take emergency non-invasive actions such as covering the item with plastic sheeting and securing the area until the appropriate exclusion and safety zones have been determined.

(3) If Hazardous, Toxic, or Radiological Waste (HTRW) is encountered on-site, the work site will be evacuated until the Tetra Tech Project Health and Safety Officer, with concurrence of the client point of contact at the facility, identifies and implements appropriate protective measures.

For any of the scenarios, upon receiving notification from the Tetra Tech UXO Team Leader, the Tetra Tech UXO Manager will then immediately inform the Tetra Tech TOM, who will then immediately inform

the client Project Manager. Tetra Tech Program Management personnel will then be notified. The client Project Manager will then make all other necessary notifications within the client's organization.

The following table lists contacts information.

Position	Name	Organization	Direct Dial Phone	Cell Phone
Tetra Tech TOM	Mark Sladic	Tetra Tech	412.921.8216	
Tetra Tech UXO Manager	Ralph Brooks	Tetra Tech	770.413.0965 x231	404.661.4916
Facility Contact	Tim Harrington	MCRD Parris Island	843.228.3423	
Navy Remedial Project Manager	Charles Cook	NAVFAC Southeast	904.542.6409	

ATTACHMENT 1

MEC TRACKING LOG

MCRD Parris Island

SITE:_____

ID #	ITEM IDENTIFICATION	UXO TECH NAME	ITEM COORDINATES	DATE/TIME FOUND	DIGITAL PHOTGRAPH NUMBER	ARMED / UNARMED	PHYSICAL CONDITION / APPEARANCE	DATE DESTROYED

STANDARD OPERATING PROCEDURE
MUNITIONS RESPONSE PROGRAM (MRP) SOP 05
GPS DATA COLLECTION AND TRANSFER

1.0 OVERVIEW

The primary purpose of this Standard Operating Procedure (SOP) is to provide the Field Technicians with basic instructions for operating a handheld Global Positioning System (GPS) unit allowing them to set GPS parameters in the receiver, record GPS positions on the field device, and transfer the data for integration into existing Geographic Information System (GIS) figures.

This SOP is specific to GIS quality data collection for Trimble-specific hardware and software.

If possible, the Trimble GeoXT or XH Operators Manual should be downloaded onto the operator's personal computer for reference before or while in the field. The manual can be downloaded at the following website:
http://trl.trimble.com/docushare/dsweb/Get/Document-311749/TerraSyncReferenceManual.pdf

Unless the operator is proficient in the setup and operation of the GPS unit, the Project Manager (or designee) should have the GPS unit shipped to the project-specific contact listed below in the Pittsburgh, Pennsylvania office at least five working days prior to field mobilization so project-specific data files (i.e. shape files), background images, data dictionaries, and correct coordinate systems can be uploaded into the unit.

Tetra Tech NUS
Attn: Ralph Basinski
661 Anderson Drive, Bldg #7
Pittsburgh, PA 15220

The SOP also describes how field collected data is to be transferred through the use of the MRP Website. (http://www.ttnus.com/MRPRepository/). This website serves as a centralized portal to facilitate data exchange for field personnel, GIS staff, and project managers. The website contains a "Reference" page that will contain the latest version of this SOP and other valuable documentation.

For technical questions regarding operation of the GPS units and data collection, please contact John Wright (john.wright@tetratech.com). For general questions about this SOP and use of the MRP website, please contact Mark Maguire (mark.maguire@tetratech.com).

2.0 REQUIRED EQUIPMENT

The following hardware and software should be utilized for locating and establishing GPS points in the field:

2.1 GPS Hardware & Equipment

- Hand-held GPS Unit capable of sub-meter accuracy. This includes the docking cradle, a/c adapter, stylus, and USB cable for data transfer. Two models, the GeoXH and GeoXT, are acceptable for use. The XH yields higher accuracy (in both real-time and post-processed) and should always be requested when highly precise data is required.

- An external antenna will yield better satellite reception, especially in heavy tree canopy. Associated accessories include a range pole and hardware clamp, for mounting the GPS unit to the pole.

- Indelible marker.

- Non-metallic pin flags for temporary marking of positions.

2.2 GPS Software

The following software is required to transfer data from the handheld GPS unit to a personal computer:

- Trimble TerraSync version 2.6 or later (pre-loaded onto GPS unit from vendor)

- Microsoft ActiveSync version 4.5 or later. Download to personal computer from: http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/activesync-download.mspx

  Note: Windows Vista and Windows 7 users should download Windows Mobile Device Center version 6.1 or later from the following site, if it is not already loaded on the machine: http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/device-center-download.mspx

- Trimble Data Transfer Utility (freeware version 2.1 or later). Download to personal computer from: http://www.trimble.com/datatransfer.shtml

3.0 START-UP PROCEDURES

Prior to utilizing the GPS in the field, ensure the unit is fully charged. The unit may come charged from the vendor, but an overnight charge is recommended prior to fieldwork.

The Geo-series GPS units require a docking cradle for both charging and data transfer. The Geo-series GPS unit is docked in the cradle by first inserting the far domed end in the top of the cradled, then gently seating the contact end into the latch. The power charger is then connected to the cradle at the back end using the twist-lock connector. Attach a USB cable as needed between the cradle (B end) and the laptop/PC (A end).

It is recommended that the user also be familiar and check various Windows Mobile settings. One critical setting is the Power Options. The backlight should be set as needed to conserve power when not in use.

3.1 Initial Start Up

1) Power on the GPS unit by pushing the small green button located on the lower right front of the unit.

2) Utilizing the stylus that came with the GPS unit, launch **TerraSync** from the Windows Operating System by tapping on the start icon located in the upper left hand corner of the screen and then tap on **TerraSync** from the drop-down list.

3) If the unit does not default to the Setup screen, tap the Main Menu (uppermost left tab, just below the Windows icon) and select Setup.

4) If the unit was previously shipped to the Pittsburgh office for setup, you can skip directly to Section 4.0. However, to confirm or change settings, continue on to Section 3.1.

3.2 Confirm Setup Settings

Use the Setup section to confirm the TerraSync software settings. To open the Setup section, tap the Main Menu and select Setup. (Note that if the unit was shipped from the Pittsburgh office, these settings should have been set for your specific project. Feel free to contact Pittsburgh staff with any questions.)

1) Tap on the Coordinate System.

2) Verify the project specs are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu. **Note:** It is always best to utilize the Cancel tab rather than the OK tab if no changes are made since configurations are easily changed by mistake.

3) Tap on the Units.

4) Verify the user preferences are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.

5) Tap Real-time Settings.

6) Verify the Real-time Settings are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.

7) The GPS unit is now configured correctly for your specific project.

3.3 Antenna Connection

1) If a connection has been properly made with the internal antenna, a satellite icon along with the number of usable satellites will appear at the top of the screen next to the battery icon. If no connection is made (e.g.: no satellite icon), tap on the GPS tab to connect antenna.
2) At this point the GPS unit is ready to begin collecting data.

3.4 Loading a Background file

This section provides instructions on pulling in a pre-loaded background file. These files are helpful in visualizing your current location.

1) From the Main Menu select Map, then tap on Layers, select the background file from drop down list.

2) Select the project-specific background file from the list of available files.

3) Once the selected background file appears, the operator can manipulate the screen utilizing the +/- and <-/-> functions at the bottom of the screen.

4) In operating mode, the operator's location will show up on the background file as a floating "x".

4.0 FIELD DATA COLLECTION

For MRP data collection activities, a new GPS file should be created **every day** and transferred **nightly** using the MRP website (see Section 9.0). This is to insure the timely transfer of data, file organization in the database, and allow for next-day GIS mapping. Also, individual GPS data files should be **unique to a particular site** or unit (typically a UXO number). If multiple sites are visited in a single data, multiple files should be created.

4.1 Creating a Data File

1) From the Main Menu select Data.

2) From the Sub Menu (located below the Data tab) select New which will bring up the New Data File menu.

3) An auto-generated filename appears and should be edited for your specific project. The following naming convention should be followed as closely as possible: **IH-UXO4-01012010-TeamA**, where "IH" is the installation abbreviation (Indian Head), "UXO04" is the site, and "01012010" is the data in MMDDYYYY format. If multiple teams are being deployed across an individual site on the same day, it is important to specify the field team name at the end of the file name ("TeamA"). If the integral keyboard does not appear, tap the small keyboard icon at the bottom of the screen.

4) Select the data dictionary that will be used to collect features. The data dictionary provides predefined fields and drop-down menus to facilitate data collection as it relates to specific MRP data types. The MRP data dictionary is entitled "**MRP Data Collection**" and should appear in the data dictionary drop-down list. This should have been pre-loaded into the GPS prior to use. The data dictionary file is available on the MRP website under the "Reference" section.

5) After entering the file name and selecting the data dictionary, tap Create to create the new file.

6) Confirm antenna height if screen appears. Antenna height is the height that the GPS unit will be held from the ground surface (Typically 3 to 4 feet)

7) The Choose Feature screen appears.

4.2 Collecting Features

1) If not already open, the Collect Feature screen can be opened by tapping the Main Menu and selecting Data. The Sub Menu should default to Collect.

2) **Do not begin the data logging process until you are at the specific location for which you intend to log the data.**

3) A known reference or two should be shot at the beginning and at the end of each day in which the GPS unit is being used. This allows for greater accuracy during post-processing of the data.

4) Upon arriving at the specific location, select the proper feature type from the data dictionary list (MEP Object, Transect End Point, GPS QC Point, or General Point).

5) Tap Create to begin data logging.

6) As the GPS is collecting positions, enter the feature attributes, starting with the Item ID. This field is required and will not allow the user to continue or save the position without entering a value. Enter any additional notes or feature descriptions in the appropriate fields.

7) Data logging can be confirmed by viewing the writing pencil icon in the upper part of the screen. Also, the logging counter will begin. As a Rule of Thumb, accumulate a minimum of 20 readings on the counter, per point, as indicated by the logging counter before saving the GPS data.

8) Once the counter has reached a minimum number of counts (i.e. 20), tap on OK to save the data point to the GPS unit. Confirm the feature. All data points are automatically saved within the GPS unit.

9) Repeat steps 2 through 8, giving each data point a unique name or number.

Note: If the small satellite icon or the pencil icon is blinking, this is an indication the GPS unit is not collecting data. A possible problem may be too few satellites. While still in data collection mode, tap on Main Menu in upper left hand corner of the screen and select Status. Skyplot will display as the default showing the number of available satellites. To increase productivity (number of usable satellites) use the stylus to move the pointer on the productivity and precision line to the left. This will decrease precision, but increase productivity. The precision and productivity of the GPS unit can be adjusted as the number of usable satellites changes throughout the day. To determine if GPS is correctly recording data, see Section 5.2. If the precision toggle is decreased, the user should frequently check the Skyplot display to restore the default values as soon as possible.

4.3 Navigation

This section provides instructions on navigating to saved data points in an existing file within the GPS unit.

1) From the Main Menu select Map.
2) Using the Select tool, pick the point on the map to where you want to navigate.
3) The location you select will have a box placed around the point.
4) From the Options menu, choose the Set Nav Target (aka set navigation target).

5) The location will now have double blue flags indicating this point is you navigation target.
6) From the Main Menu select Navigation.
7) The dial and data on this page will indicate what distance and direction you need to travel to reach the desired target.
8) Follow the navigation guide until you reach the point you select.
9) Repeat as needed for any map point by going back to Step 1.

4.4 Data Quality Control

Quality control checks should be performed each day of data collection and/or data navigation. QC checks are important both to understand real-time accuracy while in the field, and also to provide control data needed during post-processing.

1) Known survey benchmarks, surveyed monitoring wells, or other established and documented control points should be identified

2) GPS equipment should be placed on known control points and positions recorded

3) For data collection tasks - QC check data should be collected at least at the start and completion of the fieldwork for the day of data collection. Additional occupation and collection of control point data should occur as possible during the work day, and should increase in frequency as the number of data points increase and the need for accurate data collection increases

4) For navigation tasks such as stake placement for planned sample locations, QC data checks should be done at least at the start and completion of the fieldwork for each day. Known visible targets should be occupied and observed by the user, while the GPS satellite status and other user interface data is reviewed. The user should assess whether the real-time accuracy settings on the GPS are within the tolerance of the observed visual reference points.

4.5 Viewing Data or Entering Additional Data Points to the Current File

1) To view the stored data points in the current file, tap on the Main Menu and select Map. Stored data points for that particular file will appear. Use the +/- and <-/-> icons in lower left hand corner of screen to zoom in/out and to manipulate current view.

2) To return to data collection, tap on the Main Menu and select Data. You are now ready to continue to collect additional data points.

4.6 Viewing Data or Entering Data Points from an Existing File

1) To view data points from a previous file, tap on Main Menu and select Data, then select File Manager from the Sub Menu.

2) Highlight the file you want to view and select Map from the Main Menu.

3) To add data points to this file, tap on Main Menu and select Data. Continue to collect additional data points.

4.7 Shutting Down

This section provides instruction for properly shutting down the GPS unit.

1) When shutting down the GPS unit for the day, first click on the “X” in the upper right hand corner.
2) You will be prompted to ensure you want to exit TerraSync. Select Yes.
3) Power off the GPS unit by pushing the small green button located on the bottom face of the unit.
4) Place the GPS unit in its cradle to recharge the battery overnight. Ensure the green charge light is visible on the charging cradle.

5.0 DATA TRANSFER

This section describes how data should be downloaded from the GPS units and uploaded to a central website for post-processing and integration into GIS datasets. GPS data collected on a given day should be transferred **that night** for post-processing by GIS staff the next morning. Once post-processed, the GPS data will be plotted on a map and be immediately provided to the project team for review. Data upload, download, and review will be facilitated through a secure MRP website: http://www.ttnus.com/MRPRepository/

5.1 Load Data from the GPS Unit to Your Computer

1) Install the Data Transfer and ActiveSync software installed on your PC (see section 2.2)

2) Connect the GeoXH/XT to your PC via an A/B USB cable (blade end and square end type "HP printer" style)

3) ActiveSync should auto-detect the connection and recognize the data collector

4) Make sure the data file desired is CLOSED in TerraSync prior to transfer

5) Connect via ActiveSync as a guest (not a partnership)

6) Run the Trimble Data Transfer Utility program on your PC

7) Select "***GIS Datalogger on Windows CE***" or similar selection

8) Hit the green connect icon to the right - the far right area should say "***Connected to ....***" if successful

9) Select the "***Receive***" data tab (under device)

10) Select "***Data***" from file types on the right

11) Find the file(s) needed for data transfer. You can sort the data files by clicking on the date/time header

12) Select or browse to a C-drive folder you can put this file for upload

13) When the file appears on the list, hit the "***Transfer All***". Once complete, a packet of multiple data files will appear on your computer in the specified folder.

5.2 Gain Access to MRP Website

1) Confirm that your computer has internet access
2) Click on the following link: http://www.ttnus.com/MRPRepository/
3) To register for the website, click on the "Register here" link. Enter your information and click "Submit." NOTE: Requests for registration are sent to Ralph Basinski, Program Manager, for approval. Please contact mark.maguire@tetratech.com if you experience any access issues.
4) Enter your username (Tetra Tech email address) and password to log in.

5.3 Upload GPS Data from Your Computer to the MRP Website

1) From the main page, select "Upload" from the menu at left.

2) Select the type of data you are uploading, typically "GPS Field Data"

3) Select the appropriate Installation and Site. Remember that GPS files should be unique for each site, even if multiple sites are visited in one day. If collected data is not associated with a site, select "Other."

4) Select “browse” to navigate to the appropriate *.SSF file on your computer. When you use the Trimble download utility to grab data from the GPS unit, multiple files will appear on your computer. You only need to the upload the *.SSF file.

5) Populate the “Comments” field to describe the dataset and any other pertinent information. This information will be provided to the GIS analyst who will be integrating the dataset, so be sure to be as descriptive as possible especially if there are any issues with the data. (For example, if you were to sample 16 points and for some reason you believe only 15 were logged, it is helpful to share this information.)

6) Select “Upload.” Users will be notified if the files were uploaded successfully.

5.4 Download Data from the MRP Website to Your Computer

The download utility on the MRP website will serve different user types. **Field staff** will use the utility to download GIS figures (in PDF format) and view the previous day(s) field data on aerial photographs, checking for any discrepancies or missing data elements. **Project Managers** will also have the ability to download and view these figures, to visualize the data and track project progress. This utility will also allow **GIS Analysts** to download the *.SSF files posted by field staff for post-processing and map plotting.

To download GIS Figures:

1) From the main page, select “Download” from the menu at left.

2) Select an Installation and Site

3) Users can view Figures for a particular date or by a range of dates, by selecting the ` appropriate options. To search all dates, leave all of these fields as the default.

4) Select “Search”

5) A table will appear showing the files available for download. Simply click on the link to the file and you will be prompted to save it to your computer.

APPENDIX D

LABORATORY STANDARD OPERATING PROCEDURES

Katahdin Analytical Serviced, Inc. and GPL Laboratories
Laboratory SOPs
MCRD Parris Island

Document Title	SOP Number	Revision No. and Date
Katahdin Analytical Serviced, Inc.		
Equipment Maintenance	CA-101	Rev. 7 07/2008
Determination of Nitroaromatics and Nitroamines by HPLC Method 8330	CA-402	Rev. 3 07/2008
Acid Digestion of Aqueous Samples by EPA Method 3010 for ICP Analysis of Total or Dissolved Metals	CA-604	Rev. 4 05/2009
Acid Digestion of Solid Samples by USEAP Method 3050 for Metals Analysis by ICP-AES and GFAA	CA-605	Rev. 3 03/2008
Trace Metals Analysis by ICP-AES Using USEPA Method 6010	CA-608	Rev. 8 02/2009
pH Concentration Measurements In Soil Matrices - SW 846 Method 9045	CA-709	Rev. 7 08/2009
Determination of Total Organic Carbon in Solids using the EPA Region II Lloyd Kahn Method	CA-741	Rev. 2 06/2008
Sample Receipt and Internal Control	SD-902	Rev. 8 05/2009
Sample Disposal	SD-903	Rev. 4 05/2009
GPL Laboratories		
General Laboratory Mulit Incremental Sampling (MIS) Sub-Sampling Procedures	G.22	Rev. 5 01/2009

LABORATORY
ACCREDITATION
BUREAU

Certificate Number L2223

Certificate of Accreditation

Accredited to DoD ELAP and ISO/IEC 17025:2005

Katahdin Analytical Services, Inc.

600 Technology Way
Scarborough, ME 04074

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation Granted through: November 4, 2012

R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 4th of November, 2009

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements
Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

November 13, 2009

Ms. Virginia Zusman
GPL Laboratories, LLC.
7210A Corporate Court
Frederick, MD 21703

Dear Ms. Virginia Zusman:

Congratulations! This letter is to inform you that our accreditation review committee has made an affirmative vote to grant your organization accreditation to DoD ELAP QSM Version 4.1. We are now finalizing your certificate of accreditation and will have this available for your review shortly. A certificate number **L09-110** has been assigned to this accreditation reflecting an issue date of **November 13, 2009** and an expiration date of **November 12, 2011**.

On behalf of the PJLA staff, I would like to commend you on your superior laboratory management system and demonstrated commitment to quality. If we can be of any further assistance to you, please feel free to contact me directly. Thank you for selecting Perry Johnson Laboratory Accreditation, Inc.

Sincerely,

Tracy Szerszen
President/Operations Manager
Perry Johnson Laboratory Accreditation, Inc.
26555 Evergreen Road, Suite 1325
Southfield, MI 48076
Ph-248-356-3545
Fax-248-213-0737
Email: tszerszen@pjlabs.com

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61 - 81, entitled "State Environmental Laboratory Certification Regulation,"

KATAHDIN ANALYTICAL SERVICES
600 TECHNOLOGY WAY
SCARBOROUGH, MAINE 04074

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: DEBORAH NADEAU
Certifying Authority: FL
Date of Issue: September 15, 2009
Date of Expiration: June 30, 2010
Certificate Number: 57001001

Director
Office of Environmental Laboratory Certification

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Laboratory Director: DEBORAH NADEAU
Certifying Authority: FL
Certificate Number: 57001001

Date of Issue: September 15, 2009
Expiration Date: June 30, 2010

CLEAN WATER ACT

INORGANIC - DEMAND

BIOCHEMICAL OXYGEN DEMAND(BOD)	SM 5210B (18TH)
CHEMICAL OXYGEN DEMAND (COD)	EPA 410.4 (1993)
TOTAL ORGANIC CARBON (TOC)	SM 5310B (18TH)

INORGANIC - MINERAL

ALKALINITY	SM 2320B (18TH)
CHLORIDE	SM 4500CL-E (18TH)
HYDROGEN-ION CONC. (PH)	SM 4500HB (18TH)
SULFATE	ASTM D516-02

INORGANIC - MISCELLANEOUS

CYANIDE	EPA 335.4 (1993)
PHENOLICS, TOTAL RECOVERABLE	EPA 420.1 (1978)
SULFIDE	SM 4500S2E (18TH)
TURBIDITY	EPA 180.1 (1993)

INORGANIC - NUTRIENT

AMMONIA-NITROGEN	EPA 350.1 (1993)
KJELDAHL-NITROGEN	EPA 351.2 (1993)
NITRATE-NITRITE (N02&N03)	EPA 353.2 (1993)
ORTHOPHOSPHATE	SM 4500PE (18TH)
PHOSPHORUS	EPA 365.4 (1974)

INORGANIC - RESIDUE

RESIDUE, NONFILTERABLE (TSS)	SM 2540D (18TH)
RESIDUE, TOTAL (TS)	SM 2540B (18TH)
RESIDUE, VOLATILE (VS)	EPA 160.4 (1979)

INORGANIC - TRACE METAL

ALUMINUM	EPA 200.7 (1994)
ANTIMONY	EPA 200.7 (1994)
ARSENIC	EPA 200.7 (1994)
BARIUM	EPA 200.7 (1994)
BERYLLIUM	EPA 200.7 (1994)
BORON	EPA 200.7 (1994)
CADMIUM	EPA 200.7 (1994)
CALCIUM	EPA 200.7 (1994)
CHROMIUM	EPA 200.7 (1994)
CHROMIUM, HEXAVALENT	SM 3500CRD (18TH)
COBALT	EPA 200.7 (1994)
COPPER	EPA 200.7 (1994)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Laboratory Director: DEBORAH NADEAU
Certifying Authority: FL
Certificate Number: 57001001

Date of Issue: September 15, 2009
Expiration Date: June 30, 2010

CLEAN WATER ACT

INORGANIC - TRACE METAL

IRON	EPA 200.7 (1994)
LEAD	EPA 200.7 (1994)
MAGNESIUM	EPA 200.7 (1994)
MANGANESE	EPA 200.7 (1994)
MERCURY	EPA 1631E (2002)
MERCURY	EPA 245.1 (1994)
MOLYBDENUM	EPA 200.7 (1994)
NICKEL	EPA 200.7 (1994)
POTASSIUM	EPA 200.7 (1994)
SELENIUM	EPA 200.7 (1994)
SILVER	EPA 200.7 (1994)
SODIUM	EPA 200.7 (1994)
THALLIUM	EPA 200.7 (1994)
TIN	EPA 200.7 (1994)
VANADIUM	EPA 200.7 (1994)
ZINC	EPA 200.7 (1994)

PCBS AND PESTICIDES

ORGANOCHLORINE PESTICIDES & PCBS - GC/E	EPA 608

SEMI-VOLATILES

BASE/NEUTRALS AND ACIDS - GC/MS	EPA 625

VOLATILES (VOCS)

PURGEABLES - GC/MS	EPA 624

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Certifying Authority: FL
Certificate Number: 57001001

Date of Issue: September 15, 2009
Expiration Date: June 30, 2010

CLEAN WATER ACT

--------PCBS AND PESTICIDES--------

EPA 608

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
BETA-BHC
CHLORDANE
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
GAMMA-BHC (LINDANE)
HEPTACHLOR
HEPTACHLOR EPOXIDE
PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)
TOXAPHENE

----------SEMI-VOLATILES----------

EPA 625

1,2,4-TRICHLOROBENZENE
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE (2,4-DNT)
2,6-DINITROTOLUENE (2,6-DNT)
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYL-4,6-DINITROPHENOL
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL

EPA 625

4-CHLOROPHENYL PHENYL ETHER
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZYL BUTYL PHTHALATE
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIMETHYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE (NB)
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE

----------VOLATILES (VOCS)---------

EPA 624

1,1,1-TRICHLOROETHANE
1,1,2,2-TETRACHLOROETHANE
1,1,2-TRICHLOROETHANE

EPA 624

1,1-DICHLOROETHANE
1,1-DICHLOROETHENE
1,2-DICHLOROBENZENE
1,2-DICHLOROETHANE
1,2-DICHLOROPROPANE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2-CHLOROETHYLVINYL ETHER
BENZENE
BROMODICHLOROMETHANE
BROMOFORM
BROMOMETHANE
CARBON TETRACHLORIDE
CHLOROBENZENE
CHLORODIBROMOMETHANE
CHLOROETHANE
CHLOROFORM
CHLOROMETHANE
CIS-1,3-DICHLOROPROPENE
DICHLORODIFLUOROMETHANE
ETHYLBENZENE
METHYLENE CHLORIDE
TETRACHLOROETHENE
TOLUENE
TRANS-1,2-DICHLOROETHENE
TRANS-1,3-DICHLOROPROPENE
TRICHLOROETHENE
TRICHLOROFLUOROMETHANE
VINYL CHLORIDE
XYLENE, TOTAL

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61 - 81, entitled
"State Environmental Laboratory Certification Regulation"

KATAHDIN ANALYTICAL SERVICES
600 TECHNOLOGY WAY
SCARBOROUGH, MAINE 04074

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: DEBORAH NADEAU
Certifying Authority: FL
Date of Issue: October 21, 2009
Date of Expiration: June 30, 2010
Certificate Number: 57001002

Director
Office of Environmental Laboratory Certification

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Laboratory Director: DEBORAH NADEAU
Certifying Authority: FL
Certificate Number: 57001002

Date of Issue: October 21, 2009
Expiration Date: June 30, 2010

SOLID & HAZARDOUS WASTES

INORGANIC - DEMAND

TOTAL ORGANIC CARBON (TOC)	EPA 9060A

INORGANIC - HAZARDOUS WASTE CHARACTERISTICS

IGNITABILITY (PENSKY MARTENS)	EPA 1010A
TCLP - BOTTLE EXTRACTION	EPA 1311
TCLP - ZERO HEADSPACE	EPA 1311

INORGANIC - MINERAL

CHLORIDE	EPA 9056A
CHLORIDE	EPA 9251
HYDROGEN-ION CONC. (PH)	EPA 9040C
HYDROGEN-ION CONC. (PH) (SOIL AND WAST	EPA 9045D
SULFATE	EPA 9038
SULFATE	EPA 9056A

INORGANIC - MISCELLANEOUS

BROMIDE	EPA 9056A
CYANIDE	EPA 9012B
OIL & GREASE	EPA 9070A
OIL & GREASE	EPA 9071B
PHENOLICS, TOTAL RECOVERABLE	EPA 9065

INORGANIC - NUTRIENT

NITRATE-NITROGEN	EPA 9056A
NITRITE-NITROGEN	EPA 9056A
ORTHOPHOSPHATE	EPA 9056A

INORGANIC - TRACE METAL

ALUMINUM	EPA 6010C
ALUMINUM	EPA 6020A
ANTIMONY	EPA 6010C
ANTIMONY	EPA 6020A
ARSENIC	EPA 6010C
ARSENIC	EPA 6020A
BARIUM	EPA 6010C
BARIUM	EPA 6020A
BERYLLIUM	EPA 6010C
BERYLLIUM	EPA 6020A
CADMIUM	EPA 6010C
CADMIUM	EPA 6020A
CALCIUM	EPA 6010C

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Laboratory Director: DEBORAH NADEAU
Certifying Authority: FL
Certificate Number: 57001002

Date of Issue: October 21, 2009
Expiration Date: June 30, 2010

SOLID & HAZARDOUS WASTES

INORGANIC - TRACE METAL

CHROMIUM	EPA 6010C
CHROMIUM	EPA 6020A
CHROMIUM, HEXAVALENT	EPA 7196A
COBALT	EPA 6010C
COBALT	EPA 6020A
COPPER	EPA 6010C
COPPER	EPA 6020A
IRON	EPA 6010C
LEAD	EPA 6010C
LEAD	EPA 6020A
MAGNESIUM	EPA 6010C
MANGANESE	EPA 6010C
MANGANESE	EPA 6020A
MERCURY	EPA 7470A
MERCURY	EPA 7471B
MOLYBDENUM	EPA 6010C
NICKEL	EPA 6010C
NICKEL	EPA 6020A
POTASSIUM	EPA 6010C
SELENIUM	EPA 6010C
SILVER	EPA 6010C
SILVER	EPA 6020A
SODIUM	EPA 6010C
THALLIUM	EPA 6010C
THALLIUM	EPA 6020A
VANADIUM	EPA 6010C
ZINC	EPA 6010C
ZINC	EPA 6020A

PCBS AND PESTICIDES

ORGANOCHLORINE PESTICIDES BY GC	EPA 8081B	EPA 3510C
ORGANOCHLORINE PESTICIDES BY GC	EPA 8081B	EPA 3550C
ORGANOCHLORINE PESTICIDES BY GC	EPA 8081B	EPA 3580A
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082A	EPA 3510C
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082A	EPA 3550C
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082A	EPA 3580A

SEMI-VOLATILES

EDB & DBCP BY MICROEXTRACTION AND GC	EPA 8011	
SEMIVOLATILE ORGANICS BY GC/MS	EPA 8270D	EPA 3520C
SEMIVOLATILE ORGANICS BY GC/MS	EPA 8270D	EPA 3540C
SEMIVOLATILE ORGANICS BY GC/MS	EPA 8270D	EPA 3580A
SEMIVOLATILE ORGANICS BY GC/MS	EPA 8270D	EPA 3550C
TPH - DIESEL RANGE ORGANICS (DRO)	EPA 8015C (DRO)	EPA 3510C

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Laboratory Director: DEBORAH NADEAU
Certifying Authority: FL
Certificate Number: 57001002

Date of Issue: October 21, 2009
Expiration Date: June 30, 2010

SOLID & HAZARDOUS WASTES

SEMI-VOLATILES

TPH - DIESEL RANGE ORGANICS (DRO)	EPA 8015C (DRO)	EPA 3550C
TPH - DIESEL RANGE ORGANICS (DRO)	EPA 8015C (DRO)	EPA 3580A

VOLATILES (VOCS)

VOLATILE ORGANICS BY GC/MS	EPA 8260B	EPA 3585
VOLATILE ORGANICS BY GC/MS	EPA 8260B	EPA 5030B
VOLATILE ORGANICS BY GC/MS	EPA 8260B	EPA 5035

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Certifying Authority: FL
Certificate Number: 57001002
Date of Issue: October 21, 2009
Expiration Date: June 30, 2010

SOLID & HAZARDOUS WASTES

--------PCBS AND PESTICIDES--------

EPA 8081B
EPA 3510C

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE
HEPTACHLOR
HEPTACHLOR EPOXIDE
METHOXYCHLOR

EPA 8081B
EPA 3550C

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE
HEPTACHLOR
HEPTACHLOR EPOXIDE

EPA 8081B
EPA 3550C

METHOXYCHLOR

EPA 8081B
EPA 3580A

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE
HEPTACHLOR
HEPTACHLOR EPOXIDE
METHOXYCHLOR

EPA 8082A
EPA 3510C

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

EPA 8082A
EPA 3550C

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)

EPA 8082A
EPA 3550C

PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

EPA 8082A
EPA 3580A

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

----------SEMI-VOLATILES----------

EPA 8011

1,2-DIBROMO-3-CHLOROPROPANE(DBCP)
1,2-DIBROMOETHANE (EDB)

EPA 8015C (DRO)
EPA 3510C

TPH - HIGH BOIL. PT. (DIESEL)

EPA 8015C (DRO)
EPA 3550C

TPH - HIGH BOIL. PT. (DIESEL)

EPA 8015C (DRO)
EPA 3580A

TPH - HIGH BOIL. PT. (DIESEL)

EPA 8270D
EPA 3520C

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL

EPA 8270D
EPA 3520C

2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE (2,4-DNT)
2,6-DINITROTOLUENE (2,6-DNT)
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE
4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANILINE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZOIC ACID
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Certifying Authority: FL
Certificate Number: 57001002
Date of Issue: October 21, 2009
Expiration Date: June 30, 2010

SOLID & HAZARDOUS WASTES

----------SEMI-VOLATILES----------

EPA 8270D
EPA 3520C

FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE (NB)
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE
PYRIDINE

EPA 8270D
EPA 3540C

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE (2,4-DNT)
2,6-DINITROTOLUENE (2,6-DNT)
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE

EPA 8270D
EPA 3540C

4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANILINE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZOIC ACID
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE (NB)
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE
PYRIDINE

EPA 8270D
EPA 3550C

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE (2,4-DNT)
2,6-DINITROTOLUENE (2,6-DNT)
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE
4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANILINE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZOIC ACID
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE

EPA 8270D
EPA 3550C

DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE (NB)
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE
PYRIDINE

EPA 8270D
EPA 3580A

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE (2,4-DNT)
2,6-DINITROTOLUENE (2,6-DNT)
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Certifying Authority: FL
Certificate Number: 57001002
Date of Issue: October 21, 2009
Expiration Date: June 30, 2010

SOLID & HAZARDOUS WASTES

----------SEMI-VOLATILES----------

EPA 8270D
EPA 3580A

4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE
4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANILINE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZOIC ACID
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE (NB)

EPA 8270D
EPA 3580A

PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE
PYRIDINE

----------VOLATILES (VOCS)---------

EPA 8260B
EPA 3585

1,1,1,2-TETRACHLOROETHANE
1,1,1-TRICHLOROETHANE
1,1,2,2-TETRACHLOROETHANE
1,1,2-TRICHLOROETHANE
1,1-DICHLOROETHANE
1,1-DICHLOROETHENE
1,1-DICHLOROPROPENE
1,2,3-TRICHLOROBENZENE
1,2,3-TRICHLOROPROPANE
1,2,4-TRICHLOROBENZENE
1,2,4-TRIMETHYLBENZENE
1,2-DIBROMO-3-CHLOROPROPANE(DBCP)
1,2-DIBROMOETHANE (EDB)
1,2-DICHLOROBENZENE
1,2-DICHLOROETHANE
1,2-DICHLOROPROPANE
1,3,5-TRIMETHYLBENZENE
1,3-DICHLOROBENZENE
1,3-DICHLOROPROPANE
1,4-DICHLOROBENZENE
2,2-DICHLOROPROPANE
2-CHLOROETHYLVINYL ETHER
2-CHLOROTOLUENE
2-HEXANONE
4-CHLOROTOLUENE
4-METHYL-2-PENTANONE
ACETONE
ACETONITRILE
ACROLEIN
ACRYLONITRILE
BENZENE
BROMOBENZENE
BROMOCHLOROMETHANE
BROMODICHLOROMETHANE

EPA 8260B
EPA 3585

BROMOFORM
BROMOMETHANE
CARBON DISULFIDE
CARBON TETRACHLORIDE
CHLOROBENZENE
CHLORODIBROMOMETHANE
CHLOROETHANE
CHLOROFORM
CHLOROMETHANE
CIS-1,2-DICHLOROETHENE
CIS-1,3-DICHLOROPROPENE
DIBROMOMETHANE
DICHLORODIFLUOROMETHANE
DIETHYL ETHER
ETHYLBENZENE
HEXACHLOROBUTADIENE
IODOMETHANE
ISOPROPYLBENZENE
METHYL ETHYL KETONE (MEK)
METHYL TERT BUTYL ETHER (MTBE)
METHYLENE CHLORIDE
N-BUTYLBENZENE
N-PROPYLBENZENE
NAPHTHALENE
P-ISOPROPYLTOLUENE
SEC-BUTYLBENZENE
STYRENE
TERT-BUTYLBENZENE
TETRACHLOROETHENE
TOLUENE
TRANS-1,2-DICHLOROETHENE
TRANS-1,3-DICHLOROPROPENE
TRICHLOROETHENE
TRICHLOROFLUOROMETHANE
VINYL ACETATE
VINYL CHLORIDE
XYLENE, TOTAL

EPA 8260B
EPA 5030B

1,1,1,2-TETRACHLOROETHANE
1,1,1-TRICHLOROETHANE
1,1,2,2-TETRACHLOROETHANE
1,1,2-TRICHLOROETHANE

EPA 8260B
EPA 5030B

1,1-DICHLOROETHANE
1,1-DICHLOROETHENE
1,1-DICHLOROPROPENE
1,2,3-TRICHLOROBENZENE
1,2,3-TRICHLOROPROPANE
1,2,4-TRICHLOROBENZENE
1,2,4-TRIMETHYLBENZENE
1,2-DIBROMO-3-CHLOROPROPANE(DBCP)
1,2-DIBROMOETHANE (EDB)
1,2-DICHLOROBENZENE
1,2-DICHLOROETHANE
1,2-DICHLOROPROPANE
1,3,5-TRIMETHYLBENZENE
1,3-DICHLOROBENZENE
1,3-DICHLOROPROPANE
1,4-DICHLOROBENZENE
2,2-DICHLOROPROPANE
2-CHLOROETHYLVINYL ETHER
2-CHLOROTOLUENE
2-HEXANONE
4-CHLOROTOLUENE
4-METHYL-2-PENTANONE
ACETONE
ACETONITRILE
ACROLEIN
ACRYLONITRILE
BENZENE
BROMOBENZENE
BROMOCHLOROMETHANE
BROMODICHLOROMETHANE
BROMOFORM
BROMOMETHANE
CARBON DISULFIDE
CARBON TETRACHLORIDE
CHLOROBENZENE
CHLORODIBROMOMETHANE
CHLOROETHANE
CHLOROFORM
CHLOROMETHANE
CIS-1,2-DICHLOROETHENE
CIS-1,3-DICHLOROPROPENE
DIBROMOMETHANE
DICHLORODIFLUOROMETHANE
DIETHYL ETHER
ETHYLBENZENE

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

KATAHDIN ANALYTICAL SERVICES (Laboratory ID 57001)
Certifying Authority: FL
Certificate Number: 57001002

Date of Issue: October 21, 2009
Expiration Date: June 30, 2010

SOLID & HAZARDOUS WASTES

----------VOLATILES (VOCS)---------

EPA 8260B
EPA 5030B

HEXACHLOROBUTADIENE
IODOMETHANE
ISOPROPYLBENZENE
METHYL ETHYL KETONE (MEK)
METHYL TERT BUTYL ETHER (MTBE)
METHYLENE CHLORIDE
N-BUTYLBENZENE
N-PROPYLBENZENE
NAPHTHALENE
P-ISOPROPYLTOLUENE
SEC-BUTYLBENZENE
STYRENE
TERT-BUTYLBENZENE
TETRACHLOROETHENE
TOLUENE
TRANS-1,2-DICHLOROETHENE
TRANS-1,3-DICHLOROPROPENE
TRICHLOROETHENE
TRICHLOROFLUOROMETHANE
VINYL ACETATE
VINYL CHLORIDE
XYLENE, TOTAL

EPA 8260B
EPA 5035

1,1,1,2-TETRACHLOROETHANE
1,1,1-TRICHLOROETHANE
1,1,2,2-TETRACHLOROETHANE
1,1,2-TRICHLOROETHANE
1,1-DICHLOROETHANE
1,1-DICHLOROETHENE
1,1-DICHLOROPROPENE
1,2,3-TRICHLOROBENZENE
1,2,3-TRICHLOROPROPANE
1,2,4-TRICHLOROBENZENE
1,2,4-TRIMETHYLBENZENE
1,2-DIBROMO-3-CHLOROPROPANE(DBCP)
1,2-DIBROMOETHANE (EDB)
1,2-DICHLOROBENZENE
1,2-DICHLOROETHANE
1,2-DICHLOROPROPANE
1,3,5-TRIMETHYLBENZENE

EPA 8260B
EPA 5035

1,3-DICHLOROBENZENE
1,3-DICHLOROPROPANE
1,4-DICHLOROBENZENE
2,2-DICHLOROPROPANE
2-CHLOROETHYLVINYL ETHER
2-CHLOROTOLUENE
2-HEXANONE
4-CHLOROTOLUENE
4-METHYL-2-PENTANONE
ACETONE
ACETONITRILE
ACROLEIN
ACRYLONITRILE
BENZENE
BROMOBENZENE
BROMOCHLOROMETHANE
BROMODICHLOROMETHANE
BROMOFORM
BROMOMETHANE
CARBON DISULFIDE
CARBON TETRACHLORIDE
CHLOROBENZENE
CHLORODIBROMOMETHANE
CHLOROETHANE
CHLOROFORM
CHLOROMETHANE
CIS-1,2-DICHLOROETHENE
CIS-1,3-DICHLOROPROPENE
DIBROMOMETHANE
DICHLORODIFLUOROMETHANE
DIETHYL ETHER
ETHYLBENZENE
HEXACHLOROBUTADIENE
IODOMETHANE
ISOPROPYLBENZENE
METHYL ETHYL KETONE (MEK)
METHYL TERT BUTYL ETHER (MTBE)
METHYLENE CHLORIDE
N-BUTYLBENZENE
N-PROPYLBENZENE
NAPHTHALENE
P-ISOPROPYLTOLUENE
SEC-BUTYLBENZENE
STYRENE
TERT-BUTYLBENZENE

EPA 8260B
EPA 5035

TETRACHLOROETHENE
TOLUENE
TRANS-1,2-DICHLOROETHENE
TRANS-1,3-DICHLOROPROPENE
TRICHLOROETHENE
TRICHLOROFLUOROMETHANE
VINYL ACETATE
VINYL CHLORIDE
XYLENE, TOTAL

From: Moreno, Pati (NFESC)
To: Leslie Dimond;
Subject: Navy Assessment - Katahdin
Date: Tuesday, June 09, 2009 1:55:23 PM

Ms. Dimond,

This email addresses the status of Katahdin Analytical Services, located at 600 Technology Way, Scarborough, Maine in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

NAVSEA 04XQ conducted a laboratory assessment of Katahdin Analytical Services of Scarborough, Maine as a support service to the Naval Facilities Engineering Service Center (NFESC). The general conclusion of the assessment is that the laboratory has successfully completed the evaluation for the parameters summarized in NAVSEA 04XQ letter Ser 04XQ (LABS)/211 dated December 2, 2008; these results are applicable to the Navy ER QA Program administered by NFESC. Based on the outcome of the assessment, a re-evaluation of your laboratory under the Navy ER QA Program will be due not later than September 23, 2010.

The outcome of this assessment does not guarantee the delivery of any analytical samples, and is facility specific (i.e. is applicable to the location specified and is not applicable to an affiliated or subcontract laboratory). The Navy reserves the right to conduct additional laboratory assessments. The outcome of the assessment may result in the addition or removal of parameters listed in the original scope of review, or reclassification from successful to unsuccessful.

Sincerely,
Pati Moreno
NFESC ER QA Program Coordinator
PH: (805) 982-1659 Fax: (805) 982-4304
Email: pati.moreno@navy.mil

No virus found in this incoming message.
Checked by AVG - www.avg.com
Version: 8.5.339 / Virus Database: 270.12.57/2163 - Release Date: 06/09/09 05:53:00

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
August 23, 2007

Ms. Leslie Dimond
Quality Assurance Officer
Katahdin Analytical Services
340 Country Road No. 5
Westbrook, ME 04098

Dear Ms. Dimond,

This correspondence addresses the status of Katahdin Analytical Services of Westbrook, Maine in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires September 30, 2008. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

The Navy's assessment included a review of the laboratory's QA manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, performance test (PT) results and onsite assessment documentation[1].

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD	PARAMETER	MATRIX
300 Series/9056	Anions: Bromide, Chloride, Fluoride, Nitrate, Nitrite, Orthophosphate, Phosphorus, Sulfate, Sulfide, Sulfite	Water/Solid
8260B	Volatile Organic Compounds	Water/Solid
8270C	Semivolatile Organic Compounds	Water/Solid
8081A	Organochlorine Pesticides	Water/Solid
8330	Explosives	Water/Solid
8082	Polychlorinated Biphenyls (PCBs)	Water/Solid

[1] The State of Florida conducted the onsite on August 28-30, 2006 to assess laboratory conformance with National Environmental Laboratory Accreditation Conference (NELAC) requirements. A supplementary Navy onsite was conducted May 8, 2007.

6010B/7000A	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
6020	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
7196	Chromium VI	Water/Solid
1664	Total Petroleum Hydrocarbons (TPH)	Water/Solid
8011	1,2 Dibromoehtane and 1,2 Dibromo-3-Chloropropane by Microestraction and Gas Chromatograph	Water/Solid
8015M	Total Petroleum Hydrocarbons – Gasoline Range Organics (GRO) Diesel Range Organics (DRO)	Water/Solid
9012	Cyanide	Water/Solid

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at pati.moreno@navy.mil.

Sincerely,

Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

From: Moreno, Pati (NFESC)
To: Leslie Dimond;
Subject: Navy Assessment - Katahdin
Date: Tuesday, June 09, 2009 1:55:23 PM

Ms. Dimond,

This email addresses the status of Katahdin Analytical Services, located at 600 Technology Way, Scarborough, Maine in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

NAVSEA 04XQ conducted a laboratory assessment of Katahdin Analytical Services of Scarborough, Maine as a support service to the Naval Facilities Engineering Service Center (NFESC). The general conclusion of the assessment is that the laboratory has successfully completed the evaluation for the parameters summarized in NAVSEA 04XQ letter Ser 04XQ (LABS)/211 dated December 2, 2008; these results are applicable to the Navy ER QA Program administered by NFESC. Based on the outcome of the assessment, a re-evaluation of your laboratory under the Navy ER QA Program will be due not later than September 23, 2010.

The outcome of this assessment does not guarantee the delivery of any analytical samples, and is facility specific (i.e. is applicable to the location specified and is not applicable to an affiliated or subcontract laboratory). The Navy reserves the right to conduct additional laboratory assessments. The outcome of the assessment may result in the addition or removal of parameters listed in the original scope of review, or reclassification from successful to unsuccessful.

Sincerely,
Pati Moreno
NFESC ER QA Program Coordinator
PH: (805) 982-1659 Fax: (805) 982-4304
Email: pati.moreno@navy.mil

No virus found in this incoming message.
Checked by AVG - www.avg.com
Version: 8.5.339 / Virus Database: 270.12.57/2163 - Release Date: 06/09/09 05:53:00

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
August 23, 2007

Ms. Leslie Dimond
Quality Assurance Officer
Katahdin Analytical Services
340 Country Road No. 5
Westbrook, ME 04098

Dear Ms. Dimond,

This correspondence addresses the status of Katahdin Analytical Services of Westbrook, Maine in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires September 30, 2008. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

The Navy's assessment included a review of the laboratory's QA manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, performance test (PT) results and onsite assessment documentation[1].

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD	PARAMETER	MATRIX
300 Series/9056	Anions: Bromide, Chloride, Fluoride, Nitrate, Nitrite, Orthophosphate, Phosphorus, Sulfate, Sulfide, Sulfite	Water/Solid
8260B	Volatile Organic Compounds	Water/Solid
8270C	Semivolatile Organic Compounds	Water/Solid
8081A	Organochlorine Pesticides	Water/Solid
8330	Explosives	Water/Solid
8082	Polychlorinated Biphenyls (PCBs)	Water/Solid

[1] The State of Florida conducted the onsite on August 28-30, 2006 to assess laboratory conformance with National Environmental Laboratory Accreditation Conference (NELAC) requirements. A supplementary Navy onsite was conducted May 8, 2007.

6010B/7000A	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
6020	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
7196	Chromium VI	Water/Solid
1664	Total Petroleum Hydrocarbons (TPH)	Water/Solid
8011	1,2 Dibromoehtane and 1,2 Dibromo-3-Chloropropane by Microestraction and Gas Chromatograph	Water/Solid
8015M	Total Petroleum Hydrocarbons – Gasoline Range Organics (GRO) Diesel Range Organics (DRO)	Water/Solid
9012	Cyanide	Water/Solid

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at pati.moreno@navy.mil.

Sincerely,

Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

Elsa Tai

From: Moreno, Pati (NFESC) [pati.moreno@navy.mil]
Sent: Tuesday, October 16, 2007 1:56 PM
To: tai@gplab.com
Cc: Neil, Kenda L. (NFESC)
Subject: RE: Navy Assessment - GPL Laboratories

Ms. Tai,

This email addresses the status of GPL Laboratories, LLLP of Frederick Maryland in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

NAVSEA 04XQ conducted a laboratory assessment of GPL Laboratories, LLLP of Frederick Maryland as a support service to the Naval Facilities Engineering Service Center (NFESC). The general conclusion of the assessment is that the laboratory has successfully completed the evaluation for the parameters summarized in NAVSEA 04XQ letter Ser 04XQ (LABS)/274A dated October 16, 2007; these results are applicable to the Navy ER QA Program administered by NFESC. Based on the outcome of the assessment, a re-evaluation of your laboratory under the Navy ER QA Program will be due not later than August 16, 2009.

The outcome of this assessment does not guarantee the delivery of any analytical samples, and is facility specific (i.e. is not applicable to an affiliated or subcontract laboratory). The Navy reserves the right to conduct additional laboratory assessments. The outcome of the assessment may result in the addition or removal of parameters listed in the original scope of review, or reclassification from successful to unsuccessful.

Contact Ms. Kenda Neil (kenda.neil@navy.mil / 805 982-6060) if there are parameters not presented on the table in the aforementioned NAVSEA letter that the laboratory expects to run on a routine basis in support of Navy environmental restoration projects. In these circumstances the laboratory's capability to run the tests will be assessed and the table will be modified accordingly. Any other questions concerning the information provided should be directed to me.

Sincerely,
Pati Moreno
NFESC ER QA Program Coordinator
PH: (805) 982-1659 Fax: (805) 982-4304
Email: pati.moreno@navy.mil

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
1333 ISAAC HULL AVE SE
WASHINGTON NAVY YARD DC 20376-0001

IN REPLY TO

5090
Ser 04XQ(LABS)/274A
October 16, 2007

Ms. Elsa Tai
GPL Laboratories
7210A Corporate Court
Frederick, Maryland 21703-8386

Subj: COMPLETION LETTER REPORT, GPL LABORATORIES – FREDERICK, MARYLAND

NAVSEA Laboratory Quality and Accreditation Office (LQAO) has concluded the assessment of GPL Laboratories, located in Frederick, Maryland.

The assessment was intended as a general review of analytical capability to support remediation projects and the laboratory's ability to meet quality assurance requirements presented in the DoD Quality Systems Manual for Environmental Laboratories (Version 3, dated Jan 2006). The specific methods reviewed under the assessment are summarized in the attached table. This letter presents the outcome of our assessment documented in the following reports:

LQAO ltr 5090 Ser 04XQ(LABS)/ 214 of 16 Aug 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 235 of 5 Sep 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 260 of 27 Sep 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 273 of 4 Oct 07

- **Desk Assessment:** A review of laboratory supplied documentation was conducted. Documentation included the laboratory's quality assurance (QA) manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, and historical PT information. The documentation was reflective of a laboratory that was in a position to meet Navy requirements; however findings that required resolution were identified.

- **Proficiency Testing (PT) Samples:** GPL Laboratories participates in a number of external certification and PT programs, and provided results for the past 2 years. Recurring failures were not identified in any specific analyte group, and the laboratory appears to be processing PT samples regularly (i.e. two times a year for each method/matrix).

5090
Ser 04XQ (LABS)/274A
October 16, 2007

- **On-site Assessment:** Existing on-site assessment documentation is available and was applied to this assessment. The State of Florida Environmental Laboratory Accreditation Program (FL ELAP) conducted an on-site assessment of the laboratory on June 19 - 21, 2007. FL ELAP is a National Environmental Laboratory Accreditation Conference (NELAC) recognized accreditation body. The State of Florida accepted the corrective actions and accredited the laboratory effective July 1, 2007, expiring June 30, 2008. The Florida assessment report and the laboratory Corrective Action Report (CAR) were reviewed. The nature of the findings did not raise a level of concern that would require a Navy follow-up on-site assessment.

- **Corrective Actions:** The laboratory successfully remedied all of the Navy findings associated with the desk assessment.

The laboratory has provided documentation that demonstrates their capability to support environmental restoration projects (for the tests reviewed under this assessment, and summarized in the following table), and conformance the DoD Quality Systems Manual. If you have questions concerning your standing in the Navy ER QA Program, please contact Pati Moreno at (805) 982-1659. This report is an amendment to Serial report 274, which had an incorrect scope of analyses.

Sincerely,

by direct

E. B. HARTZOG, JR.
Director, Laboratory Quality
and Accreditation Office

Copy To: NFESC (P. Moreno, Code 413)

GPL Laboratories - Methods Reviewed
(including parameters and matrices)

METHOD	PARAMETER	MATRIX
8260B	Volatile Organics	Water/ Solids
6010B/7000A/6020	TAL Metals: Aluminum, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/ Solids
8270D	Semivolatile Organics	Water/ Solids
8081A	Organochlorine Pesticides	Water/ Solids
8082	Polychlorinated Biphenyls	Water/ Solids/Oil
8015B	Diesel Range Organics	Water/ Solids
8015B	Gasoline Range Organics	Water/Solids
7196A	Hexavalent Chromium	Water/ Solids
9056	Anions: Chloride, Fluoride, Sulfate, Nitrate, and Nitrite	Water/Solids
9014	Cyanide	Water/ Solids
9065	Total Phenolics	Water/ Solids
8330	Explosives by HPLC	Water/ Solids
9060	Total Organic Carbon	Water/Solids
9071	Oil and Grease	Water/ Solids
8151A	Chlorinated Herbicides	Water/ Solids
RSK-175	Methane, Ethane, and Ethene	Water/ Solids
8011	1,2-Dibromoehtane, 1,2-Dibromo-3-chloropropane, and 1,2,3-Trichloropropane by GC	Water/ Solids

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

SOP Number: CA-101
Revision History
Cover Page
Page 1

TITLE: **EQUIPMENT MAINTENANCE**

Prepared By: Julie Ricardi Date: 8-96

Approved By:

Group Supervisor: _____ Date: _____

Operations Manager: Joel C. Burton Date: 12/15/00

QA Officer: Deborah J. Nadeau Date: 12·13·00

General Manager: JCBurton for D. McGrath Date: 12/15/00

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
01	Added requirements for recording maintenance in appropriate log. Added Archon maintenance. Modified Lachat maintenance. Attached equipment list.	DN	12·13·00	12·13·00
02	Removed references to General Manager. Removed furnace (GFAA) maintenance from Figure 1 and added ICP-MS. Updated equipment list.	DN	10·22·02	10·22·02
03	Changed Supervisor to department manager. Added maintenance for the ASE and general lab maintenance. Updated equipment list.	HRC	06.03.04	06.03.04
04	Added new equipment list.	LAD	01·28·05	01·28·05
05	Added Horizon SPE extractor & HPLC maintenance to Table 1. Added TOC analyzer, IC & miscellaneous instrument maintenance to Table 2. Updated equipment list.	DN	03·06	03·06

TITLE: **EQUIPMENT MAINTENANCE**

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
06	Updated ICP maintenance to include maintenance for new ICP (7500). Updated equipment list.	DR	04·07	04·07
07	Updated equipment list.	DR	07·08	07·08

TITLE: EQUIPMENT MAINTENANCE

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document **CA-101-07**, titled **EQUIPMENT MAINTENANCE**.

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document **CA-101-07**, titled **EQUIPMENT MAINTENANCE**.

Recipient: _____ Date: _____

TITLE: EQUIPMENT MAINTENANCE

1.0 SCOPE AND APPLICATION

The consistent generation of high quality analytical results requires properly operating analytical equipment. Accordingly, Katahdin Analytical Services, Inc. has an equipment maintenance program, which prescribes the necessary maintenance measures required and also schedules the frequency of conduct and documentation of those measures.

The purpose of this SOP is to describe the routine maintenance procedures employed for analytical equipment utilized by Katahdin Analytical personnel. It is applicable to all equipment utilized by laboratory personnel for analytical work. The procedures outlined in this SOP provide general guidance for equipment maintenance and documentation. The appropriate equipment manufacturer's manual(s) and specific analytical SOPs must be available and shall be consulted for specific maintenance and cleaning procedures.

1.1 Definitions

1.2 Responsibilities

It is the responsibility of each technical employee to carry out and document the required routine equipment maintenance at the required frequency for the instrumentation that they use.

It is the responsibility of each Department Manager to ensure that maintenance performed in-house is conducted properly by experienced personnel familiar with the equipment. On a routine basis, the department manager or qualified designee reviews equipment maintenance activities and recordkeeping requirements. Deficiencies are brought to the attention of the analyst who is responsible for an unacceptable procedure or entry, and any corrections are made by the appropriate analyst.

The Quality Assurance Officer is responsible for conducting periodic audits of the equipment maintenance program and documentation in each analytical area. Maintenance logs and contracted vendor maintenance records are reviewed for completeness and frequency of maintenance. Deficiencies are immediately brought to the attention of the Supervisor who is responsible for informing his/her staff and initiating the necessary corrective or improved actions in his/her analytical area.

2.0 SUMMARY OF METHOD

Not applicable.

3.0 INTERFERENCES

Refer to specific instrument manufacturer's operating manuals.

TITLE: EQUIPMENT MAINTENANCE

4.0 APPARATUS AND MATERIALS

Not applicable.

5.0 REAGENTS

Not applicable.

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Not applicable.

7.0 PROCEDURES

7.1 ROUTINE PREVENTIVE MAINTENANCE

Preventive maintenance (PM) may be conducted by qualified Katahdin personnel or may be performed under contract by authorized service technicians. Between service visits, instruments having PM service contracts are cleaned and maintained according to manufacturer's specifications by experienced Katahdin personnel. Instruments not under service contracts are cleaned and maintained by experienced laboratory personnel according to manufacturer's specifications and based on professional experience. The frequency of maintenance performed depends on the equipment. Preventive maintenance in each analytical section at Katahdin Analytical is scheduled, conducted and documented on a regular basis by the analytical section staff. Many maintenance needs (e.g., accidental breakage, part failure) are not satisfied by scheduled maintenance and are performed as needed. This would apply to routine daily instrument maintenance as well as non-scheduled instrument maintenance (e.g., replacement of GC injection port liners, replacement of volatiles Tekmar traps, etc.). Maintenance procedures indicated in Tables 1 and 2 are documented in appropriate logbooks maintained in each analytical area. Included in the documentation are general remarks describing the maintenance operations performed, the date maintenance was performed, and the signature or initials of the individuals who completed the maintenance. If a specific instrument problem prompted the need for maintenance, the problem and its resolution are documented along with the description of maintenance performed. Specific requirements for maintenance logs are described in Section 7.3.

7.2 PREVENTIVE MAINTENANCE SCHEDULES

Tables 1 and 2 summarize the routine preventive maintenance procedures and schedules followed within Katahdin Analytical for major laboratory instrumentation. These items are required to be documented in the applicable instrument or

maintenance log. Refer to Section 7.3 for specific requirements for maintenance log documentation.

7.3 MAINTENANCE LOG (or equivalent) REQUIREMENTS

Maintenance must be recorded in either the instrument run log or in a separate maintenance log. For equipment that does not have a run log or does not necessitate a separate maintenance log (i.e. little maintenance required), any maintenance may be recorded in the appropriate logbook (i.e. balance maintenance recorded in the balance calibration log). Attachment A provides a list of analytical equipment for which maintenance activities are recorded. Balances are not listed, although maintenance activities are recorded for these.

7.3.1 Maintenance logs (or equivalent) shall include the type of equipment and the analytical group/analysis for which it is designated, the manufacturer's model number and serial number, as well as any laboratory-assigned identifier (e.g., GC08, MS2, etc.). Each lab-assigned identifier must be unique and each instrument must have only one lab-assigned identifier. As new instrumentation is received, the date acquired, condition when received (new, used, reconditioned), and date put into use should be recorded in the new instrument's maintenance log.

7.3.2 Each page of the maintenance logbook (or equivalent) must clearly indicate the type of equipment and laboratory-assigned identifier in the header information. Maintenance entries shall include the date and signature or initials of the individual performing the maintenance as well as a brief explanation of the maintenance performed. If maintenance was conducted as the result of a suspected or known instrument problem, a summary of the problem and its final resolution must be included. The maintenance record must clearly indicate whether the problem was resolved and the date when return to control was noted.

7.3.3 On a routine basis the Department Manager or qualified designee shall review equipment maintenance activities and adherence to recordkeeping requirements. Deficiencies are brought to the attention of the analyst who was responsible for the unacceptable procedure or entry, and any corrections are made by the appropriate analyst. Documentation of the maintenance log review can be made by initialing and dating each page of the log or by indicating "reviewed by", initials and date on the front cover of the maintenance log (or equivalent).

7.3.4 On a periodic basis the laboratory QA Officer shall conduct audits of the equipment maintenance program and documentation in the analytical areas. Maintenance logs and contracted vendor maintenance records are reviewed for completeness and adherence to this SOP. Deficiencies are immediately brought to the attention of the Department Manager who is responsible for informing his/her staff and initiating the necessary corrective actions in his/her analytical area.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

Not applicable.

9.0 METHOD PERFORMANCE

Not applicable.

10.0 APPLICABLE DOCUMENTS/REFERENCES

Applicable equipment manufacturer's operating manuals.

LIST OF TABLES & ATTACHMENTS

TABLE 1 – ROUTINE MAINTENANCE SCHEDULE FOR ORGANICS INSTRUMENTATION
TABLE 2 - ROUTINE MAINTENANCE SCHEDULE FOR INORGANICS INSTRUMENTATION
TABLE 3 - ROUTINE MAINTENANCE SCHEDULE FOR GENERAL LABORATORY EQUIPMENT
ATTACHMENT A – ANALYTICAL EQUIPMENT

TABLE 1

ROUTINE MAINTENANCE SCHEDULE FOR ORGANICS INSTRUMENTATION

GC/MS

Regularly performed maintenance includes, but is not limited to, the following for GC/MS instrumentation:

- Check to ensure the pressure on the primary regulator never runs below 100 psi
- Check to ensure the gas supply is sufficient for the day's activity, and delivery pressures are set as described in the SOP.
- Change septa weekly or as needed.
- Replace/cut GC column as needed.
- Replace GC injector glass liner weekly or as needed.
- Replace glass jet splitter as needed.
- Replace pump oil as needed.
- Change gas line dryers as needed.
- Replace electron multiplier as needed.

GC

Regularly performed maintenance includes, but is not limited to, the following for GC instrumentation:

- Check to ensure the pressure on the primary regulator never runs below 100 psi.
- Check to ensure the gas supply is sufficient for the day's activity, and delivery pressures are set as described in the SOP.
- Change septa weekly or as needed.
- Replace/cut GC column as needed.
- Replace GC injector glass liner as needed.
- Change O_2/moisture traps as needed
- Clean/replace GC detector as needed.

TABLE 1, cont'd

ROUTINE MAINTENANCE SCHEDULE FOR ORGANICS INSTRUMENTATION

Purge and Trap Sample Concentrator

Regularly performed maintenance includes, but is not limited to, the following:

- Check to ensure the gas supply is sufficient for the day's activity and delivery pressures are set as described in the SOP.
- Replace trap as needed.
- Decontaminate the system after running high concentration samples or as required by blank analysis.
- Check system for leaks when problem suspected.

Archons

Regularly performed maintenance includes, but is not limited to, the following:

- Visually inspect sampler for corrosion or significant water seepage past plunger.
- Check system pressure (denotes leaks).
- Check for sufficient standard materials in standard vials.

Accelerated Solvent Extractor (ASE)

Regularly performed maintenance includes, but is not limited to, the following:

- Check for leaks at the pump solvent reservoir, valves and other components.
- Inspect needle alignment of source needle.
- Check alignment of autoseal arms.
- Change peek seals and o-rings on cell caps after about 50 extractions per cell.
- Inspect cell edges for nicks and gouges on cell body.
- Inspect stainless steel frits and sonicate in solvent if needed.

TABLE 1, cont'd

ROUTINE MAINTENANCE SCHEDULE FOR ORGANICS INSTRUMENTATION

Horizon SPE Automated Extractor System

Regularly performed maintenance includes, but is not limited to, the following:

- Check and clean sensors with a KIMWipe.
- Change sensors as needed.
- Purge system with solvent before use and after use.
- Clean system with hot water by running method 15 after samples are analyzed and before purging system.

HPLC

Regularly performed maintenance includes, but is not limited to, the following for HPLC instrumentation:

- Check and sonicate pump valves as needed.
- Backflush column as needed.
- Replace analytical column or guard column as needed.
- Sonicate and replace solvent with every use.
- Replace the UV lamp as needed.
- Check and replace seal-pak as needed

TABLE 2

ROUTINE MAINTENANCE SCHEDULE FOR INORGANICS INSTRUMENTATION

ICP/MS

Regularly performed maintenance includes, but is not limited to, the following for ICP instrumentation:

- Clean torch assembly and spray chamber when discolored.
- Clean nebulizer as needed.
- Check to ensure that the argon supply is sufficient for the day's activity, and that delivery pressures are set as described in the SOP. Change argon tanks as necessary.
- Replace peristaltic pump tubing when it becomes stretched or develops flat spots.
- Check coolant water level weekly; replenish as necessary.
- Check rinse solution level daily; replenish as necessary.
- Check waste container level daily; empty as necessary.
- Check cleanliness of instrument air filters weekly; clean or replace as necessary.
- Check instrument computer date and time at the start of each day; correct as necessary.
- Check condition of vacuum pump oil weekly, replace as necessary.
- Clean sampling and skimmer cones every 2-4 weeks.
- Clean extraction lenses monthly, or as needed.
- Clean Einzel lenses every 3-6 months.

ICP

Regularly performed maintenance includes, but is not limited to, the following for ICP instrumentation:

- Clean torch assembly and spray chamber when discolored.
- Clean nebulizer as needed.

TABLE 2, cont'd

ROUTINE MAINTENANCE SCHEDULE FOR INORGANICS INSTRUMENTATION

ICP, cont'd

- Check to ensure that the argon supply is sufficient for the day's activity, and that delivery pressures are set as described in the SOP. Change argon tanks as necessary.
- Replace peristaltic pump tubing when it becomes stretched or develops flat spots.
- Check coolant water level weekly; replenish as necessary.
- Check rinse solution level daily; replenish as necessary.
- Check waste container level daily; empty as necessary.
- Check instrument computer date and time at the start of each day; correct as necessary.

Mercury Analyzer

Regularly performed maintenance includes, but is not limited to, the following:

- Replace drying tube as necessary
- Replace peristaltic pump tubing when it becomes stretched or develops flat spots.
- Replace mercury lamp as necessary.
- Clean optical cell quarterly or as needed.
- Clean liquid/gas separator when it becomes cloudy. Replace as needed.
- Check waste container level before each use; empty as necessary.
- Check exhaust system integrity before each use; correct as necessary.
- Check instrument computer date and time at the start of each day; correct as necessary.

TABLE 2, cont'd

ROUTINE MAINTENANCE SCHEDULE FOR INORGANICS INSTRUMENTATION

Lachat Autoanalyzer

Regularly performed maintenance includes, but is not limited to, the following:

- Check pump tubing; replace as needed.
- Clean interference filter with Kimwipe.
- Check reagent levels and expiration dates; refill or replace as needed.
- Rinse manifolds with water after analysis.
- Check manifold board surfaces; clean as needed by running under tap water.
- Check supplies and reagents; order as needed
- Check for leaks
- Check autosampler and autosampler trays;clean and/or lubricate as needed.
- Check fittings and o-rings on boards; replace as needed.
- Check peristaltic pump rollers; clean and lubricate as needed.
- Inspect manifold tubing for kinks and/or stains; replace as needed.
- Inspect valve flares; clean or replace as needed.
- Inspect reagent and waste lines; replace as needed.
- Check flow cell; clean as needed with Kimwipe.

Konelab AutoAnalyzer

Regularly performed maintenance includes, but is not limited to, the following:

- Rinse and refill distilled water container weekly.

TABLE 2, cont'd

ROUTINE MAINTENANCE SCHEDULE FOR INORGANICS INSTRUMENTATION

Konelab AutoAnalyzer, cont'd

- Check cleanness of segments weekly.
- Wash reagent tubes monthly.
- Change lamp as needed.
- Change diluent and wash tubes as needed.
- Change mixing paddles as needed.
- Change syringes as needed.
- Change dispensing needles as needed.
- Change drain and waste tubes as needed.
- Check used cuvettes and waste daily.

TOC Combustion Analyzer

Regularly performed maintenance includes, but is not limited to, the following:

- Check level of dilution water, drain vessel water, humidifier water, autosampler rinse water, and phosphoric acid vessel and fill as needed.
- Replace oxygen cylinder as needed.

IC

Regularly performed maintenance includes, but is not limited to, the following for IC instrumentation:

- Check regenerate pump tubing and replace as needed.
- Clean or regenerate column as needed.

TABLE 2, cont'd

ROUTINE MAINTENANCE SCHEDULE FOR INORGANICS INSTRUMENTATION

IC, cont'd

- Replace analytical column or guard column as needed.
- Change suppressor as needed.

Miscellaneous Instrumentation

Regularly performed maintenance includes, but is not limited to, the following:

- Replace spectrophotometer lamps as needed.
- Inspect DO probe membrane for tears and check for air bubbles under the membrane.
- Replace the DO probe membrane cap and electrolyte solution as needed.
- Clean pH electrode as needed.
- Change the autotitrator filling solution as needed.
- Clean, check, calibrate to manufacturers' specifications all pH, DO, conductivity, and turbidity meters annually (minimum); clean, check, calibrate to manufacturers' specifications all spectrophotometers biannually.

TABLE 3

ROUTINE MAINTENANCE SCHEDULE FOR GENERAL LABORATORY EQUIPMENT

General Laboratory Areas

- Clean and calibrate balances biannually (minimum).
- Check balance calibration each day of use.
- Clean balance pan prior to each use.
- Calibrate automatic pipettes with each use.
- Calibrate thermometers yearly against an NIST traceable thermometer; calibrate heavily used digital thermometers quarterly.
- Record refrigerator, freezer, and oven temperatures each weekday.
- General housekeeping: keep counter tops, hoods, and floors clean.
- Check airflow in hoods once a week.

TITLE: EQUIPMENT MAINTENANCE

ATTACHMENT A

ANALYTICAL EQUIPMENT LIST

ANALYTICAL INSTRUMENTATION

KEY INSTRUMENTATION	DATE IN SERVICE	USED FOR ANALYSIS	Instrument Identification
Hewlett Packard 5973 GC/MS with EPC, Archon Autosampler with foam sensor option and EST ENCON Evolution Purge and Trap Concentrator	**2008**	5030/8260, 5035/8260, 624, Current versions of CLP SOWs (OLM, OLC, & SOM) (VOA), & 524.2	D
Hewlett Packard 5972 GC/MS with EPC, Centurion Autosampler with foam sensor option and EST ENCON Purge and Trap Concentrator	**2006**	5030/8260, 5035/8260, 624, Current versions of CLP SOWs (OLM & SOM) (VOA)	T
Hewlett Packard 5972 GC/MS with EPC; Tekmar LSC-3100 Purge and Trap concentrator; Archon autosampler capable of low soils per Method 5035.	**1998**	5030/8260, 5035/8260, 624, Current versions of CLP SOWs (OLM, OLC, & SOM) (VOA), & 524.2	S
Hewlett Packard 5972 GC/MS with EPC; Tekmar LSC - 3000 purge and trap concentrator; Archon autosampler capable of low soils per Method 5035.	**1996**	5030/8260, 5035/8260, 624, Current versions of CLP SOWs (OLM, OLC, & SOM) (VOA), & 524.2	Z
Hewlett Packard 5972 GC/MS with EPC; Encon Purge and Trap concentrator; Archon autosampler capable of low soils per method 5035.	**1995**	5030/8260, 5035/8260, 624, Current versions of CLP SOWs (OLM, OLC, & SOM) (VOA), & 524.2	M
Hewlett Packard 5972 GC/MS with EPC; Tekmar LSC-3000 Purge and Trap concentrator; Archon autosampler capable of low soils per Method 5035.	**1993**	5030/8260, 5035/8260, 624, Current versions of CLP SOWs (OLM, OLC, & SOM) (VOA), & 524.2	F
Hewlett Packard 5973 GC/MS with EPC and Model 6890 autosampler.	**2008**	8270, 625 & Current versions of CLP SOWS (OLM, OLC, & SOM) (SVOA)	G
Hewlett Packard 5973 GC/MS with EPC and Model 6890 autosampler.	**2006**	8270, 625 & Current versions of CLP SOWS (OLM, OLC, & SOM) (SVOA)	R

TITLE: EQUIPMENT MAINTENANCE

ATTACHMENT A

ANALYTICAL EQUIPMENT LIST, cont'd

ANALYTICAL INSTRUMENTATION

KEY INSTRUMENTATION	DATE IN SERVICE	USED FOR ANALYSIS	Instrument Identification
Hewlett Packard 5973 GC/MS with EPC and Model 6890 autosampler.	**1999/ 2001**	8270, 625 & Current versions of CLP SOWS (OLM, OLC, & SOM) (SVOA)	U
Hewlett Packard Model 5890 gas chromatograph with a flameionization detector; Agilent Technologies G1888 Network Headspace Analyzer.	**1991/ 2005**	Methane, Ethane and Ethene	GC05
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD); Hewlett Packard Model 7673 autosampler.	**1993**	504, 556, 608, 8011, 8081, 8082, 8151	GC08
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD); Hewlett Packard Model 7673 autosampler.	**1993**	8081, 8082, 608	GC06
Hewlett Packard Model 5890 gas chromatograph with dual electron capture detectors (ECD); Hewlett Packard Model 7673A autosampler.	**1988**	504, 8011, 8151	GC03
Hewlett Packard Model 5890 gas chromatograph with EPC and dual flame ionization detectors; Hewlett Packard Model 7673 autosampler.	**1993/ 1996**	8015 MOD., MAEPH, DRO	GC10
Hewlett Packard Model 5890 gas chromatograph with flame ionization detector; Tekmar ALS 2016 autosampler; Tekmar LSC 2000 purge and trap.	**1991**	8015 MOD., GRO	GC04
Hewlett Packard Model 5890 gas chromatograph with flame ionization detector and photo ionization detector; Tekmar ALS 2016 autosampler; Tekmar LSC 3000 purge and trap.	**1988**	8015 MOD., MAVPH, GRO	GC09

ATTACHMENT A

ANALYTICAL EQUIPMENT LIST, cont'd

ANALYTICAL INSTRUMENTATION

KEY INSTRUMENTATION	DATE IN SERVICE	USED FOR ANALYSIS	Instrument Identification
Hewlett Packard Model 5890 gas chromatograph with flame ionization and nitrogen-phosphorous detectors; Hewlett Packard Model 7673 autosampler.	**1992/ 1996**	ALCOHOLS, DMF, GLYCOLS	GC11
Hewlett Packard Model 5890 gas chromatograph with EPC and dual flame ionization detectors; Hewlett Packard Model 7673 autosampler.	**1987**	8015 MOD., MAEPH, DRO	GC12
Agilent Model 6890 gas chromatograph with dual EPC injection ports and micro electron capture detectors; Agilent Model 7683 autosampler	**2000**	8081, 8082 (including congeners), 608, current versions of CLP SOWs (OLM, OLC, & SOM) (P/P)	GC07
Hewlett Packard series 1100 HPLC with Quaternary pump, Diode Array detector and autosampler	**2008**	8330, 8332	HPLC03
ABC Autoprep 1000 GPC with UVD-1 ultraviolet detector and chart recorder.	**1994**	Current versions of CLP SOWS (OLM, OLC, $ SOM) (GPC-3640)	GPC01
Horizon SPE-DEX 4790 Automated Extractor System equipped with 4 extractors.	**2001/ 2005**	3535 method developement	Horizon #1
Horizon SPE-DEX 3000 Automated Extractor System equipped with 3 extractors.	**2006**	1664, 9070, 9071	Horizon #2
Thermo ICAP 6500 ICP Emission Spectrometer with autosampler.	**2006**	6010, 200.7, ILM05.4	I
Agilent 7500a ICP-MS with autosampler.	**2007**	6020, 200.8, ILM05.4	J
CETAC M-6100 Automated Mercury Analyzer with Autosampler	**2004**	7470/7471, 245.1, 245.5, ILM05.4	H

ATTACHMENT A

ANALYTICAL EQUIPMENT LIST, cont'd

ANALYTICAL INSTRUMENTATION

KEY INSTRUMENTATION		DATE IN SERVICE	USED FOR ANALYSIS	Instrument Identification
Tekran Series 2600 automated mercury analyzer with gold amalgam preconcentration and atomic fluorescence detector; Model 2620 autosampler.		**2000**	Ultra-trace level mercury (1631)	G
CPI ModBlock™ Metals Digestion Unit – Two 48 Place Units.		**2000**	Metals Aqueous Digestions	Digestion Unit #1 Digestion Unit #2
LACHAT Quickchem 8000 Continuum Series – Automated Ion Analyzer and autosampler.		**2000**	Various	WC1
Shimadzu TOC-V Combustion Analyzer, PC Controlled, High Sensitivity, Auto-Aqueous TOC Autosampler w/ 40 mL vials; Model SSM-5000A Solid Sample Module.		**2002**	TOC	WC2
Waters 717 Plus Autosampler, Waters 431 conductivity detector, Spectra System P4000 pump.	Dionex IonPak AS4A column; Dionex AMMS III chemical suppression system	**1991/ 2004**	Ion chromatography – Various Anions	See "Key Instrumentation " column for identification
	Dionex AS16 column; Dionex ultra ASRS electronic suppression system.		Ion Chromatography - Perchlorate	See "Key Instrumentation " column for identification
Scanning Fluorescence Detector		**1997**	Out of Service	NA
10 position Lab Crest Cyanide Midi-Distillation system.		**1998**	Cyanide	WC3
Spectronic 401 spectrophotometer.		**2000**	Various	WC4
HACH Turbidimeter, Model 2100A.		**1993**	Turbidity	WC6

ATTACHMENT A

ANALYTICAL EQUIPMENT LIST, cont'd

ANALYTICAL INSTRUMENTATION

KEY INSTRUMENTATION	DATE IN SERVICE	USED FOR ANALYSIS	Instrument Identification
Accumet pH/Conductivity Meter, Model 20.	**1998**	Various	WC8
Mettler DL25 Autotitrator & Mettler ST20A sample changer.	**1993**	Alkalinity	WC9
YSI Dissolved Oxygen Meter.	**1990**	Dissolved Oxygen & Biochemical Oxygen Demand	WC10
Konelab 20 Multi-Wavelength Photometric Analyzer.	**2003**	Various	Konelab #1
Dionex Accelerated Solvent Extractor ASE 200.	**2003**	3545	ASE #1
Waters HPLC system with 600E multisolvent delivery system, 717 plus autosampler, Spectra System UV200 detector	**2003/2004**	Food Testing	HPLC01
Thermo Spectronic Genesys 10uv spectrophotometer	**2005**	Food Testing	Food #1
DryVap Concentrator System 5000	**2005**	GC and GC/MS Extractables	DryVap #1

TITLE: **DETERMINATION OF NITROAROMATICS AND NITRAMINES BY HPLC METHOD 8330**

Prepared By: Paul Raiti Date: 5/97

Approved By:

Department Manager: [signature] Date: 6-21-06

Operations Manager: Deborah J. Nadeau Date: 6·21·06

QA Officer: Leslie Dimond Date: 6-21-06

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
02	Updated Sect. 4→10, Tables 1→3, Figures 1 & 2 to reflect current practices. Added waste management to Sect. 1.4. Changed LIMS to KIMS. Removed Turbochrom and added Target definitions. Updated PQL's	LAD	04/06	04/06
03	Major rewrite to include new instrumentation, new extraction procedures, method modifications, new low level method and new example pages.	LAD	07/08	07/08

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ____ of document **SOP CA-402-03**, titled **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ____ of document **SOP CA-402-03**, titled **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

Recipient: _____ Date: _____

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

1.0 SCOPE AND APPLICATION

The purpose of this SOP is to describe the procedures used by Katahdin Analytical Services, Inc. technical personnel for the extraction and analysis of waters and soil for explosive residues using high performance liquid chromatography (HPLC) in accordance with EPA Method 8330B. The following compounds may be determined by this method:

COMPOUND	ABBREVIATION	CAS No.
Octahydro-1,3,5,7,-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0
Hexahydro-1,3,5-trinitro-1,3,5- triazine	RDX	121-82-4
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4
1,3-Dinitrobenzene	1,3-DNB	99-65-0
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8
Nitrobenzene	NB	98-95-3
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7
4-Amino-2,6-dinitrotoluene	4-Am-DNT	1946-51-0
2-Amino-4,6-dinitrotoluene	2-Am-DNT	355-72-78-2
2,6-Dinitrotoluene	2,6-DNT	606-20-2
2,4-Dinitrotoluene	2,4-DNT	121-14-2
2-Nitrotoluene	2-NT	88-72-2
3-Nitrotoluene	3-NT	99-08-1
4-Nitrotoluene	4-NT	99-99-0
Nitroglycerin	NG	55-63-0
Pentaerythritol	PETN	78-11-5
3,5-Dinitroaniline	3,5-DNA	618-87-1
Ethylene Glycol Dinitrate	EGDN	628-96-6

The laboratory PQLs (reporting limit) for each compound in reagent water and solid matrix are listed in Table 3. The sensitivity of this method is dependent upon the level of interference rather than instrumental limitations. The reporting limits listed in Table 3 for the liquid chromatographic approach represent sensitivities that can be achieved in the absence of interferences. When interferences are present, the sensitivity will be decreased.

1.1 Definitions

ANALYTICAL BATCH: 20 or fewer samples which are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods.

METHOD BLANK (laboratory reagent blank): An artificial sample designed to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus. For aqueous samples, analyte-free water (e.g., deionized water or equivalent) is used as a blank matrix; for soil/sediment

samples, muffled sand is used for the blank matrix. The blank prepared and analyzed exactly like a sample.

CALIBRATION CURVE (STANDARD CURVE): A sequence of standards at varying analyte concentrations used to generate a curve which plots concentration of known analyte standard versus the instrument response to the analyte.

INDEPENDENT CHECK STANDARD: A standard obtained from a source (vendor or lot) which is different from that used to prepare the calibration curve standards. Results are used to verify the accuracy of a known concentration of analyte versus the standard curve.

CALIBRATION VERIFICATION CHECK (CV): Verification of the ratio of instrument response to analyte amount, a calibration check is done by analyzing for analyte standards in an appropriate solvent.

CALIBRATION STANDARD (WORKING STANDARD): A solution prepared from the stock standard solution that is used to calibrate the instrument response with respect to analyte concentration.

LABORATORY CONTROL SAMPLE (LCS): A blank that has been spiked with the analyte(s) from an independent source or stock standard solution and is analyzed exactly like a sample. Its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements. The matrix used should be phase matched with the samples and well characterized.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD): Duplicate samples that are spiked with known concentrations of analytes. The samples are the analyzed as routine samples. The results are used to evaluate matrix effects and the precision and accuracy of the method using actual samples.

STOCK STANDARD SOLUTION: A concentrated solution containing the analyte(s) of interest at certified known concentration(s). These solutions are often certified by the vendor. Stock standard solutions are used to prepare calibration standards.

SURROGATES: Organic compounds which are similar to analytes of interest in chemical composition, extraction and chromatography, but which are not normally found in environmental samples. These compounds are spiked into all blanks, standards, samples and spiked samples prior to analysis. Percent recoveries are calculated for each surrogate.

KATAHDIN INFORMATION MANAGEMENT SYSTEM (KIMS) : A complete multi-user system with the capabilities of integrating laboratory instrumentation, generating

laboratory worksheets, providing complete Lab Order status and generating reports. KIMS utilizes these features through a database.

PE NELSON TURBOCHROM: A data acquisition system that is used to collect chromatographic data. The system can also be used to archive raw data files.

TARGET: A software system that combines full processing, reporting and comprehensive review capabilities, regardless of chromatographic vendor and data type.

TARGET DB: An oracle database used to store and organize all Target data files.

QUICKFORMS: A laboratory reporting software for Target and Target DB. The QuickForms report module for Target is preconfigured with generalized forms and US EPA CLP report forms and disk deliverables, which can be customized.

1.2 Responsibilities

This method is restricted to use by, or under the supervision of analysts experienced in the analysis of explosives by HPLC Method 8330B. Each analyst must demonstrate and document their ability to generate acceptable results with this method. Refer to Katahdin SOP QA-805, current revision, "Personnel Training & Documentation of Capability".

It is the responsibility of all Katahdin technical personnel involved in analysis of explosives by HPLC Method 8330B to read and understand this SOP, to adhere to the procedures outlined, and to properly document their data in the appropriate lab notebook. Any deviations from the test or irregularities with the samples should also be recorded in the lab notebook and reported to the Department Manager or designated qualified data reviewer responsible for this data.

It is the responsibility of the Department Manager to oversee that members of their group follow this SOP, to ensure that their work is properly documented and to indicate periodic review of the associated logbooks.

1.3 Health & Safety

ALL OF THE COMPOUNDS LISTED IN SECTION 1.0 OF THIS SOP ARE EITHER USED IN THE MANUFACTURE OF EXPLOSIVES OR ARE THE DEGRADATION PRODUCTS OF COMPOUNDS USED FOR THAT PURPOSE. WHEN MAKING STOCK SOLUTIONS FOR CALIBRATION, ESPECIALLY IF YOU ARE USING NEAT MATERIALS, TREAT EACH COMPOUND AS IF IT WERE EXTREMELY EXPLOSIVE.

Users of this procedure must be cognizant of inherent laboratory hazards, proper disposal procedures for contaminated materials and appropriate segregation of hazardous wastes. The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical should be treated as a health hazard. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Everyone involved with the procedure must be familiar with the MSDSs (material safety data sheets) for all the materials used in this procedure.

Each qualified analyst or technician must be familiar with Katahdin Analytical safety procedures and the Katahdin Hazardous Waste Management Plan and must follow appropriate procedures. These include the use of appropriate personal protective equipment (PPE) such as safety glasses, gloves and lab coats when working with chemicals or near an instrument and not taking food or drink into the laboratory. Each analyst should know the location of a respirator and all safety equipment. Each analyst shall receive a safety orientation from their Department Manager, or designee, appropriate for the job functions they will perform.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

Wastes generated during the preparation of samples must be disposed of in accordance with the Katahdin Hazardous Waste Management Plan and Safety Manual and SOP SD-903, "Sample Disposal," current revision. Expired standards are lab packed, placed in the Katahdin hazardous waste storage area, and disposed of in accordance with this SOP.

All standards and samples must be classified as flammable waste and disposed of accordingly.

2.0 SUMMARY OF METHOD

This SOP describes high performance liquid chromatographic (HPLC) conditions for the detection of part per billion (ppb) levels of certain explosive compounds. Prior to use of this method, appropriate sample extraction techniques must be used. A 75 uL or 150 uL (low level) aliquot of the extract is injected into an HPLC, and compounds are detected by an ultraviolet (UV) detector.

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

3.0 INTERFERENCES

3.1 Solvents, reagents, glassware, and other sample processing hardware may yield discrete artifacts and/or elevated baselines, resulting in mis-integration or mis-interpretation of the chromatograms. All of these materials must be demonstrated to be free from interferences, under the conditions of the analysis, by the analysis and evaluation of method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required.

3.2 The chromatographic conditions described allow for a unique resolution of the specific explosive compounds covered by this method. Other explosive compounds, in addition to matrix artifacts, may interfere.

3.3 Tetryl decomposes rapidly in methanol/water solutions, as well as with heat. All aqueous samples expected to contain tetryl should be diluted with acetonitrile prior to filtration and acidified to pH <3 with aqueous sodium bisulfate. All samples expected to contain tetryl should not be exposed to temperatures above room temperature.

4.0 APPARATUS AND MATERIALS

4.1 HPLC system:

4.1.1 Agilent Hewlett Packard 1100 series HPLC system, including a multiwavelength UV detector for dual wavelength analysis.

4.1.2 Chemstation software for LC Rev A.10.02 [1757].

4.2 Primary column: Dionex Acclaim Explosives E1 reversed phase HPLC column, 4.6mm X 25 cm, 5um, order #064305; and associated pre-column or eqivalent.

4.3 Confirmation column: Dionex Acclaim Explosives E2 reverse phase HPLC column, 4.6mm X 25 cm, 5um, order # 064309, and associated pre-column. Or an equivalent.

4.4 Mechanical shaker table for soil extractions.

4.5 Volumetric flask - 1 liter and other appropriate sizes with ground glass stoppers

4.6 Erlenmeyer Flasks – 1 liter

4.7 Magnetic stirring plate and bars

4.8 Disposable 0.45 um Teflon-filters

4.9 Sieve - 30 mesh

4.10 Mortar and pestle

4.11 Graduated cylinders - 500, 25, and 10 mLs.

4.12 Balance - ± 0.1 mg

4.13 WISP 1.0 mL and 4.0 mL auto-sampler vials with Teflon septa

4.14 Vortex Mixer

4.15 12 and 40 mL glass vial and cap

4.16 Disposable pipettes.

4.17 Porapak RDX cartridges

4.18 Vacuum manifold, 24 position or equivalent

4.19 Vacuum Pump

4.20 Sep-Pak Vac Adapter

4.21 60 mL Sep-Pak Reservoir

4.22 Tubing, Tefzel, 1/8-inch O.D. X 0.040-inch I.D.

4.23 4 L glass vacuum trap

4.24 500 mL Teflon or glass bottles

4.25 12 mL centrifuge tubes

4.26 6 hole Styrofoam holder

5.0 REAGENTS

All reagent and solvent lots must be checked for possible contamination. Refer to the current version of Katahdin SOP CA-105, Reagent and Solvent Handling, for further details. The extraction staff is responsible for submitting samples to the GC or GC/MS sections for appropriate analysis. All information concerning preparation of the reagent/solvent lot sample will be recorded in the Organic Extractions Log - Explosives (Figure 1). All reagents and solvents must be free (<PQL) of any target compounds.

5.1 Calcium chloride (5 g/L), Reagent grade, Aldrich order # 383147 or equivalent: Prepare by dissolving 1.0 g in 200mL of reagent water.

5.2 Laboratory Reagent Grade water: Defined as water in which an interferant is not observed at the method detection limit of the compounds of interest.

5.3 Acetonitrile, HPLC grade, J.T. Baker order # 9017-03 or equivalent.

5.4 Methanol, HPLC grade, Fisher order # A452-4 or equivalent.

5.5 Sodium Chloride, Reagent grade, J.T. Baker order # 3624-05, or equivalent (baked @ 400 degrees for 4 hours).

5.6 Water, HPLC grade, Fisher order #W5-4 or equivalent.

5.7 Baked sand for soil blank and LCS.

5.8 Stock Standard Solution (for calibration standards): Accustandard Method 8330, order # M-8330R or equivalent, at 1.0 mg/mL in MeOH:AcCN (1:1).

5.9 Stock Standard Solution (for Independent Source and Laboratory Control Spike): Ultra Scientific Combined Stock Solution - Full Explosive Mix - order # NAIM-833E or equivalent, at 1.0 mg/mL in acetonitrile.

5.10 Stock Standard Solution (for calibration standards): nitroglycerin, Accustandard, order number M-8330-ADD-1 or equivalent, 100 mg/L in ethanol.

5.11 Stock Standard Solution (for independent source and laboratory control spike): Nitroglycerin, #31498 Restek, or equivalent, 1000µg/mL in Methanol.

5.12 Stock Standard Solution: Pentaerythritol tetranitrate (PETN), Accustandard #M8330-ADD-2-10x, or equivalent, 1000 mg/L.

5.13 Stock Standard Solution: Pentaerythritol tetranitrate (PETN), (for independent source and laboratory control spike): Restek order #31600, at 1000 mg/L or equivalent.

5.14 Stock Standard Solution: 3,5-Dintroaniline, #M8330-ADD-4 Accustandard, or equivalent.

5.15 Stock Standard Solution: 3,5-Dinitroaniline, (for independent source and laboratory control spike) Restek order #31661 at 1000 mg/L, or equivalent.

5.16 Stock Standard Solution: ethylene glycol dinitrate (EGDN), Accustandard order #M-8330-ADD-5 at 100 mg/L, or equivalent.

5.17 Stock Standard Solution (for independent source and laboratory control spike): EGDN, Restek order #31601 at 1000 mg/L.

5.18 Surrogate 1,2-Dintirobenzene, Accustandard order # M-8330-SS equivalent, at 1.0 mg/mL in MeOH.

NOTE: Stock standard solutions must be replaced after 1 year or sooner if comparison with check standards indicates a problem.

5.19 Intermediate standard solutions: Prepare the 8330 explosive standard, nitroglycerine, PETN, EGDN, and 3,5-dinitroaniline at 100mg/L and the surrogate, 1,2-Dinitrobenzene, separately at 10µg/mL in methanol or acetonitrile. Prepare the independent source at 5.0µg/mL in methanol or acetonitrile.

5.19.1 Larger volumes can be used at the convenience of the analyst. Commercially prepared stock standards can be used at any concentration if they are certified by the manufacturer or by an independent source.

5.19.2 Transfer the stock standard solutions into Teflon-sealed screw-cap bottles. Store at 4 °C and protect from light. Stock and intermediate standards should be checked frequently for signs of degradation or evaporation, especially just prior to preparing calibration standards from them.

5.19.3 Intermediate standard solutions should be refrigerated upon preparation, and may be used for 30 days.

5.20 Calibration standards: Calibration standards, at a minimum of five concentration levels for the regular explosives method and six concentration levels for the low level explosives method, should be prepared through dilution of the intermediate stock standards with acetonitrile. One of the concentration levels should be at a concentration near, but above, the method detection limit. The remaining concentration levels should correspond to the expected range of concentrations found in real samples or should define the working range of the HPLC. Calibration standards are diluted by 50% (v/v) with 5 g/L calcium chloride solution. Calibration standards are refrigerated and stored in the dark, and prepared fresh on the day of calibration.

5.21 Surrogate standards: The analyst should monitor the performance of the extraction and analytical system, and the effectiveness of the method in dealing with each sample matrix by spiking each sample, standard, and reagent water blank with a surrogate (e.g., 1,2-Dinitrobenzene or other explosive compounds not expected to be present in the sample) recommended to encompass the range of the temperature program used in this method. Deuterated analogs of analytes should not be used as surrogates for HPLC analysis due to coelution problems.

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Water samples are collected in 1 L amber glass bottles and stored until time of extraction. Water samples must be extracted within 7 days of collection and analyzed within 40 days after extraction. Soil and sediment samples are collected in 4 oz. soil jars and stored at < 6 °C. Soil and sediment samples must be extracted within 14 days of collection and analyzed within 40 days after extraction Extracts must be stored in the dark at < 6 °C until time of analysis.

7.0 PROCEDURES

7.1 The internal chain-of-custody must be signed when removing and replacing samples in storage locations. The sample preparation/extraction log must be filled out with the necessary information as extraction of each sample is completed.

7.2 SAMPLE PREPARATION

This Sop addresses both aqueous and soil samples. There are two procedures that may be used for aqueous samples. The extraction options are a solid-phase extraction method using the Porapak RDX cartridges and a salting out procedure used for samples that are either to viscous or have too much particulate matter for filtering. The solid phase extraction is the primary extraction techniques used for most aqueous samples.

7.3 Aqueous samples

Aqueous Solid-phase extraction method

Condition the cartridge:

7.3.1 Insert a Sep-Pak adapter into each Porapak RDX cartridge and connect to the manifold.

7.3.2 Connect Sep-Pak reservoir to the adapter and fill with 15 mL of acetonitrile. Pulse the pump, that is already connected to the manifold via a vacuum trap, to start the flow, then let the acetonitrile drip through under gravity.

7.3.3 Add 30 mL of DI water just before the reservoir runs dry.

7.3.4 Turn on the pump and adjust the flow rate with the stopcock valves to draw the water through the cartridges at a rate of no more than 10 mL/min. Close valves when done. Dispose of the aqueous acetonitrile in the manifold.

NOTE: Once the cartridge has been conditioned do not expose it to air until the entire sample has been loaded. If the cartridge does run dry the conditioning procedure must be repeated.

Loading the Sample

7.3.5 Using a 500 mL graduated cylinder add 500 mL of sample to a 500 mL Teflon or glass bottle. Add 0.25 mL of 10 mg/L surrogate solution or 0.1 mL of 10 mg/L surrogate solution for the low level method.

7.3.6 A method blank and a laboratory control sample (LCS) and/or laboratory control sample duplicate (LCSD) must be prepared for each daily extraction batch of twenty samples or fewer (if a work order consists of more than twenty samples, a new batch must be started on a separate page with its own method blank and LCS). To prepare the method blank and LCS/LCSD, add 500 mL reagent water to a 500 mL bottle. This blank and LCS are carried through the entire extraction and analytical procedure.

7.3.7 If the batch requires an MS/MSD, transfer two 500 mL portions of the sample selected/designated for MS/MSD to two 500 mL bottles for preparation of a matrix spike/matrix spike duplicate. An MS/MSD is required If requested by the client or per 20 samples or every 14 days, whichever occurs first. If extra MS/MSD aliquots of sample are unavailable a laboratory control sample duplicate (LCSD) may be substituted. The MS/MSD is carried through the entire extraction procedure.

7.3.8 Put the Tefzel tubing into the aqueous sample and/or QC and connect the other end to the Porapak cartridge using the Sep-Pak adapter.

7.3.9 Turn on the vacuum and adjust the flow rate to no more than 10 mL/min. Empty the vacuum trap as needed.

NOTE: Make sure the bed does not run dry during loading.

7.3.10 After all sample is loaded, apply full vacuum for two minutes to remove any residual water. Turn off the vacuum and open the bleed valve.

Eluting the Sample

7.3.11 Remove the adapters from the cartridges.

7.3.12 Place clean collection vessels, 12 mL centrifuge tubes, into the manifold by placing them inside a 40 mL vial and putting the vial inside of the 6 hole Styrofoam holder. Place the Styrofoam under the needle that contains the Porapak cartridge.

7.3.13 Add 5 mL of acetonitrile into the cartridge. Pulse the pump to start the flow, then let the acetonitrile drip through under gravity.

7.3.14 When it stops dripping turn on the vacuum briefly to draw the remaining acetonitrile through the cartridge. Open the manifold and remove the labeled tubes.

7.3.15 Bring the tubes up to 5 mL with acetonitrile and then add 5 mL of DI water.

7.3.16 Put the 10 mL sample into a 12 mL vial. Cap and mix thoroughly. The sample is now ready for HPLC analysis.

Aqueous Salting-out extraction

7.3.17 Place a 770mL aliquot of an aqueous sample in a 1 L Erlenmeyer flask. Add 1mL of 10 mg/L surrogate solution.

7.3.18 A method blank and a laboratory control sample (LCS) must be prepared for each daily extraction batch of twenty samples or fewer (if a work order consists of more than twenty samples, a new batch must be started on a separate page with its own method blank and LCS). To prepare the method blank and LCS, add 770 mL reagent water to a 1 L Erlenmeyer flask. This blank and LCS are carried through the entire extraction and analytical procedure.

7.3.19 If the batch requires an MS/MSD, transfer two 770 mL portions of the sample selected/designated for MS/MSD to two 1 L Erlenmeyer flasks for preparation of a matrix spike/matrix spike duplicate. An MS/MSD is required if requested by the client or per 20 samples or every 14 days, whichever occurs first. If extra MS/MSD aliquots of sample are unavailable a laboratory control sample duplicate (LCSD) may be substituted.

7.3.20 Add 1mL of surrogate solution to the blank, LCS and MS/MSD (if required). Add 25 uL of the 14 component mixture and 100 uL each of nitroglycerin, PETN, and EGDN to the LCS and MS/MSD.

7.3.21 Add 251.3 ± 0.1 grams of baked NaCl to all samples, including QC. Add a magnetic stir bar and vigorously stir the sample on a magnetic stir plate until all of the NaCl is completely dissolved. Be sure to dissolve all salt before proceeding further.

7.3.22 Add 164 mL of acetonitrile to each flask and continue to stir vigorously for 15 minutes.

Note: Do not extend beyond the 15 minutes of stirring or will not have any phase separation between the acetonitrile and sample/water.

7.3.23 Turn the stirrer off and allow the phases to separate for at least 10 minutes. Remove the acetonitrile layer (about 8 ml) with a Pasteur pipet to a 100 mL volumetric flask. Add 10 mL of fresh acetonitrile to the water sample in the flask. Stir for 15 minutes followed by standing for 10 minutes for phase separation. Combine the second acetonitrile portion with the initial extract.

7.3.24 Add 84 mL of salt water (325 g per 1000 mL of reagent water) to the acetonitrile extract in the 100 mL volumetric flask. Add a stir bar and stir for 15 minutes, followed by standing for at least 10 minutes for phase separation. Using a Pasteur pipet transfer the acetonitrile layer to a graduated cylinder that is big enough to accommodate the extract volume.

Note: Do not extend beyond the 15 minutes of stirring or will not have any phase separation between the acetonitrile and sample/water.

Note: The amount of water transferred with the acetonitrile must be minimized. The water contains a high concentration of NaCl that produces a large peak at the beginning of the chromatogram, where it could interfere with the HMX determination.

7.3.25 Add an additional 1.0 mL of acetonitrile to the 100 mL volumetric flask. Stir the contents of the flasks for 15 minutes followed by standing for 10 minutes for phase separation. Combine this acetonitrile portion with the original portion in the graduated cylinder.

7.3.26 Dilute this concentrated extract with an equal portion of calcium chloride solution.

7.3.27 Transfer the extract to a vial that will accommodate the extract volume.

7.4 Soil and Sediment Samples

7.4.1 Sample drying: Dry the entire soil sample in air at room temperature (or less) to a constant weight, being careful not to expose the samples to direct sunlight.

7.4.2 Place the dried samples into an acetonitrile rinsed mortar, grind with a pestle. Sample must pass through a 10-mesh sieve.

7.4.3 **Warning:** Soil samples should be screened by method 8510 and method 8515 or other applicable methods prior to grinding if very high concentrations of target compounds are expected.

7.4.4 A method blank, LCS and MS/MSD (if required) must be prepared with each daily extraction batch of twenty samples or fewer (if a work order consists of more than twenty samples, a new batch must be started on a separate page with its own method blank and LCS).

7.4.5 Weigh out 10 g of each soil sample or 10 g of baked sand for the LCS and blank in a 4 oz wide mouth bottle.

7.4.6 Add 1.0mL of surrogate solution at 10 mg/L to the blank, LCS, MS/MSD and samples. Add 50 uL of the 14 components and 20 uL of nitroglycerin, PETN, and EGDN each at 100 mg/L to the LCS and MS/MSD.

7.4.7 Add 20 mL of acetonitrile, cap and vortex swirl for one minute, and place on a mechanical shaker for 18 hours

7.4.8 After shaking, allow the sample to settle for 30 minutes. Remove 8.0mL of supernatant, and combine with 8.0mL of calcium chloride solution in a 20mL vial. Shake, and let stand for 15 minutes.

7.4.9 Place supernatant in a syringe and filter through a 0.45µm Teflon filter. Discard the first 3mL and retain the remainder in a Teflon-capped vial for HPLC analysis.

7.5 Chromatographic Conditions:

7.5.1 Primary Conditions:

Primary Column: See section 4.2.

For HPLC conditions refer to figure 4 for the primary method and figure 5 for the low level method parameters.

7.5.2 Confirmation Column:

Confirmation column: See section 4.3.

For HPLC conditions refer to figure 6 for method parameters.

TURNING ON THE INSTRUMENT

7.6 Make sure the solvent containers are filled with the proper solvent.

7.7 Turn on the instrument at the computer by pressing the on button in the middle of the screen.

7.8 Load the correct instrument method, see section 7.6, by going file and load method at the top of the screen. Then select the method you want to use.

7.9 Allow instrument to equilibrate for at least a half an hour. It is ready when the baslines that appear on the front of the screens are stable and not drifting.

7.10 Instrument is now ready to load and analyze samples.

7.11 Calibration

7.11.1 The HPLC system is calibrated using the external standard calibration procedure. One five-point calibration curve is prepared. Alternatively, if the low level method is needed a six-point calibration curve is used.

7.11.2 Each calibration standard is injected using the technique that is used to introduce the actual samples into the HPLC. The Target system will calculate the peak height or area for each compound. A calibration curve can be prepared in Target using the peak height or area (depending on the compound) versus the concentration of the standard. Usually peak height is used for compounds that co-elute and peak area is used for compounds that are well resolved. A linear calibration applying a first order polynomial equation is used to prepare the curve. In order to be used for quantitative purposes, the correlation coefficient must be greater than or equal to 0.990. The linear equation is:

$$y = mx + b$$

where:
y = Instrument response
m = Slope of the line
x = Concentration of the calibration standard
b = The Y intercept

7.11.3 One curve is calibrated for explosive analysis including all the analytes and the surrogate using the primary column. One curve is also calibrated for the second column confirmation.

7.11.4 An independent standard (ICV) must be analyzed after the initial calibration. The percent difference for each analyte must be ≤30% of the initial calibration curve.

7.11.5 The working calibration curve must be verified daily or after every 10 field samples by injecting the mid-point calibration standard. If the response for any analyte varies from the expected response by more than ± 20%, a new calibration curve must be prepared for that analyte.

7.12 Retention time windows

7.12.1 Three injections of all single component standard mixtures are made throughout the course of a 72-hour period.

7.12.2 The standard deviation of the three retention times is calculated for each single component standard.

7.12.3 Plus or minus three times the standard deviation of the retention times for each standard is used to define the retention time window; however, the experience of the analyst should weight heavily in the interpretation of chromatograms.

7.12.4 Retention time windows are calculated for each standard on each HPLC column and whenever a new HPLC column is installed. The data is kept on file in the laboratory.

7.12.5 If the calculated retention time window results in a value of 0.05 minutes or less, the laboratory will apply nominal windows of ± 0.05. This is done in order to avoid any false negative hits because of the window being too narrow. By utilizing these windows, a false positive hit may be initially indicated, but an experienced analyst could determine a false positive from scrutinizing the chromatograms.

7.13 HPLC Analysis

7.13.1 Write the sequence in the explosives run log; follow page format and proper sample coding.

7.13.2 Filter all samples through 0.45um filters into the 2 mL sample vials.

7.13.3 Samples are analyzed in a set referred to as an analysis sequence. The sequence begins with instrument calibration as listed in section 7.12 followed by sample extracts interspersed with mid-concentration calibration standards. Before any samples are analyzed the instrument must be calibrated by analyzing a five or six-point calibration or a mid-concentration standard (continuing calibration standard or CV).

7.13.4 If a CV is run, the calculated concentration must not exceed a difference of ± 20% of the expected value. Each sample analysis must be bracketed with an acceptable initial calibration or opening continuing calibration standard and a closing continuing calibration standard. The calibration standard must also be injected at intervals of not less than once every ten field samples and at the end of the analysis sequence. If the CCV fails, the instrument is checked for any obvious problems and maintenance is performed as necessary. Another

CCV is analyzed or the instrument is recalibrated and then samples are injected. All samples that were injected after the standard exceeding the criterion must be reinjected to avoid errors in quantitation, if the initial analysis indicated the presence of the specific target analyte that exceeded the criterion.

7.13.5 All positive measurements observed on the E1 column must be confirmed by injection onto the E2 column.

7.13.6 Absolute retention time windows are established daily for each analyte using the mid-point of the window of that day if after analyzing the mid-point it is determined that one or more of the analytes fall outside of the previously established daily retention time window. The daily retention time window equals the mid-point ± three times the standard deviations.

7.13.7 An analyte is tentatively identified when a peak from a sample falls within the daily retention time window.

7.13.8 If the response for an analyte exceeds the calibration range of the system, the sample must be diluted with a 1:1 H_2O/MeOH mixture and reanalyzed.

7.13.9 When a HPLC system is determined to be out of control because either a CV cannot pass or the calibration does not meet the correlation coefficient criteria, instrument maintenance is likely necessary. Routine instrument maintenance may involve changing the pre-column, replacing pump seals, or replacing the column. This information is recorded in the instrument run log (Figure 3). When an instrument requires more extensive maintenance, for example, replacing a detector or instrument part, this information is noted in the instrument maintenance logbook.

7.14 Calculations

7.14.1 The concentration of an analyte is calculated by using the calibrated curve that is prepared in Target. When an analyte is identified, Target displays a concentration when the file is processed through the appropriate calibrated method.

7.14.2 The concentrations from the reports are then incorporated with the extraction data to arrive at a final concentration.

Water concentration (ug/L) = (C) (Vt)/(Vo) * 1000

Soil/Sediment concentration (mg/kg) = (C) (Vt)/(Ws) (D) * 1000

where: C = amount calculated by Target in µg/mL
Vt = Volume of total extract including any instrument dilutions (L)
Vo = Volume of sample extracted (L)
Ws = Weight of sample extracted (Kg)
D = Decimal total solids

7.15 Data Review

7.15.1 Initial Data Review

The initial data review is accomplished by the analyst who ran the samples. This review is of sufficient quality and detail to provide a list of samples that need to be reanalyzed or diluted and reanalyzed. The initial data review is performed on the detailed quantitation reports of the analyzed samples. This data review examines criteria that directly impact whether or not the sample needs to be reanalyzed and/or extracted. These criteria include:

- QC criteria for method blank, LCS, MS/MSD, and calibration – refer to section 8.0.
- Surrogate recovery
- Chromatography: cleanups, manual integration.
- Target compound detection: quantitation, confirmation, false positives.

The requirement of the Organics laboratory is that this initial data review be completed no later than the end of the next workday. After the analyst has completed his or her initial data review, the information is then ready to be processed for reporting. Refer to section 7.11.

7.15.2 Surrogate recovery

All recoveries must meet the most recently established laboratory acceptance limits, which are listed on the Laboratory Surrogate Acceptance Limit sheet.

The sample is evaluated for recoveries of the surrogate. The sample chromatogram is reviewed for any interferences before determining whether to accept a sample based on the surrogate recoveries. If the surrogate recovery is affected by matrix interference, the sample result may be accepted with narration. If the recovery for the surrogate is not acceptable because the recovery is high and the sample does not contain any analytes above the PQL, the data is narrated. If the recovery for the surrogate is low and there is no apparent matrix effect, the sample is reextracted.

For method blanks, if the recovery of the surrogate is low or high, and the blank does not contain any target analytes above the PQL, and the recovery

of the surrogate in the sample(s) are acceptable, the data is narrated. If the recoveries in the blank are low and it does not contain any target analytes above the PQL, and the recoveries in the samples are acceptable but the sample contains one or more target analytes above the PQL, the sample may be reextracted.

For laboratory control samples (LCS), if the only discrepancy in the extraction batch is with the LCS, and the analyte spike recoveries are acceptable, the data is narrated. If the recovery of the surrogate and the analyte spikes are low, the samples may need to be reextracted.

7.15.3 Chromatography

The chromatography should be examined for the presence of any non-target peaks, which can be used as an indication of whether or not matrix interference might be influencing surrogate recoveries. If the chromatogram indicates interferences, then a cleanup may be needed.

Manual integrations are to be performed when chromatographic conditions preclude the computer algorithm from correctly integrating the peak of concern. In no instance shall a manual integration be performed solely to bring a peak within criteria. For specific procedures on how to manually integrate, refer to Katahdin SOP QA-812, Manual Integration, current revision.

Each peak of concern is examined by the primary analyst to ensure that the peak was integrated properly by the computer algorithm. Should a manual integration be necessary (for instance, due to a split peak, peak tailing, or incomplete resolution of isomeric pairs), an "m" qualifier will automatically be printed on the quantitation report summary.

7.15.4 Target Compound Detection

The chromatogram from the primary column is evaluated. If a target analyte is detected in a sample, the sample is reanalyzed on a secondary column to confirm. If a target analyte is present on both columns, the concentration is within the calibration range and the quantitation from both chromatograms agrees within ±50%, the analyte is considered to be present in the sample. The concentration from the primary column is reported

7.16 Reporting

7.16.1 After the chromatograms have been reviewed and any target analytes have been quantitated using Target, the necessary files are brought into QuickForms. Depending on the QC level requested by the client, a Report

of Analysis (ROA) and additional reports, such as LCS forms and chronology forms, are generated. The package is assembled to include the necessary forms and raw data. The data package is reviewed by the primary analyst and then forwarded to the secondary reviewer. The secondary reviewer validates the data and checks the package for any errors. When completed, the package is sent to the department manager for final review. A completed review checklist (Figure 3) is provided with each package. The final data package from the Organics department is then processed by the Data Management department.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

Refer to Table 1 and to details in this section for a summary of QC requirements, acceptance criteria, and corrective actions. These criteria are intended to be guidelines for analysts. The criterion does not cover all possible situations. If any of the QC requirements are outside the recovery ranges listed in this section or in Table 1, all associated samples must be evaluated against all of the QC. In some cases data may be reported, but may be reanalyzed in other cases. Making new reagents and standards may be necessary if the standardization is suspect. The corrective actions listed in this section and in Table 1 may rely on analyst experience to make sound scientific judgments. These decisions are based on holding time considerations, client and project specific Data Quality Objectives and on review of chromatograms. The Department Manager, Operations Manager, and/or Quality Assurance Officer may be consulted to evaluate data. Some samples may not be able to be reanalyzed within hold time. In these cases "qualified" data with narration may be advisable after consultation with the client.

In some cases the standard QC requirements listed in this section and in Table 1 may not be sufficient to meet the Data Quality Objectives of the specific project. Much of the work performed at the lab is analyzed in accordance with specific QC requirements spelled out in a project specific Quality Assurance Project Plan (QAPP) or in a program specific Quality Systems Manual (QSM). The reporting limits, acceptance criteria and/or corrective actions may be different than those specified in this SOP. In these cases the appropriate information will be communicated to the Department Manager and/or senior chemists before initiation of the analyses so that specific product codes can be produced for the project. In addition, the work order notes for each project will describe the specific QAPP or QSM to be followed.

8.1 For each analytical batch (up to 20 samples), a method blank, laboratory control sample (LCS), matrix spike and matrix spike duplicate are analyzed. They are carried through all stages of the sample preparation and analysis steps.

8.2 Spike concentrations: The LCS and the MS/MSD are spiked with the full list of analytes. The spike concentrations are:

MATRIX	SPIKE AMT.	SPIKE CONC.	FINAL CONC.
Water	0.05 mL	100 ug/mL	10 ug/L
Soil	0.2 mL	100 ug/mL	2000ug/kg

The surrogate spike concentrations in are:

MATRIX	SPIKE AMT.	SPIKE CONC.	FINAL CONC.
Water	0.25 mL	10 ug/mL	5 ug/L
Soil	1.0 mL	10 ug/mL	1000 ug/kg

8.3 LCS and MS/MSD acceptance criteria and Corrective Action: All QC samples are calculated for percent recovery of the spiked analyte(s). The recoveries are compared to the acceptance limits, 30-150%. These limits are used for LCSs and MS/MSDs for both soil and water matrices. There currently are not enough data points to statistically derive LCS and MS/MSD limits based on in-house recoveries. When enough data points are collected, in-house limits will be established.

If any spike compound in the laboratory control sample falls outside of the established recovery acceptance limit window, the QC sample is considered to be out of control and any sample that is associated should be reextracted. However, if the recovery is high and the associated samples do not contain the specific compound(s), the data can possibly be accepted with narration.

If a spike compound is outside of the acceptance limits in the matrix spike sample but is acceptable in the LCS, the data is considered acceptable. The cause of the failure is possibly attributable to matrix interference. However, if the compound fails in both the LCS and the MS/MSD, the result for that analyte is suspect and may not be reported for regulatory compliance purposes.

8.4 Surrogate recoveries are calculated on all samples, blanks and spikes. The recoveries are compared to the acceptance limits, 30 - 150%. There currently are not enough data points to statistically derive surrogate limits based on in-house recoveries. When enough data points are collected, in-house limits will be established.

When a sample has a surrogate that falls outside of the laboratory established acceptance limit window, the problem should be investigated. If the recovery looks like it is affected by the sample matrix, the sample may be reinjected to confirm matrix interference. When a sample has no detectable surrogate recovery, the sample should be reextracted.

8.5 CAR: Whenever data is not acceptable because of a failing LCS or surrogate recovery, a corrective action report (CAR) must be initiated as soon as possible.

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

9.0 METHOD PERFORMANCE

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The MDLs are determined annually per type of instrument and filed with the Organic Department Manager and with the QAO. Refer to the current revision of Katahdin SOP QA-806, Method Detection Limit and Instrument Detection Limit Studies, for procedures on determining the MDL. The Practical Quantitation Limit (PQL) concentrations for all the target analytes are listed in Table 3.

Refer to the current revision of Method 8330B for other method performance parameters and requirements.

10.0 APPLICABLE DOCUMENTS/REFERENCES

Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846, 3rd edition, 1986, and Updates I, II, IIA, III, IIIA, and IIIB 1996, 1998 & 2004 Method 8330B, Rev. 2, Oct. 2006.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition. Promulgated Update III dated December, 1996, Method 8000B.

Waters Solid Phase Extraction Technology for the Analysis of Explosives, Section 5.; "Determination of Low-Level Explosive Residue in Water by HPLC: Solid-Phase Extraction vs. Salting - Out Solvent Extraction", Michael G. Winslow; Bradley A. Weichert; and Robert D. Baker. Proceedings of the EPA 7th Annual Waste and Quality Assurance Symposium, Washington, D.C. 1991.

LIST OF TABLES AND FIGURES

Table 1 QC Requirements
Table 2 Summary of Method Modifications
Table 3 Katahdin Reporting Limits For Explosives By Method 8330B mod
Figure 1 Example of Aqueous Extractions Logbook Page
Figure 2 Example of Soil Extractions Logbook Page
Figure 3 Example of Runlog Page
Figure 4 Data Review Checklist
Figure 5 Primary method and column instrument conditions
Figure 6 Primary column low level method instrument conditions
Figure 7 Confirmation column instrument conditions

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

TABLE 1

QC REQUIREMENTS

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method blank	One per prep batch of twenty or fewer samples	No analyte detected >PQL	(1) Investigate source of contamination (2) Evaluate the samples and associated QC: ie. the blank results are above the PQL, report sample results which are <PQL or > 10X the blank concentration. Otherwise, reprep a blank and the remaining samples.
LCS	One per prep batch of twenty or fewer samples	30-150 %R	(1) Evaluate the samples and associated QC: i.e. If an MS/MSD was performed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the surrogate recoveries in the LCS are also low but are acceptable in the blank and samples, narrate. If the LCS recovery is high but the sample results are < PQL, narrate. Otherwise, reprep a blank and the remaining samples.
CCV (CV)	One after every 10 samples: midpoint of initial calibration	20% D	(1) Evaluate the samples: If the %D > +20% and sample results are < PQL, narrate. If %D > ± 20% only on one channel, narrate. If %D > ± 20% and is likely a result of matrix interference, narrate. Otherwise, reanalyze all samples back to last acceptable CV.
Matrix Spike\ Matrix Spike Duplicate	One for every set of 20 samples	30 -150 %R 30% RSD	(1) Evaluate the samples and associated QC: ie. If the LCS results are acceptable, narrate. (2) If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.
5 pt calibration of Explosive Mix	Initial cal prior to sample analysis	5 pt & 6 pt calibration - correlation coefficient ≥ 0.990	(1) Repeat Initial calibration .
Independent Calibration Verification	Once, immediately following calibration	20%D	Problem must be corrected. No sample analysis until calibration has been verified.
Second Column Confirmation	All positive hits must be verified	± 40% D	"J" Flag if > 40%; "Q" flag if not confirmed and narrate.
Demonstration of analyst proficiency; accuracy and precision	Once per analyst initially and annually thereafter	Must pass all applicable QC for method	Repeat analysis until able to perform passing QC; document successful performance in personal training file
MDL study	Once per year	Ideally, PQL = at least 3xMDL	Repeat MDL

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

TABLE 2

SUMMARY OF METHOD MODIFICATIONS

Topic	Katahdin SOP CA-402-03	Method 8330B/8000
Apparatus/ Materials	None	
Reagents	None	
Sample preservation/ handling	None	
Procedures	See SOP Section 10.0 referenced method 3, section 7.2.2: "Low Level Aqueous Sample Preparation" See SOP Section 7.6.5 : If calculated retention time window results in a value of 0.05 minutes or less, nominal limits will be applied. See SOP Section 7.7.3 : Absolute retention time windows are established daily for each analyte using the mid-point of the window of that day if after analyzing the mid-point it is determined that one or more of the analytes fall outside of the previously established retention time window. Perform a total solids analysis on samples and use in calc. Use 10g from a 4 oz soil container.	See SW 846 Method 8330; Section 7.1.1.1. See SW 846 Method 8000; Section 7.5: Plus or minus three times the standard deviation of the retention times for each standard will be used to determine the retention time window. See SW 846 Method; Section 7.6.9 : Establish daily retention time windows for each analyte. Air dry soil samples at room temp. Subsample 10g from a 1kg aliquot.-see method 8330B.
QC - Continuing Calibration		
QC - LCS	None	
QC - Accuracy/Precision	None	
QC - MDL	PQL – Practical Quantitation Level – three to ten times the MDL.	EQL – Estimated Quantitation Level – five to ten times the MDL

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

TABLE 3

KATAHDIN REPORTING LIMITS FOR EXPLOSIVES BY METHOD 8330B mod

COMPOUND	WATERS (µg/L)	SOLIDS (µg/kg)
HMX	1.00	200
RDX	1.00	200
1,3,5-TNB	1.00	200
1,3-DNB	1.00	200
Tetryl	1.00	200
NB	1.00	200
2,4,6-TNT	1.00	200
4-Am-DNT	1.00	200
2-Am-DNT	1.00	200
2,6-DNT	1.00	200
2,4-DNT	1.00	200
2-NT	1.00	200
3-NT	1.00	200
4-NT	1.00	200
NG	4.0	800
PETN	4.0	800
EGDN	4.0	800

Katahdin Reporting Limits for Low Level Explosives

COMPOUND	WATERS (µg/L)
HMX	0.25
RDX	0.25
1,3,5-TNB	0.25
1,3-DNB	0.25
Tetryl	0.25
NB	0.25
2,4,6-TNT	0.25
4-Am-DNT	0.25
2-Am-DNT	0.25
2,6-DNT	0.25
2,4-DNT	0.25
2-NT	0.25
3-NT	0.25
4-NT	0.25

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 1

EXAMPLE OF AQUEOUS EXTRACTIONS LOGBOOK PAGE

KATAHDIN ANALYTICAL SERVICES
ORGANIC EXTRACTIONS LOGBOOK - AQUEOUS EXPLOSIVES
METHOD: SW846 8330 B Mod.

Surrogate Lot # _____
Spike Lot # _____
Acetonitrile (ACN) Lot # _____
Cartidrge Lot # _____

Other Lot # _____
Other Lot # _____

Extract Date	Analyst	Sample ID	Bottle ID.	Initial Vol. (500 mL)	Surr.: Add 50 uL of 10 ug/mL Add to all samples	SPIKE: Add 25 uL of 10 ug/mL to MS/D & LCS/D	Elute 15 mL ACN (at gravity flow rate) thru cartridge and discard	Elute 30 mL water thru cartridge and discard	Elute sample through cartidge and discard	Elute 5 mL ACN through cartidge and collect	Add 5 mL water to ACN extract	Store sample in labeled amber vial	Tray Location	Comments

Reviewed By: Review Date:

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 2

EXAMPLE OF SOIL EXTRACTIONS LOGBOOK PAGE

KATAHDIN ANALYTICAL SERVICES, INC.
ORGANIC EXTRACTIONS LOG - EXPLOSIVES

Extraction Method: Salting out_____ Solid Phase Extraction_____

Analytical Method: SW846 8330A ✓ SW846 8330B_____ SW846 8332_____

Analysis: Explosives ✓ Nitroglycerin_____ PETN_____ EDGN_____

Surrogate ID:	P4735	Surrogate Conc.	10 ug/ml	Matrix: Aqueous (Soil)	
Surrogate ID:	[illegible]	Surrogate Conc.	↓	Solvent Lot:	ACN Lot HL371935
Spike ID:	[illegible]	Spike Conc.	10 ug/ml	Solvent Lot:	—
Spike ID:	STT3515 Nitro	Spike Conc.	10 ug/ml		
Spike ID:	STT3517 EGDN	Spike Conc.	↓		
Spike ID:	P4633 PETN	Spike Conc.	↓		

Date Extracted	Ext. Init.	Sample ID	Initial Amount (g) ml.	Surr. Volume mL	Spike Volume mL	Final Volume mL	Tray Location	Comments
051905	FCC	NC651001-1	9.81	1.0	NR	20		
↓	↓	-2	10.00	↓	5 ml Mix Explosives	↓		
↓	↓	-3	9.85	↓	↓	↓		
↓	↓	SB 171191	10.00	↓		↓		
↓	↓	-1 Dup	9.94	↓		↓		NOT Reported

QAEX137

O000042

Date Extracted	Ext. Init.	Sample ID	Initial Vol. mL	Surr. Vol.	Spike Vol.	Final Vol. mL	Tray Location	Comments

QAEX137

Reviewed By_____ Date_____

O000043

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 3

EXPLOSIVES RUNLOG PAGE

Katahdin Analytical Services, Inc.

HPLC Runlog
Instrument: HPLC03

Method (circle): 8330B MOD. 8330B

Column:	Accucore EI	**Injection Volume:**	15 µL
Flow Rate:	1.00 mL/min	**Methanol lot #:**	081717
Detector Wavelengths:	254 nm	**Reviewed by/Date:**	

Date	Init.	Result File	Sample ID	Y/N	Method	Comments
062708	KCR	HBF1213	MDL 4	Y	18	
		214	5	Y	18	Return baseline rise
		215	5	Y		
		216	6	Y		
		217	7	Y		
		218	8	Y		
		219	9	Y		
072808		220	~~CV 2.5~~ BLANK	Y		
072808	KCR	HBG1002	2.0	Y	KCR 7/31	
		25	1.0	Y		
		26	0.5	Y		
		27	0.25	Y		
		28	0.10	Y		
		29	END ICS	Y		
		30	0.05	N		Test
		31	0.025	N		
		32	CV 0.5	Y		
		33	BLANK	Y		
		34	MDL 1	Y		Matrix spike 1ppb Nitro,
		35	2	Y		
		36	3	Y		
		37	4	Y		
		38	5	Y		
		39	6	Y		
		40	7	Y		
		41	8	Y		
072908		42	CV 0.5	Y		
		4		Y		

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 4

DATA REVIEW CHECKLIST

Verbal Due Date _____ Due Date_____

Client:		Primary	Secondary
Method:		Date:	Date:
SDG No:	Level:	Initials:	Initials:
KAS No:			Approved : ☐ Yes

PRIMARY REVIEW CHECKLIST

Highlight Method / project specific information. _____

All needed forms are present . _____

Sample Data Summary Included (Level III & IV). _____

Correct Work Order Number or SDG name (all forms). _____

Correct project name and spelling (all forms). _____

Correct file numbers (all forms). _____

Analysis Date Correct. _____

Extraction Method & Analysis Method Correct. _____

Product list compared to ROAs (compounds & PQLs). _____

Chromatogram reviewed for unlabeled peaks (check product list). _____

Flagging of all ROAs correct (Florida Flagging ☐). _____

All tunes included (level IV) . _____

All log book pages included (Soil weights,TCLP & SPLP). _____

Verify quant results for CLP. _____

Update sample history files. _____

Sign & Date Manual integration (Narrate as needed). _____

Sample I.D's Truncated (NARRATE). YES ☐ Please list KAS # below :

_____

First correction ☐ → Review and replace appropriate SDS Forms ☐.

Second correction ☐ → Review and replace appropriate SDS Forms ☐.

Last saved by kasgc04/13/07

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 5

PRIMARY METHOD AND COLUMN INSTRUMENT CONDITIONS

Method: C:\HPCHEM\1\METHODS\31.M of 7/8/2008 1:05:01 PM

1100 Quaternary Pump 1

Control
- Column Flow : 1.000 ml/min
- Stoptime : 60.00 min
- Posttime : Off

Solvents
- Solvent A : 67.0 % (WATER)
- Solvent B : 2.0 % (ACETONITRILE)
- Solvent C : 31.0 % (MeOH)
- Solvent D : Off

PressureLimits
- Minimum Pressure : 0 bar
- Maximum Pressure : 400 bar

Auxiliary
- Maximal Flow Ramp : 100.00 ml/min^2
- Primary Channel : Auto
- Compressibility : 100*10^-6/bar
- Minimal Stroke : Auto

Store Parameters
- Store Ratio A : Yes
- Store Ratio B : Yes
- Store Ratio C : Yes
- Store Ratio D : Yes
- Store Flow : Yes
- Store Pressure : Yes

Timetable

Time	Solv.B	Solv.C	Solv.D	Flow	Pressure
0.00	2.0	31.0	0.0	1.000	400
12.00	2.0	31.0	0.0	1.000	400
14.00	2.0	34.0	0.0	1.000	400

Agilent 1100 Multiple Wavelength Detector 1

Signals

Signal	Store	Signal,Bw		Reference,Bw		[nm]
A:	No	218	20	360	100	
B:	Yes	254	16	360	100	
C:	No	214	20	360	100	
D:	No	220	20	360	100	
E:	Yes	210	16	360	200	

Time
- Stoptime : As pump
- Posttime : Off

Required Lamps
- UV lamp required : Yes
- Vis lamp required : No

Autobalance
- Prerun balancing : Yes
- Postrun balancing : Yes

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 5 (cont.)

PRIMARY METHOD AND COLUMN INSTRUMENT CONDITIONS

```
Method: C:\HPCHEM\1\METHODS\31.M of 7/8/2008 1:05:01 PM

        Margin for negative Absorbance: 100 mAU

    Peakwidth                   :        >  0.1 min
    Slit                        :            16 nm

    Analog Outputs
        Zero offset ana. out. 1:             2 %
        Zero offset ana. out. 2:             2 %
        Attenuation ana. out. 1:           250 mAU
        Attenuation ana. out. 2:          2000 mAU

    Timetable is empty

    ======================================================================
                         Agilent 1100 Autosampler 1
    ======================================================================

    Injection
        Injection Mode          :    Needle Wash
        Injector volume         :         75.00 µl
        Wash Vial               :         81
        Optimization            :        none

    Auxiliary
        Drawspeed               :          100 µl/min
        Ejectspeed              :          100 µl/min
        Draw position           :          0.0 mm

    Time
        Stoptime                :      As Pump
        Posttime                :      Off

    ======================================================================
                         Agilent 1100 Column Thermostat 1
    ======================================================================

    Temperature settings
        Left temperature        :      36.0°C
        Right temperature       :      Same as left
        Enable analysis         :      When Temp. is within setpoint +/-  0.8°C
        Store left temperature :       Yes
        Store right temperature:       Yes

    Time
        Stoptime                :      As pump
        Posttime                :      Off

    Column Switching Valve      :      Column 1

    Timetable is empty
```

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 6

PRIMARY COLUMN LOW LEVEL METHOD INSTRUMENT CONDITIONS

```
Method: C:\HPCHEM\1\METHODS\18.M of 6/24/2008 10:58:59 AM

    ======================================================================
                              1100 Quaternary Pump 1
    ======================================================================

    Control
        Column Flow              :      1.000 ml/min
        Stoptime                 :         35.00 min
        Posttime                 :      Off

    Solvents
        Solvent A                :       57.0 % (WATER)
        Solvent B                :        0.0 % (ACETONITRILE)
        Solvent C                :       43.0 % (MeOH)
        Solvent D                :      Off

    PressureLimits
        Minimum Pressure         :        0 bar
        Maximum Pressure         :      400 bar


    Auxiliary
        Maximal Flow Ramp        :      100.00 ml/min^2
        Primary Channel          :      Auto
        Compressibility          :      100*10^-6/bar
        Minimal Stroke           :      Auto

    Store Parameters
        Store Ratio A            :      Yes
        Store Ratio B            :      Yes
        Store Ratio C            :      Yes
        Store Ratio D            :      Yes
        Store Flow               :      Yes
        Store Pressure           :      Yes

    Timetable is empty


    ======================================================================
                       Agilent 1100 Multiple Wavelength Detector 1
    ======================================================================

    Signals

        Signal  Store  Signal,Bw   Reference,Bw  [nm]
          A:     No      218  20      360 100
          B:     Yes     254  16      360 100
          C:     No      214  20      360 100
          D:     No      220  20      360 100
          E:     No      210  16      360 200

    Time
        Stoptime                 :      As pump
        Posttime                 :      Off

    Required Lamps
        UV lamp required         :      Yes
        Vis lamp required        :      No

    Autobalance
        Prerun balancing         :      Yes
        Postrun balancing        :      Yes
        Margin for negative Absorbance: 100 mAU

    Peakwidth                    :        >  0.1 min
    Slit                         :            16 nm

Instrument 1 7/14/2008 2:04:47 PM KGT                                Page 1 of 2
```

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 6 (cont.)

PRIMARY COLUMN LOW LEVEL METHOD INSTRUMENT CONDITIONS

```
Method: C:\HPCHEM\1\METHODS\18.M of 6/24/2008 10:58:59 AM

    Analog Outputs
        Zero offset ana. out. 1:            2 %
        Zero offset ana. out. 2:            2 %
        Attenuation ana. out. 1:          250 mAU
        Attenuation ana. out. 2:         2000 mAU

    Timetable is empty


    ======================================================================
                          Agilent 1100 Autosampler 1
    ======================================================================

    Injection
        Injection Mode          :    Needle Wash
        Injector volume         :        100.00 µl
        Wash Vial               :         81
        Optimization            :        none

    Auxiliary
        Drawspeed               :          100 µl/min
        Ejectspeed              :          100 µl/min
        Draw position           :          0.0 mm

    Time
        Stoptime                :      As Pump
        Posttime                :      Off


    ======================================================================
                          Agilent 1100 Column Thermostat 1
    ======================================================================

    Temperature settings
        Left temperature        :      32.0°C
        Right temperature       :      Same as left
        Enable analysis         :      When Temp. is within setpoint +/-  0.8°C
        Store left temperature :       Yes
        Store right temperature:       Yes

    Time
        Stoptime                :      As pump
        Posttime                :      Off

    Column Switching Valve      :      Column 1

    Timetable

          Time      Column                 Temp.(left)    Temp.(right)
        |--------|--------------------|-------------|-------------|
            0.00                             32.0
           16.00                             34.0
```

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 7

CONFIRMATION COLUMN INSTRUMENT CONDITIONS

Method: C:\HPCHEM\1\METHODS\8330E2.M of 5/27/2008 10:28:47 AM

```
=====================================================================
                        1100 Quaternary Pump 1
=====================================================================

Control
    Column Flow            :      1.250 ml/min
    Stoptime               :         57.00 min
    Posttime               :      Off

Solvents
    Solvent A              :       55.0 % (WATER)
    Solvent B              :        0.0 % (ACETONITRILE)
    Solvent C              :       45.0 % (MEOH)
    Solvent D              :      Off

PressureLimits
    Minimum Pressure       :        0 bar
    Maximum Pressure       :      400 bar


Auxiliary
    Maximal Flow Ramp      :      100.00 ml/min^2
    Primary Channel        :      Auto
    Compressibility        :      100*10^-6/bar
    Minimal Stroke         :      Auto

Store Parameters
    Store Ratio A          :      Yes
    Store Ratio B          :      Yes
    Store Ratio C          :      Yes
    Store Ratio D          :      Yes
    Store Flow             :      Yes
    Store Pressure         :      Yes

Timetable

       Time    Solv.B  Solv.C  Solv.D   Flow  Pressure
    |--------|-------|-------|-------|-------|-------|
        0.00    0.0    45.0     0.0     1.250   400
       59.00    3.0    43.0     0.0     1.250   400
       60.00    3.0    55.0     0.0     1.250   400


=====================================================================
                  Agilent 1100 Multiple Wavelength Detector 1
=====================================================================

Signals

    Signal  Store  Signal,Bw   Reference,Bw  [nm]
      A:     No      218  20      360 100
      B:     Yes     254  16      360 100
      C:     No      214  20      360 100
      D:     No      220  20      360 100
      E:     Yes     210  16      360 200

Time
    Stoptime               :      As pump
    Posttime               :      Off

Required Lamps
    UV lamp required       :      Yes
    Vis lamp required      :      No

Autobalance
    Prerun balancing       :      Yes
    Postrun balancing      :      No
```

TITLE: **DETERMINATION OF NITROAROMATICS, NITRAMINES, AND NITRATE ESTERS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) METHOD 8330B, MOD.**

FIGURE 7 (cont.)

CONFIRMATION COLUMN INSTRUMENT CONDITIONS

```
Method: C:\HPCHEM\1\METHODS\8330E2.M of 5/27/2008 10:28:47 AM

        Margin for negative Absorbance: 100 mAU

    Peakwidth                   :        >  0.1 min
    Slit                        :            16 nm

    Analog Outputs
        Zero offset ana. out. 1:             2 %
        Zero offset ana. out. 2:             2 %
        Attenuation ana. out. 1:          3.91 mAU
        Attenuation ana. out. 2:          3.91 mAU

    Timetable is empty


    ======================================================================
                          Agilent 1100 Autosampler 1
    ======================================================================

    Injection
        Injection Mode          :    Needle Wash
        Injector volume         :        100.00 µl
        Wash Vial               :         81
        Optimization            :        none

    Auxiliary
        Drawspeed               :          100 µl/min
        Ejectspeed              :          100 µl/min
        Draw position           :          0.0 mm

    Time
        Stoptime                :      As Pump
        Posttime                :      Off


    ======================================================================
                         Agilent 1100 Column Thermostat 1
    ======================================================================

    Temperature settings
        Left temperature        :      26.0°C
        Right temperature       :      Same as left
        Enable analysis         :      When Temp. is within setpoint +/-  0.8°C
        Store left temperature :       Yes
        Store right temperature:       Yes

    Time
        Stoptime                :      As pump
        Posttime                :      Off

    Column Switching Valve      :      Column 1

    Timetable is empty
```

TITLE: ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP ANALYSIS OF TOTAL OR DISSOLVED METALS

Prepared By: George Brewer Date: 11/97

Approved By:

Group Supervisor: George Brewer Date: 01/19/01

Operations Manager: John C. Buxton Date: 1/22/01

QA Officer: Deborah J. Madeau Date: 1·22·01

General Manager: Dennis F. Hefner Date: 1/22/01

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
01 3010A	Format changes, added pollution prevention, block digester; revised database references; revised and added tables.	DH	1·22·01	1/22/01
02 3010A	Added wording allowing use of digestates for ICP-MS analysis. Added use of block digester as primary heating source & adjusted volumes. Revised standard solution names & concs. in Figures 3 & 4.	DH	8·29·02	8·29·02
03	Added Uranium to spiking solutions for LCS & MS/D. Removed the Internal Custody Record for Metals Digestates figure and reference.	LAD	04/06	04/06
04	Minor changes to Section 7 to reflect current practices. Updated Figure 1 - Sample Prep Logbook. Updated Figure 2 and 3 - Spike amounts.	LAD	05/09	05/09

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ____ of document **SOP CA-604-04**, titled **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**.

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ____ of document **SOP CA-604-04**, titled **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**.

Recipient: _____ Date: _____

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

1.0 SCOPE AND APPLICATION

The purpose of this SOP is to describe the procedure utilized by Katahdin Analytical Services, Inc. personnel to solubilize metals in aqueous samples, wastes that contain suspended solids, and mobility-procedure extracts prior to analysis by inductively coupled plasma atomic emission spectroscopy (ICP) and inductively coupled plasma mass spectrometry (ICP-MS). This SOP applies to samples prepared by EPA Method 3010, with the method modifications mentioned in Table 2.

1.1 Definitions - none.

1.2 Responsibilities

This method is restricted to use by, or under the supervision of analysts experienced in the acid digestion of aqueous samples by EPA Method 3010. Each analyst must demonstrate and document their ability to generate acceptable results with this method. Refer to Katahdin SOP QA-805, current revision, "Personnel Training & Documentation of Capability".

It is the responsibility of all Katahdin technical personnel involved in the acid digestion of aqueous samples using EPA Method 3010 to read and understand this SOP, to adhere to the procedures outlined, and to properly document their work in the appropriate lab notebook. Any deviations from the method or irregularities with the samples should also be recorded in the lab notebook and reported to the Supervisor or designated qualified data reviewer responsible for these data.

It is the responsibility of the Supervisor to ensure that technical personnel perform acid digestions in accordance with this SOP and to confirm that their work is properly documented through periodic review of the associated logbooks.

1.3 Safety

The acids used in this procedure are highly corrosive and reactive, and spiking standards contain toxic metals. The toxicity and reactivity of client samples are usually unknown, so samples should always be assumed to present a contact hazard. To reduce or eliminate exposure to potentially harmful chemicals, lab coats, gloves, and safety glasses or goggles must be worn whenever handling samples or reagents. Additional safety apparel, including face shields, rubber aprons, dust masks, and rubber shoe protectors, is available in the metals prep lab and should be worn whenever circumstances warrant.

Acids should be added to samples slowly and carefully while watching for reactions. This should be done under a hood, in case harmful fumes are evolved.

Hood sashes should be lowered as far as possible whenever beakers are being heated in the hood. Use caution when handling hot beakers.

Each qualified analyst or technician must be familiar with Katahdin Analytical Health and Safety Manual including the Katahdin Chemical Hygiene Plan and must follow appropriate procedures. These include the use of appropriate personal protective equipment (PPE) such as safety glasses, gloves and lab coats when working with chemicals or near an instrument and not taking food or drink into the laboratory. Each analyst should know the location of a respirator and all safety equipment. Each analyst shall receive a safety orientation from their supervisor, or designee, appropriate for the job functions they will perform.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

Excess spiking solutions must be emptied into the corrosive waste carboy located in the metals prep lab for subsequent appropriate disposal in accordance with the Chemical Hygiene Plan and Safety Manual.

Sample digestates should be stored for a minimum of 60 days after digestion to allow for analysis, and reanalysis if necessary. Digestates older than 60 days may be emptied into the corrosive waste carboy in the metals prep lab for subsequent appropriate disposal in accordance with the Chemical Hygiene Plan and Safety Manual.

Any other wastes generated during the preparation of samples must be disposed of in accordance with the Katahdin Chemical Hygiene Plan and Safety Manual and SOP SD-903, "Sample Disposal," current revision.

2.0 SUMMARY OF METHOD

The aqueous sample is refluxed with nitric acid in a covered digestion vessel. Additional nitric acid is added until the color of the digestate has stabilized. After the digestate has been evaporated to a low volume, it is refluxed with hydrochloric acid and diluted to the appropriate final volume with reagent water.

Samples may be concentrated (i.e. final digestate volume less than initial sample volume) during digestion if lower detection limits are required. Volumes of reagents and spiking standards must be added in proportion to the final volume of the digestate. Because concentration of samples during digestion increases the concentrations of dissolved solids

and may exacerbate analytical interferences, concentration factors greater than 5 are not recommended.

3.0 INTERFERENCES

Interferences are discussed in the applicable analytical SOPs.

4.0 APPARATUS AND MATERIALS

4.1. 250 mL and 400 mL pre-cleaned Griffin beakers (cleaned according to the current revision of SOP CA-100, "Labware Cleaning") for digestion using a hot plate. If digestion will be performed using a block digester, 70ml graduated, polyethylene block digester tubes (with attached snap caps) will be used instead of glass beakers.

4.2 Ribbed watch glasses. If digestion is performed using a hot plate, 75 mm diameter and 100 mm diameter glass watch glasses (pre-cleaned as above) are used. If digestion is performed using a block digester, 40mm diameter disposable polyethylene watch glasses are used.

4.3 Adjustable volume automatic pipets covering the range from 10 uL to 1000 uL and disposable pipet tips; calibrated Finn pipets or Eppendorf pipets are acceptable.

4.4 Disposable graduated polystyrene specimen containers with pouring lips, 200 mL capacity.

4.5 Hot plate, block digester, or other heating source - adjustable and capable of maintaining a temperature of 90-95°C. Hot plates must be numbered for easy identification.

4.6 Device for measuring hot plate temperature. This may consist of a heat-resistant 100ml beaker containing reagent water in which a thermometer is immersed. When using a block digester, a digestion tube containing reagent water in which a thermometer is immersed may be used. The temperature of one hot plate is measured each day, on a rotating basis. The hot plate identification number and the measured temperature are recorded on the sample preparation logbook sheet.

4.7 Plastic funnels, pre-cleaned as in Section 4.1.

4.8 Filter funnel holders, capable of suspending plastic funnels above disposable specimen containers.

4.9 Polyethylene wash bottles for dispensing reagent water and 5% HNO_3.

4.10 Filter paper, Whatman No. 41 or equivalent. Filters are acid-washed immediately prior to use as follows. Place a pre-cleaned funnel in the funnel holder and put a disposable plastic specimen container under the funnel to collect the rinsates. Place a folded filter in the funnel and rinse three times with approximate 10 mL volumes of 5% HNO_3, making sure the entire surface of the filter is wetted each time and allowing each rinse to drain completely before continuing. Then rinse three times with approximate 25 mL volumes of reagent water. Discard the rinsates into the appropriate waste container. The acid-washed filter is now ready for use.

4.11 Polyethylene sample containers with screw caps or graduated polyethylene sample containers with attached snap lids, 125 mL capacity. These are not necessary when using the block digester since the final digestates are stored in the digestion tubes.

4.12 Repipetters (adjustable repeating pipetters with reservoirs) for dispensing concentrated nitric acid and 1:1 HCl.

5.0 REAGENTS

5.1 Concentrated nitric acid, HNO_3 – trace metals grade.

5.2 Concentrated hydrochloric acid, HCl – trace metals grade.

5.3 Reagent water - water that meets the performance specifications of ASTM Type II water (ASTM D1193).

5.4 Hydrochloric acid, 1:1. Add a volume of concentrated hydrochloric acid to an equivalent volume of reagent water and swirl gently to mix.

5.5 Nitric acid, 5% v/v. Add 25 mL concentrated HNO_3 to 475 mL reagent water in a 500 mL wash bottle. Cap, point the dispensing tip into a sink, and shake gently to mix.

5.6 Multi-element spiking solutions (as listed in Figure 3).

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Samples to be analyzed for dissolved metals should be filtered through a 0.45 um membrane filter and preserved as soon as possible after collection. Samples to be analyzed for total metals should be preserved, unfiltered, as soon as possible after collection. Aqueous samples are preserved by acidification with nitric acid to a pH of <2.

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

7.0 PROCEDURES

7.1 Prior to performing the digestion, make a list of the samples that are to be digested. Enter digestion information (Katahdin Sample Numbers, QC Batch ID, preparation date, analyst initials, etc.) into the ACCESS computer spreadsheet. Print out a copy of the spreadsheet. With a permamament marker, make sample labels and attach to the polyethylene sample containers that will contain the digestates.

7.2 If using glass beakers as the digestion vessels, submerge previously cleaned beakers three times into a 10% nitric acid bath, then rinse three times with reagent water. The polyethylene digestion tubes used in conjunction with the block digester do not require acid rinsing or precleaning. Label the digestion vessels with sample numbers.

7.3 If digestion is performed using a block digester, the sample aliquot may be measured in the digestion vessel using the graduations on the digestion tubes. Measure 50 ml of well-mixed sample into a 70 ml block digestion tube. A larger sample aliquot may be used (up to 250 mL) if concentration of the sample during digestion is desired. Sample volumes larger than 50 mL may be digested in 250 mL beakers. Measure aliquot of well-mixed sample into a graduated specimen cup and transfer into a properly cleaned 250 mL beaker. Sample volumes of more than 50ml may not be digested using the 70ml block digester tubes. The volumes of reagents and spiking solutions used must be adjusted in proportion to the final digestate volume. The reagent and spiking solution volumes listed below are based on a final volume of 50 mL.

7.4 Add spike solutions to matrix spike samples and laboratory control samples (refer to Figure 3 for spiking instructions).

7.5 Use a repipetter to add 1.5 mL of concentrated HNO_3 (per 50 mL final volume) to the sample. Cover with a ribbed watch glass and place on heatsource. Heat cautiously, without boiling the sample, and evaporate to a low volume (10 - 15 mL).

NOTE: Do not allow any portion of the bottom of the digestion vessel to go dry during any part of the digestion. If a sample is allowed to go to dryness, low recoveries may result. Should this occur, discard the digestate and re-prepare the sample.

7.6 Cool the sample and add another 1.5 mL aliquot (per 50 mL final volume) of concentrated HNO_3. Cover and resume heating, increasing the temperature until a gentle reflux action occurs.

7.7 Continue heating, adding additional acid as necessary, until the digestate is light in color or does not change in appearance with continued refluxing.

7.8 Evaporate digestate to a low volume (10 - 15 mL).

7.9 Cool the sample and use a repipetter to add 5 mL (per 50 mL final volume) of 1:1 HCl. Cover the sample and resume heating, refluxing for an additional 15 minutes to dissolve any precipitate or residue resulting from evaporation.

7.10 Allow the sample to cool.

7.11 If the digestate contains visible particulate material, it must be filtered. Use a pre-cleaned funnel and acid-rinsed filter paper to filter the digestate into a clean graduated plastic specimen container or block digester digestion tube. Using a wash bottle, rinse the digestion vessel with reagent water and add the rinsates to the filter apparatus. After all of the liquid in the filter has drained into the specimen container or digestion tube, thoroughly rinse the filter three times with small (5-10 mL) volumes of reagent water, allowing the liquid to drain completely after each rinse.

If the digestion was performed using hot plates and the digestate does not contain particulate material, simply decant the digestate into a clean graduated specimen container (or graduated sample container with attached snap lid), rinse the beaker with reagent water, and add the rinsates to the container.

If the digestion was performed using a block digester and the digestate contains no visible particulate material, the digestate may be brought to final volume and stored in the digestion tube without decanting or rinsing.

7.12 Using the graduations on the specimen container, snap-lid container or digestion tube, dilute to the required final volume with reagent water. If a specimen container has been used, transfer the contents to the corresponding labeled polyethylene sample bottle, cap the bottle, and discard the empty specimen container. If a snap-lid container or digestion tube has been used, close and secure the snap-lid. Shake the container gently to mix. The digestate is now ready for analysis.

7.13 Review the ACCESS computer spreadsheet for accuracy. If any information is incorrect, make the necessary changes to the computer spreadsheet and print out a corrected copy. Do not discard the original copy of the spreadsheet. Record (hand write) the sample bottle ID, reagent lot numbers, spiking information, initial and final volumes, hot plate ID and hot plate temperature in the appropriate spaces on the spreadsheet. Record any method deviations, irregularities with the samples, or other pertinent observations at the bottom of the page, and sign and date the spreadsheet. Bind all copies of the spreadsheet in the sample preparation log. An example sample preparation logbook page (ACCESS spreadsheet) is included as Figure 1.

7.14 Place each batch of digestates in a box labeled with the QC Batch ID, and put the box of digestates in the metals digestates storage area.

7.15 A condensation of the procedure described above is included in this SOP as Table 3. A controlled copy of this table may be posted in the metals preparation laboratory for reference by the analyst.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

8.1 At least one preparation blank for waters (PBW) is processed concurrently with each digestion batch of 20 or fewer samples, and is used to assess contamination resulting from the digestion procedure. The PBW consists of an aliquot of reagent water that is digested using the same reagents as those used to digest associated samples. The initial and final volumes of the PBW must be identical to those of the associated samples (i.e., if the associated samples were concentrated during digestion, the PBW must also be concentrated). Refer to the appropriate analytical SOP for PBW acceptance criteria and corrective actions.

8.2 At least one laboratory control sample for waters (LCSW) is processed concurrently with each digestion batch of 20 or fewer samples. The LCSW consists of an aliquot of reagent water that is spiked to contain all analytes of interest at known concentrations, and is digested using the same reagents as those used to digest associated samples. The initial and final volumes of the LCSW must be identical to those of the associated samples (i.e., if the associated samples were concentrated during digestion, the LCSW must also be concentrated). Directions for spiking the LCSW are contained in Figures 3 and 4. The measured analyte recoveries for the LCSW are used to assess digestion method performance. Refer to the appropriate analytical SOP for LCSW recovery acceptance criteria and corrective actions.

8.3 Matrix spiked samples are processed concurrently with each digestion batch at a minimum frequency of one per digestion batch. A matrix spike sample consists of an aliquot of a sample that is spiked with known amounts of all analytes of interest. Matrix spike recoveries are used to assess the effects of sample matrix on digestion and analysis performance. Directions for spiking matrix spike samples are contained in Figures 3 and 4. Refer to the appropriate analytical SOP for matrix spike recovery acceptance criteria and corrective actions.

8.4 Matrix spiked duplicate samples are processed concurrently with each digestion batch at a minimum frequency of one per digestion batch. Matrix spiked duplicate samples are used to assess the precision of the digestion and analysis methods. Refer to the appropriate analytical SOP for matrix spike duplicate precision acceptance criteria and corrective actions.

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

NOTE: Clients may choose specific samples for matrix spike and matrix spike duplicate analysis; otherwise, the choice is left to the person performing the digestion. The sample volumes available may restrict the choice of samples used for matrix spike and duplicate digestion. Field blank samples should not be chosen for matrix spike and matrix spike duplicate analysis.

8.5 The quality control measures and frequencies described above are minimum requirements. They are summarized for reference in Table 1. Individual clients and analytical programs may impose additional QC requirements.

9.0 METHOD PERFORMANCE

Refer to the applicable analytical SOPs for method performance information.

10.0 APPLICABLE DOCUMENTS/REFERENCES

"Test Methods for the Evaluation of Solid Waste," United States Environmental Protection Agency, SW-846, Third Edition, Final Update III, 12/96, Method 3010A.

LIST OF TABLES AND FIGURES

Table 1 QC Requirements
Table 2 Summary of Method Modifications
Table 3 Procedure Condensation
Figure 1 Example Page From Metals Sample Preparation Logbook
Figure 2 Preparation of Matrix Spikes, LCSs, and Spiking Solutions: Method 3010
Figure 3 Element Concentrations in Matrix Spikes, LCSs, and Spiking Solutions: Method 3010

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

TABLE 1

QC REQUIREMENTS

Analytical Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
3010	Preparation Blank for Waters (PBW)	One per prep batch of 20 or fewer samples	Refer to analytical method	Refer to analytical method
	Laboratory Control Sample for Waters (LCSW)	One per prep batch of 20 or fewer samples	Refer to analytical method	Refer to analytical method
	Matrix Spike Sample	One per prep batch	Refer to analytical method	Refer to analytical method
	Matrix Spike Duplicate Sample	One per prep batch	Refer to analytical method	Refer to analytical method
	Demonstration of analyst proficiency; accuracy and precision	One time demonstration by each analyst performing the method	Must pass all applicable QC for method	Repeat analysis until able to perform passing QC; document successful performance in personal training file

TABLE 2

SUMMARY OF METHOD MODIFICATIONS

TOPIC	KATAHDIN SOP CA-604-04	EPA METHOD 3010, current revision
Apparatus/Materials	1) Disposable plastic specimen cup used to measure sample volume. 2) Digestion performed in 250 mL, 400 mL Griffin beaker, or 70ml digestion tube to facilitate evaporation. 3) Ribbed watch glass used throughout digestion to reduce contamination.	1) Graduated cylinder used to measure sample volume. 2) Digestion performed in 150 mL Griffin beaker. 3) Ribbed and non-ribbed watch glasses alternated in digestion.
Procedures	1) Digestate may be analyzed for antimony and silver. 2) Sample aliquots larger or smaller than 100 mL may be used. 3) Sample evaporated to 10 - 15 mL.	1) Digestate may not be analyzed for antimony and silver. 2) Requires sample aliquot of 100 mL. 3) Sample evaporated to 5 mL.

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

TABLE 3

PROCEDURE CONDENSATION: EPA METHOD 3010

1. If performing digestion on a hot plate, rinse glass beakers and ribbed watch glasses 3 times in acid bath. Then rinse beakers and watch glasses 3 times with reagent water. If performing digestion with block digester, polyethylene digestion tubes do not require precleaning.
2. Label digestion vessels with sample numbers.
3. Mix sample well, measure 50 mL (or smaller or larger aliquot) into a polyethylene digestion tube. If using glass beakers, measure aliquot into graduated specimen container, and transfer to appropriate digestion vessel.
4. Add spike solutions to matrix spike samples and LCSW (refer to Figure 3 of this SOP).
5. Add 1.5 mL (per 50 mL final volume) concentrated HNO_3 to sample.
6. Cover with a ribbed watch glass.
7. Place on heating device (hotplate or block digester) and evaporate to 10 - 15 mL.
8. Cool sample and add another 1.5 mL (per 50 mL final volume) concentrated HNO_3.
9. Resume heating until gentle reflux action occurs.
10. Continue heating, adding additional HNO_3 as necessary until digestion is complete.
11. Evaporate to 10 - 15 mL.
12. Cool sample and add 5 mL (per 50 mL final volume) 1:1 HCl. Resume heating and reflux gently for 15 minutes.
13. Cool sample and filter (if necessary) or decant into a graduated polyetheyne digestion tube. Rinse beaker with reagent water and filter or decant rinsate into specimen container.
14. Dilute to appropriate final volume with reagent water.
15. Cap sample container and shake gently to mix.

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

FIGURE 1

EXAMPLE PAGE FROM METALS SAMPLE PREPARATION LOGBOOK

Katahdin Analytical Services, Inc.

Metals Preparation Benchsheet

Reagent Information:
JT Baker HNO3: C20022 JT Baker HCL: C07046 Ashland H2O2: NA

Method: 3010

Standards/Spiking Information:
I.V. CLPP-SPK-1 (ID/Vol): MS1362 / 0.05 mL NA : NA
CLPP-SPK-INT1 (ID/Vol): MW9975 / 0.5 mL Hot Plate No.: A
CLPP-SPK-INT2 (ID/Vol): MW9930 / 0.5 mL Temp.: 95 °C
U-Spike (ID/Vol): MS1332 / 0.05 mL

REVIEWED
EM 06-27-06
KATAHDIN ANALYTICAL METALS SECTION

Spiking Witnessed by: N/A

Sample ID	Batch ID	Initial Wt/Vol	Initial Units	Final Vol	Final Units	MX	Meth	Anal.	Date	Initial Color	Initial Clarity	Final Color	Final Clarity	Artifacts	Bottle
LC2WWF27ICW1	WF27ICW1	0.05	L	0.05	L	AQ	IC	DJJ	06/27/2006	N/A	N/A	N/A	N/A	N/A	N/A
LCSWWF27ICW1	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006	N/A	N/A	N/A	N/A		
PBWWF27ICW1	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006	N/A	N/A	N/A	N/A		
WW3165-001	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-002	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-003	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-004	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-005	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-006	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-007	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-008	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-009	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-010	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-011	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-012	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-013	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-014	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-015	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-016	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-017	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-018	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-019	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						
WW3165-020	WF27ICW1		L		L	AQ	IC	DJJ	06/27/2006						

DJJ 6/27/06

Digestion performed by: DJJ On: 6/27/06

Page: WF061 Revision: 00

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

FIGURE 2

PREPARATION OF MATRIX SPIKES, LABORATORY CONTROL SAMPLES, AND SPIKING SOLUTIONS FOR DIGESTION OF AQUEOUS SAMPLES BY METHOD 3010

Sample or Solution Name	Component Solution Name	Source of Component	Amount of Component Added per 50 mL Final Volume (mL)
Laboratory Control Sample (LCSW) and Matrix Spike	CLPP-SPK-1	Inorganic Ventures	0.050
	CLPP-SPK-INT1	Lab Prepared (see below)	0.50
	CLPP-SPK-INT2	Lab Prepared (see below)	0.50
	1000 mg/L Uranium Standard	Inorganic Ventures	0.005

Sample or Solution Name	Component Solution Name	Source of Component	Amount of Component Added per 100 mL Final Volume (mL)
CLPP-SPK-INT1	1000 mg/L Se	High Purity Standards	5.0
	1000 mg/L As	High Purity Standards	5.0
	1000 mg/L Pb	High Purity Standards	5.0
	1000 mg/L Cd	High Purity Standards	2.5
	1000 mg/L Sb	High Purity Standards	5.0
	10000 mg/L K	High Purity Standards	10.0
	10000 mg/L Na	High Purity Standards	7.5
	10000 mg/L Mg	High Purity Standards	5.0
	10000 mg/L Ca	High Purity Standards	2.5
CLPP-SPK-INT2	2007ICS-1	Inorganic Ventures	10.0
	1000 mg/L Sr	High Purity Standards	5.0
	1000 mg/L Sn	High Purity Standards	5.0
	10000 mg/L Si	High Purity Standards	5.0

TITLE: **ACID DIGESTION OF AQUEOUS SAMPLES BY EPA METHOD 3010 FOR ICP AND ICP-MS ANALYSIS OF TOTAL OR DISSOLVED METALS**

FIGURE 3

ELEMENT CONCENTRATIONS IN MATRIX SPIKES, LABORATORY CONTROL SAMPLES, AND THEIR COMPONENT SPIKING SOLUTIONS FOR DIGESTION OF AQUEOUS SAMPLES BY METHOD 3010

Element	CONCENTRATION IN SOLUTION, mg/L							
	Matrix Spike	LCSW	CLPP-SPK-1	CLPP-SPK-4	CLPP-SPK-INT1	CLPP-SPK-INT2	2007 ICS-1	1000 mg/L U
Aluminum	2.000	2.000	2000					
Antimony	0.500	0.500		100	50			
Arsenic	0.500	0.500		4	50			
Barium	2.000	2.000	2000					
Beryllium	0.050	0.050	50					
Boron	0.500	0.500		50		50	500	
Cadmium	0.250	0.250		5	25			
Calcium	2.500	2.500			250			
Chromium	0.200	0.200	200					
Cobalt	0.500	0.500	500					
Copper	0.250	0.250	250					
Iron	1.000	1.000	1000					
Lead	0.500	0.500		2	50			
Magnesium	5.000	5.000			500			
Manganese	0.500	0.500	500					
Molybdenum	0.300	0.300		30		30	300	
Nickel	0.500	0.500	500					
Potassium	10.000	10.000			1000			
Selenium	0.500	0.500		5	50			
Silicon	5.230	5.230				523	230	
Silver	0.050	0.050	50					
Sodium	7.500	7.500			750			
Strontium	0.500	0.500		50		50		
Thallium	0.500	0.500		5	50			
Tin	0.500	0.500		50		50		
Titanium	1.000	1.000		100		100	1000	
Uranium	0.100	0.100						1000
Vanadium	0.500	0.500	500					
Zinc	0.500	0.500	500					

TITLE: **ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES AND GFAA**

Prepared By: George Brewer Date: 3/98

Approved By:

Group Supervisor: George Brewer Date: 01/24/01

Operations Manager: Joel C. Burton Date: 1/24/01

QA Officer: Deborah J. Nadeau Date: 1.24.01

General Manager: Duncan F. Lufkin Date: 1/25/01

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
01 3050B	Format changes, added pollution prevention, added MSD, added spiking instruction tables.	DN	1.24.01	1/24/01
02 3050B	Removed all references/procedures devoted to GFAA. Added use of digestates for ICP-MS analysis. Revised standard solution names + concs. in Tables 3 + 4 to reflect current practice.	DN	8.29.02	8.29.02
03 3050B	New Title to include ILMO5.3. Use of digestion block and polyethylene digestion tubes added to sections 4.0, 7.0 and Table 1. PBS changed from 1.0g water to 1.0g boiling chips. H_2O_2 addition from 3.0ml then 7.0mls to 2.0ml, 2.0ml then 7.0ml. Figures and Tables updated to reflect current practices.	LAD	03/08	03/08

TITLE: ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document **SOP CA-605-03**, titled **ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS AND ILM05.3.**

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document **SOP CA-605-03**, titled **ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS AND ILM05.3.**

Recipient: _____ Date: _____

TITLE: ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS

1.0 SCOPE AND APPLICATION

The purpose of this SOP is to describe the Katahdin Analytical Services, Inc. procedure utilized to dissolve solid matrices and solubilize metals from solid samples prior to analysis for metals by ICP-AES and ICP-MS. This SOP applies to samples prepared by EPA Method 3050, with method modifications as summarized in Table 2.

This procedure applies to all solid sample (e.g. sediments, sludges, soils, and ashes) preparations for ICP-AES and ICP-MS analyses. This method is not a total digestion technique for most samples. It is a very strong acid digestion that will dissolve almost all elements that could become "environmentally available". By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

1.1 Definitions

ICP-AES – Inductively Coupled Plasma Atomic Emission Spectroscopy.

ICP-MS – Inductively Coupled Plasma Mass Spectrometry.

LCSS – Laboratory Control Sample for Solids – A standard or solid reference material that has been brought through the sample preparation process.

Matrix Spike – An aliquot of a sample to which a known amount of analyte has been added before digestion.

PBS – Preparation Blank for Solids – An aliquot of reagent water that has been brought through the sample preparation process.

1.2 Responsibilities

This method is restricted to use by, or under the supervision of analysts experienced in the acid digestion of solid samples by USEPA Method 3050 for metals analysis. Each analyst must demonstrate the ability to generate acceptable results with this method. Refer to Katahdin SOP QA-805, current revision, "Personnel Training & Documentation of Training".

It is the responsibility of all Katahdin technical personnel involved in the acid digestion of solid samples by USEPA Method 3050 to read and understand this SOP, to adhere to the procedures outlined, and to properly document their data in the appropriate lab notebook. Any deviations from the procedure or irregularities with the samples should also be recorded in the lab notebook and reported to the responsible Department Manager or designated qualified data reviewer.

It is the responsibility of the Department Manager to ensure that technical personnel perform acid digestions in accordance with this SOP and to confirm that their work is properly documented through periodic review of the associated logbooks.

1.3 Safety

The acids used in this procedure are highly corrosive and reactive, and spiking standards contain toxic metals. The toxicity and reactivity of client samples are usually unknown, so samples should always be assumed to present a contact hazard. To reduce or eliminate exposure to potentially harmful chemicals, lab coats, gloves, and safety glasses or goggles must be worn whenever handling samples or reagents. Additional safety apparel, including face shields, aprons, dust masks, and shoe protectors, is available in the Metals prep lab and should be worn whenever circumstances warrant.

Acids should be added to samples slowly and carefully, while watching for reactions. This should be done under a hood, in case harmful fumes are evolved.

Hood sashes should be lowered as far as possible whenever beakers are being heated on a hot plate. Use caution when handling hot beakers.

Personnel are required to read the Katahdin Hazrdous Waste Management Plan and Safety Manual before performing this procedure, and must be familiar with the general rules for laboratory safety, personal hygiene, housekeeping, and use of protective clothing and equipment.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

Excess spiking solutions must be emptied into the corrosive waste carboy located in the Metals prep lab for subsequent appropriate disposal in accordance with the Katahdin Hazardous Waste Management Plan and Safety Manual.

Sample digestates should be stored for a minimum of 60 days after digestion to allow for analysis, and reanalysis if necessary. Digestates older than 60 days may be emptied into the corrosive waste carboy in the Metals prep lab for subsequent appropriate disposal in accordance with the Katahdin Hazardous Waste Mnagement Plan and Safety Manual.

TITLE: ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS

2.0 SUMMARY OF METHOD

A representative 1 to 2 g (wet weight) sample is digested with repeated additions of nitric acid and hydrogen peroxide. Hydrochloric acid is added to the initial digestate and the sample is refluxed. The digestate is then filtered and diluted to a final volume of 100 mL.

3.0 INTERFERENCES

Interferences are discussed in the applicable analytical SOPs.

4.0 APPARATUS AND MATERIALS

4.1 Digestion vessels. If digestion is performed using a hot plate, the appropriate digestion vessels are 100 mL pre-cleaned Griffin beakers (cleaned according to the current revision of SOP CA-100, "Labware Cleaning" and CA-602, "Glassware Preparation and Sample Preservation for Trace Element Analyses"). If digestion is performed using a block digester, the appropriate digestion vessels are new 70 mL disposable graduated polyethylene digestion tubes with attached snap lids.

4.2 Ribbed watch glasses. If digestion is performed using a hot plate, 75 mm diameter glass watch glasses (pre-cleaned as above) are used. If digestion is performed using a block digester, 40 mm diameter disposable polyethylene watch glasses are used.

4.3 Adjustable volume automatic pipets covering the range from 10 uL to 1000 uL and disposable pipet tips; calibrated Finn pipets or Eppendorf pipets are acceptable.

4.4 Disposable graduated polystyrene specimen containers with pouring lips, 200 mL capacity.

4.5 Hot plate or block digester, griddle, or other heating source - adjustable and capable of maintaining a temperature of 95°C ± 5°C. Heating sources must be numbered for easy identification.

4.6 Device for measuring hot plate temperature, consisting of a flask or digestion vessel in which the bulb of a thermometer is immersed in sand or water. The temperature of each hot plate used is measured and recordedeach day. The hot plate identification number and the measured temperature are recorded on the sample preparation logbook sheet.

4.7 Plastic funnels, pre-cleaned as in Section 4.1.

4.8 Filter funnel holders, capable of suspending plastic funnels above disposable specimen containers.

4.9 Polyethylene wash bottles for dispensing reagent water and 5% HNO_3.

4.10 Filter paper, Whatman No. 41 or equivalent. Filters are acid-washed immediately prior to use as follows. Place a pre-cleaned funnel in the funnel holder and put a disposable plastic specimen container under the funnel to collect the rinsates. Place a folded filter in the funnel and rinse three times with approximate 10 mL volumes of 5% HNO_3, making sure the entire surface of the filter is wetted each time and allowing each rinse to drain completely before continuing. Then rinse three times with approximate 25 mL volumes of reagent water, again allowing each rinse to drain completely. Discard the rinsates into the appropriate waste container. The acid-washed filter is now ready for use.

4.11 Polyethylene sample containers with screw caps or graduated polyethylene sample containers with attached snap lids, 125 mL capacity.

4.12 Repipetters (adjustable repeating pipetters with reservoirs) for dispensing concentrated nitric acid, 1:1 HNO_3, and concentrated HCl.

4.13 Analytical balance capable of reading to 0.01 gram.

4.14 Spatulas, scoops, or spoons; plastic or stainless steel, rinsed with 5% HNO_3 and reagent water. Disposable tongue depressors may be used and do not requrire to be rinsed.

5.0 REAGENTS

5.1 Concentrated nitric acid, HNO_3 – trace metals grade.

5.2 Concentrated hydrochloric acid, HCl – trace metals grade.

5.3 Reagent water - water that meets the performance specifications of ASTM Type II water (ASTM D1193).

5.4 Nitric acid, 1:1. Add a volume of concentrated HNO_3 to an equivalent volume of reagent water and swirl gently to mix.

5.5 Nitric acid, 5% v/v. Add 25 mL concentrated HNO_3 to 475 mL reagent water in a 500 mL wash bottle. Cap, point the dispensing tip into a sink, and shake gently to mix.

5.6 30% hydrogen peroxide (H_2O_2) - spectrometric grade.

5.7 Multielement spiking solutions (see Table 3 for a list of required spiking solutions).

5.8 Solid reference material – a soil containing all the elements of interest, with empirically established method-specific recoveries and acceptance limits for all analytes. Solid reference materials are purchased with documentation of analysis provided by the vendor. See Figure 4 for an example certificate of analysis for a solid reference material.

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Samples should be collected in clean plastic or glass containers. Samples must be refrigerated (4°C ±2°C) upon receipt by the laboratory. The holding time for solid samples is 6 months from the date of sample collection.

7.0 PROCEDURE

The procedure described below is condensed for quick reference in Table 3.

SAMPLE PREPARATION

7.1 Prior to performing the digestion, make a list of the samples that are to be digested. Enter digestion information (Katahdin Sample Numbers, QC Batch ID, preparation date, analyst initials, etc.) into the ACCESS computer spreadsheet. Print out a copy of the spreadsheet (see Figure 2 for an example). Hand label the digestate vessels

7.2 If using glass beakers as the digestion vessels, submerge previously cleaned beakers and watch glasses three times into a 10% nitric acid bath, then rinse three times with reagent water. The polyethylene digestion tubes used in conjunction with the block digeter do not require acid rinsing or precleaning. Label the digestion vessels with sample numbers.

7.3 Weigh 1 to 2 g of well-mixed sample into a properly cleaned, labeled, and tared Griffin beaker or polyethylene digestion tube. Record (hand write) the weight of each sample on the printout of the digestion spreadsheet.

7.4 Weigh an appropriate amount of solid reference material to a clean, labeled, and tared Griffin beaker or polyethylene digestion tube to serve as a laboratory control sample.

7.5 Add spike solutions to matrix spike samples (refer to Tables 3 and 4 for spiking instructions).

7.6 Using repipetters, add 10 mL of 1:1 HNO_3, mix the slurry. Cover with a ribbed watch glass and place on heat source. Gently heat the sample to 95°C ± 5 °C and reflux for 10 to 15 minutes without boiling. Remove the digestion vessel from the heat source and cool the sample.

7.7 Add 5 mL of concentrated HNO_3 to the sample, replace the watch glass, and reflux for 30 minutes. If brown fumes are generated, indicating oxidation of the sample by HNO_3, repeat this step (addition of 5 mL of concentrated HNO_3) until no brown fumes are given off by the sample, indicating complete reaction by HNO_3.

7.8 Continue heating the sample at 95°C ± 5°C without boiling until the digestate has evaporated to approximately 5 to 10 mL or until two hours have elapsed, whichever occurs first. Do not allow the sample to go to dryness. Remove the digestion vessel from the heat source and cool the sample.

7.9 Add 2 mL of reagent water and 2 mL of 30% H_2O_2 to the sample, replace the watch glass, and heat gently on the heat source to start the peroxide reaction. Continue heating until effervescence subsides.

7.10 Add an additional 2 mL of 30% H_2O_2 to the sample, replace the watch glass, and heat gently on the heat source to start the peroxide reaction. Continue heating until effervescence subsides.

7.11 Add an additional 6 mL of 30% H_2O_2 in 1-mL aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged.

7.12 Continue heating the sample at 95°C ± 5°C without boiling until the digestate has evaporated to approximately 5 to 10 mL or until two hours have elapsed, whichever occurs first. Do not allow the sample to go to dryness. Remove the sample from the heat source and cool.

7.13 Add 10 mL of concentrated HCl to the digest from 7.12, replace the watch glass, and reflux at 95°C ± 5°C for 15 minutes. Remove the sample from the heat source and cool.

7.14 Use a pre-cleaned funnel and acid-rinsed filter paper to filter the digestate into a clean graduated polystyrene specimen container or graduated polyethylene sample container with attached snap lid. Using a wash bottle, rinse the digestion vessel with reagent water and add the rinsates to the filter apparatus. After all of the liquid in the filter has drained into the specimen container, thoroughly rinse the filter three times with small (5-10 mL) volumes of reagent water, allowing the liquid to drain completely after each rinse. Using the graduations on the specimen container or snap-lid container, dilute to 100 mL with reagent water. If a specimen container has been used, transfer the contents to the corresponding labeled polyethylene sample bottle, cap the bottle, and discard the empty specimen container. If a snap-lid

container has been used, close and secure the snap-lid. Shake the container gently to mix. The digestate is now ready for ICP-AES or ICP-MS analysis.

7.15 Review the ACCESS computer spreadsheet for accuracy. If any information is incorrect, make the necessary changes to the computer spreadsheet and print out a corrected copy. Do not discard the original copy of the spreadsheet. Record (hand write) reagent lot numbers, spiking information, and heat source temperature in the appropriate spaces on the spreadsheet. Record any method deviations, irregularities with the samples, or other pertinent observations at the bottom of the page, and sign and date the spreadsheet. Bind all copies of the spreadsheet in the sample preparation log. An example sample preparation logbook page (ACCESS spreadsheet) is included as Figure 2.

7.15 Reopen the electronic ACCESS spreadsheet for the digestion and transcribe the sample weights from the handwritten, bound copy into the electronic copy. The information in this electronic spreadsheet will later be imported into the ACCESS metals database and used to calculate sample concentrations on a weight basis.

7.16 Place each batch of digestates in a box labeled with the QC Batch ID, and put the box of digestates in the metals digestates storage area.

CALCULATIONS

7.17 Analytical results for solid samples are reported on a dry weight basis. Total solids are determined by the Wet Chemistry Group, and are recorded in spreadsheets that are electronically imported into the Access metals database. Final dry weight concentrations are calculated by the Access database as follows:

$$\text{Concentration (mg/kg dry weight)} = (C \times V) / (W \times S)$$

where: C = Measured concentration (mg/L)
V = Digestate final volume (L)
W = Sample wet weight (kg)
S = % Solids/100

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

USEPA Method 3050 requires the laboratory to perform specific quality control checks to assess laboratory performance and data quality. Minimum frequencies, acceptance criteria, and corrective actions for these control checks are tabulated in Table 1 and are described below. Table 1 criteria are intended to be guidelines for analysts. The table does not cover all possible situations. If any of the QC requirements are outside the recovery ranges listed in Table 1, all associated samples must be evaluated against all the QC. In some cases data may be reported, but may be reanalyzed in other cases. Making new

reagents and standards may be necessary if the standardization is suspect. The corrective actions listed in Table 1 may rely on analyst experience to make sound scientific judgements. These decisions are based on holding time considerations and client and project specific Data Quality Objectives. The Depatment Manager, Operations Manager, and/or Quality Assurance Officer may be consulted to evaluate data. Some samples may not be able to be reanalyzed within hold time. In these cases "qualified" data with narration may be advisable after consultation with the client.

8.1 At least one preparation blank for soils (PBS) is processed concurrently with each digestion batch of 20 or fewer samples, and is used to assess contamination resulting from the digestion procedure. The PBS consists of a 1.0 g of boiling stones that is digested using the same reagents as those used to digest associated samples. Refer to the appropriate analytical SOP for PBS acceptance criteria and corrective actions.

8.2 At least one laboratory control sample for soils (LCSS) is processed concurrently with each digestion batch of 20 or fewer samples. The LCSS consists of an aliquot of a solid reference material for which the concentrations of the analytes of interest have been empirically established (solid-matrix LCSS), or an aliquot of reagent water that is spiked to contain all analytes of interest at known concentrations (aqueous-matrix LCSS). The solid reference material should normally be used as the LCSS, unless a particular client or analytical program requires that spiked reagent water be used. The LCSS is digested using the same reagents as those used to digest associated samples. Directions for spiking the aqueous-matrix LCSS are contained in Table 3. The measured analyte recoveries for the LCSS are used to assess digestion method performance. Refer to the appropriate analytical SOP for LCSS recovery acceptance criteria and corrective actions.

8.3 Matrix spike samples are processed along with each digestion batch at a minimum frequency of one per digestion batch. A matrix spike sample consists of an aliquot of a sample that is fortified with known amounts of all analytes of interest prior to digestion. Matrix spike recoveries are used to assess the biasing effects of sample matrix on digestion and analysis performance. Directions for spiking matrix spike samples are contained in Figure 2. Refer to the appropriate analytical SOP for matrix spike recovery acceptance criteria and corrective actions.

8.4 Matrix spiked duplicate samples are processed concurrently with each digestion batch at a minimum frequency of one per digestion batch. Matrix spiked duplicate samples are used to assess the precision of the digestion and analysis methods. Refer to the appropriate analytical SOP for matrix spike duplicate precision acceptance criteria and corrective actions.

NOTE: Clients may choose specific samples for matrix spike and duplicate analysis; otherwise, the choice is left to the person performing the digestion.

8.5 The quality control measures and frequencies described above are minimum requirements. Individual clients and analytical programs may impose additional QC requirements.

9.0 METHOD PERFORMANCE

Refer to the applicable instrumental analysis SOP for method performance information.

10.0 APPLICABLE DOCUMENTS/REFERENCES

"Test Methods for the Evaluation of Solid Waste," United States Environmental Protection Agency, SW-846, Third Edition, Final Update III, 12/96, Method 3050B.

LIST OF TABLES AND FIGURES

Table 1 QC Requirements – Method 3050
Table 2 Summary of Method Modifications – Method 3050
Table 3 Preparation of Matrix Spikes and Spiking Solutions
Table 4 Element Concentrations in ICP-AES Matrix Spikes and Their Component Spiking Solutions
Figure 1 Procedure Condensation – Method 3050
Figure 2 Example Page from Metals Sample Preparation Logbook
Figure 3 Example Certificate of Analysis for Solid Reference Material

TABLE 1

QC REQUIREMENTS – METHOD 3050

Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
3050	Preparation Blank for Solids (PBS)	One per prep batch of 20 or fewer samples.	Refer to analytical method.	Refer to analytical method.
	Laboratory Control Sample for Solids (LCSS)	One per prep batch of 20 or fewer samples.	Refer to analytical method.	Refer to analytical method.
	Matrix Spike Sample	One per prep batch.	Refer to analytical method.	Refer to analytical method.
	Matrix Spike Duplicate Sample	One per prep batch.	Refer to analytical method.	Refer to analytical method.
	Demonstration of analyst proficiency	One-time demonstration by each analyst performing the method.	Must pass all applicable QC for method.	Repeat analysis until able to perform passing QC; document successful performance in personal training file.

TABLE 2

SUMMARY OF METHOD MODIFICATIONS – METHOD 3050

Topic	Katahdin SOP CA-605-02	Method 3050, current revision
Apparatus /Materials	1) Digestion performed in 100 mL Griffin beaker or 70 mL polyethylene tube. 2) Graduated disposable plastic cup or 120 mL polyethylene tube used to bring digestate to final volume.	1) Digestion performed in 250 mL Griffin beaker. 2) Volumetric flask used to bring digestate to final volume.
Procedure	1) Digestate volume reduced to 5 to 10 mL prior to filtering. 2) After filtration, the filters are rinsed three times with reagent water. 3) 30% H_2O_2 is added in two 2 mL aliquots and then six 1 mL aliquots.	1) Digestate volume reduced to 5 mL prior to filtering. 2) After filtration, the filters are rinsed twice with reagent water. 3) 30% H_2O_2 is added in one 3 mL aliquot and then seven 1 mL aliquots.

TABLE 3

PREPARATION OF MATRIX SPIKES AND SPIKING SOLUTIONS FOR DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050

Sample or Solution Name	Component Solution Name	Source of Component	Amount of Component Added per 100 mL Final Volume (mL)
Matrix Spike for ICP-AES	CLPP-SPK-1	Inorganic Ventures	0.10
	CLPP-SPK-INT1	Lab Prepared (see below)	1.00
	CLPP-SPK-INT2	Lab Prepared (see below)	1.00
	1000 mg/L U	High Purity Standards	0.01

Sample or Solution Name	Component Solution Name	Source of Component	Amount of Component Added per 100 mL Final Volume (mL)
CLPP-SPK-INT1	QCP-CICV-3	Inorganic Ventures	10.0
	1000 mg/L Sb	High Purity Standards	5.0
	10000 mg/L K	High Purity Standards	10.0
	10000 mg/L Na	High Purity Standards	7.5
	10000 mg/L Mg	High Purity Standards	5.0
	10000 mg/L Ca	High Purity Standards	2.5
CLPP-SPK-INT2	2007ICS-1	Inorganic Ventures	10.0
	1000 mg/L Sr	High Purity Standards	5.0
	1000 mg/L Sn	High Purity Standards	5.0
	10000 mg/L Si	High Purity Standards	5.0

TITLE: ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS

TABLE 4

ELEMENT CONCENTRATIONS IN ICP-AES MATRIX SPIKES AND THEIR COMPONENT SPIKING SOLUTIONS FOR DIGESTION OF SOLID SAMPLES BY METHOD 3050

Element	CONCENTRATION IN SOLUTION, mg/L							
	Matrix Spike (ICP-AES)	CLPP-SPK-1	CLPP-SPK-4	CLPP-SPK-INT1	CLPP-SPK-INT2	QCP-CICV-3 SPK-3	2007 ICS- 1	1000 mg/L U
Aluminum	2.000	2000						
Antimony	0.500		100	50				
Arsenic	2.000		40	200		500		
Barium	2.000	2000						
Beryllium	0.050	50						
Boron	0.500				50		500	
Cadmium	0.050		50	5		250		
Calcium	2.500			250				
Chromium	0.200	200						
Cobalt	0.500	500						
Copper	0.250	250						
Iron	1.000	1000						
Lead	0.500		20	50		500		
Magnesium	5.000			500				
Manganese	0.500	500						
Molybdenum	0.300				30		300	
Nickel	0.500	500						
Potassium	25.000			2500				
Selenium	2.000		10	200		500		
Silicon	5.230				523		230	
Silver	0.050	50						
Sodium	7.500			750				
Strontium	0.500				50			
Thallium	2.000		50	200		500		
Tin	0.500				50			
Titanium	1.000				100		1000	
Uranium	1.000	1.000						1000
Vanadium	0.500	500						
Zinc	0.500	500						

TITLE: ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS

FIGURE 1

PROCEDURE CONDENSATION – METHOD 3050

1. Prepare and print out ACCESS spreadsheet.
2. If performing digestion on a hot plate, rinse 250 mL Griffin beakers and ribbed watch glasses 3 times in acid bath. Then rinse beakers and watch glasses 3 times with laboratory reagent grade water. If perfoming digestion with block digester, polyethylene digestion tubes do not require precleaning.
3. Label digestion vessels (beakers or polyethylene sample tubes) with sample numbers.
4. Weigh 1 to 2 g of well-mixed sample into tared digestion vessels. Record sample weights.
5. Add spike solutions to matrix spike samples.
6. Add 10 mL 1:1 HNO_3 to samples and cover with watch glasses.
7. Reflux for 10 to 15 minutes at $95^{o} \pm 5^{o}$ C. without boiling. Cool samples.
8. Add 5 mL conc. HNO_3, cover beakers, and reflux for 30 minutes.
9. Repeat Step 8 as necessary until digestion is complete.
10. Reduce sample volumes to 5 to 10 mL or heat for 2 hours, whichever occurs first.
11. Cool sample and add 2 mL reagent water and 2 mL 30% H_2O_2. Heat gently until effervescence subsides.
12. Cool sample and add 2 mL 30% H_2O_2. Heat gently until effervescence subsides.
13. Cool samples and add 6 mL of 30% H_2O_2 in 1 mL aliquots. Heat gently until effervescence subsides.
14. Reduce sample volumes to 5 to 10 mL or heat for 2 hours, whichever occurs first.
15. Add 10 mL conc. HCl and reflux for 10 to 15 minutes at $95^{o} \pm 5^{o}$ C.
16. Cool sample and filter into graduated specimen container. Bring to volume with reagent water and transfer to labeled polyethylene bottle.
17. Enter sample weights into ACCESS spreadsheet.

TITLE: ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS

FIGURE 2

EXAMPLE PAGE FROM METALS SAMPLE PREPARATION LOGBOOK

Katahdin Analytical Services, Inc.

Metals Preparation Benchsheet

Reagent Information:
JT Baker HNO3: E26035 JT Baker HCL: E33033 Air Products H2O2: 416348 LCSS: MS1474 Method: 3050H

Standards Information:
I.V. CLPP-SPK-1 (ID/Vol): MS1476 / 0.100 mL N/A : mL
CLPP-SPK-INT1 (ID/Vol): MW10896 / 1.000 mL Hot Plate No.: A
CLPP-SPK-INT2 (ID/Vol): MW10896 / 1.000 mL Start Temp.: 95 °C
Uranium spike (ID/Vol): MS1437 / 0.010 mL End Temp.: 95 °C

Fisher Filter Paper: #11207132B #11207133 A

REVIEWED
01-18-08
KATAHDIN ANALYTIC METALS SECTION

Sample ID	Batch ID	Initial Wt/Vol	Initial Units	Final Vol	Final Units	MX	Meth	Anal.	Date	Initial Color	Initial Texture	Final Color	Final Clarity	Artifacts	Bottle
LCSSYA16ICS0	YA16ICS0	0.5042	g	0.100	L	SL	IC	HHH	01/16/2008	N/A	N/A	N/A	N/A		
PBSYA16ICS0	YA16ICS0	1.000	g		L	SL	IC	HHH	01/16/2008	N/A	N/A	N/A	N/A		
SB0164-001	YA16ICS0	1.000	g		L	SL	IC	HHH	01/16/2008						A
SB0164-002	YA16ICS0	1.040	g		L	SL	IC	HHH	01/16/2008						
SB0164-003	YA16ICS0	1.050	g		L	SL	IC	HHH	01/16/2008						
SB0164-004	YA16ICS0	1.030	g		L	SL	IC	HHH	01/16/2008						
SB0164-005	YA16ICS0	1.260	g		L	SL	IC	HHH	01/16/2008						
SB0164-006	YA16ICS0	1.020	g		L	SL	IC	HHH	01/16/2008						
SB0164-007	YA16ICS0	1.020	g		L	SL	IC	HHH	01/16/2008						
SB0164-008	YA16ICS0	1.260	g		L	SL	IC	HHH	01/16/2008						A
SB0164-009	YA16ICS0	1.020	g		L	SL	IC	HHH	01/16/2008						E
SB0189-001	YA16ICS0	1.070	g		L	SL	IC	HHH	01/16/2008						
SB0189-002	YA16ICS0	1.140	g		L	SL	IC	HHH	01/16/2008						
SB0189-003	YA16ICS0	1.050	g		L	SL	IC	HHH	01/16/2008						
SB0189-004	YA16ICS0	1.060	g		L	SL	IC	HHH	01/16/2008						
SB0189-005	YA16ICS0	1.220	g		L	SL	IC	HHH	01/16/2008						
SB0189-006	YA16ICS0	1.220	g		L	SL	IC	HHH	01/16/2008						
SB0189-008	YA16ICS0	1.090	g		L	SL	IC	HHH	01/16/2008						
SB0189-010	YA16ICS0	1.090	g		L	SL	IC	HHH	01/16/2008						
SB0189-010P	YA16ICS0	1.060	g		L	SL	IC	HHH	01/16/2008						E
SB0189-010S	YA16ICS0	1.150	g		L	SL	IC	HHH	01/16/2008						A
SB0238-002	YA16ICS0	1.060	g		L	SL	IC	HHH	01/16/2008						A
SB0247-001	YA16ICS0	1.010	g		L	SL	IC	HHH	01/16/2008						

Add 1-16-08

Digestion performed by: HHH On: 1-16-08

Page: YA036 Revision: 00

TITLE: ACID DIGESTION OF SOLID SAMPLES BY USEPA METHOD 3050 FOR METALS ANALYSIS BY ICP-AES, ICP-MS

FIGURE 3

EXAMPLE CERTIFICATE OF ANALYSIS FOR SOLID REFERENCE MATERIAL

ENVIRONMENTAL RESOURCE ASSOCIATES®
The Industry Standard™

M51475

DataPacK™
Lot No. D051-540

Trace Metals in Soil
Catalog No. 540

Certification

Method 3050 HNO3, H2O2, HCl Parameter	Total Concentration [1] (mg/Kg)	Certified Value [2] (mg/Kg)	Performance Acceptance Limits™ [3] (mg/Kg)
aluminum	55600*	7870	4630 - 11100
antimony	160	70.5	D.L. - 149
arsenic	316	289	234 - 344
barium	869	211	174 - 247
beryllium	60.9	54.4	45.2 - 63.6
boron	129	91.3	58.8 - 124
cadmium	114	101	82.9 - 119
calcium	9750*	3680	2970 - 4390
chromium	249	224	180 - 268
cobalt	113	101	82.7 - 119
copper	94.9	88.0	73.3 - 103
iron	24400*	15700	6610 - 24900
lead	184	158	129 - 187
magnesium	3780*	2260	1760 - 2750
manganese	703	420	343 - 497
mercury	5.32	5.18	3.42 - 6.87
molybdenum	80.2	69.6	55.5 - 83.7
nickel	137	120	99.1 - 141
potassium	33000*	3000	2200 - 3800
selenium	146	130	101 - 159
silver	127	104	68.9 - 139
sodium	15600*	1080	692 - 1470
strontium	326	113	90.5 - 135
thallium	106	94.0	72.8 - 115
tin	175	149	104 - 194
titanium	3100*	284	116 - 453
vanadium	151	111	85.1 - 137
zinc	311	272	215 - 329

Method 3050 HNO3, H2O2 Parameter	Total Concentration [1] mg/Kg	Certified Value [2] mg/Kg	Performance Acceptance Limits™ [3] mg/Kg
aluminum	55600*	7380	4440 - 10300
antimony	160	75.2	D.L. - 198
arsenic	316	284	225 - 343
barium	869	217	177 - 257
beryllium	60.9	53.6	42.7 - 64.5
boron	129	89.5	58.9 - 120
cadmium	114	103	83.6 - 122
calcium	9750*	3540	2800 - 4270
chromium	249	224	172 - 275
cobalt	113	101	82.0 - 120
copper	94.9	85.5	70.4 - 100
iron	24400*	12500	5480 - 19500
lead	184	162	132 - 192
magnesium	3780*	2160	1650 - 2670
manganese	703	415	330 - 500
mercury	5.32	5.18	3.42 - 6.87
molybdenum	80.2	68.8	52.7 - 84.9
nickel	137	119	98.5 - 140
potassium	33000*	2840	2160 - 3520
selenium	146	135	104 - 166
silver	127	107	49.8 - 164
sodium	15600*	1010	709 - 1310
strontium	326	111	89.0 - 133
thallium	106	99.3	76.8 - 122
tin	175	148	70.6 - 225
titanium	3100*	283	104 - 463
vanadium	151	104	70.5 - 138
zinc	311	275	222 - 328

TITLE: TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010

Prepared By: George Brewer Date: 7/98

Approved By:

Group Supervisor: George Brewer Date: 01/23/01

Operations Manager: John C. Burton Date: 1/23/01

QA Officer: Deborah J. Nadeau Date: 1.23.01

General Manager: Dennis P. Hufnagle Date: 1/25/01

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
01 6010B	Format changes, added pollution prevention, expanded procedure and QC sections. Added tables.	DH	1.23.01	1/23/01
02 6010B	Calibration begins with analysis of S0 (cal. blank) followed by S1 (Mixed Cal. Std.) Changes to section 7.5 and Table 8 to reflect this. Made changes to element concs. in Tables 3,4,5,6 to reflect current practices.	DH	10.21.02	10.21.02
03 6010B	Added MN-IEC to standards run. Changed frequency of LRS. Changed concentration of HNO_3 in calibration blank. CRI changed from three separate solutions to one. Changed CRI vendor.	MRC	04.15.04	04.15.04
04	updated ICV, CCV, ICB, PQL Chkstd. PBW, PBS, MS & MSD acceptance criteria updated Table 1	LAD	05/06	05/06
05	Updated Tables 3,4,5,6 and 7 with current standard concentrations and prep. Updated Table 1 with current practices including NAVY audit findings. Updated sections 2, 7.2, 7.6 and Table 1 with new ICP information. Updated Table 8 with current sequence requirements.	LAD	07/07	07/07

TITLE: TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
06	Added hardness definition and calculation (APP. 1)	LAD	09/07	09/07
07	Updated Summary to reflect new ICP functions. Removed ICP set-up updated tables to reflect changes in standard concentrations and preparation	LAD	11/08	11/08
08	Updates to Sections 8 and 10, Tables 1 and 2 to reflect changes from 6010B to 6010C. Added LLQC information and criteria to Sect. 8 and Table 1. Added criteria to analyze PQL standard at the beginning and END of each run.	LAD	02/09	02/09

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document **SOP CA-608-08**, titled **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010.**

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document **SOP CA-608-08**, titled **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010.**

Recipient: _____ Date: _____

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

1.0 SCOPE AND APPLICATION

Inductively coupled plasma atomic-emission spectroscopy (ICP-AES) determines trace elements, including metals, in solution. The purpose of this SOP is to describe the procedures used by Katahdin Analytical Services, Inc. personnel to analyze aqueous and solid samples for trace metals by USEPA Method 6010 (Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods, USEPA SW846).

Sample types that may be analyzed using these methods include drinking waters, ground waters, aqueous samples, TCLP, SPLP and EP Toxicity extracts, industrial and organic wastes, soils, sludges, sediments, and other solid wastes. The following elements may be analyzed under this SOP: Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Si, Ag, Na, Sn, Sr, Tl, Ti, V, and Zn.

All samples, except filtered ground water samples, analyzed under USEPA Method 6010 require digestion prior to analysis. USEPA Methods 3005, 3010, and 3050 describe appropriate digestion procedures for samples to be analyzed by ICP-AES under EPA Method 6010. Refer to current revisions of Katahdin SOPs CA-604 and CA-605, current revisions, for sample digestion procedures.

1.1 Definitions

Analytical Spike - An aliquot of a sample to which a known amount of analyte has been added before analysis and after digestion, if digestion is required.

CCB - Continuing Calibration Blank - An analyte-free solution consisting of acidified reagent water used to verify calibration accuracy periodically during analysis.

CCV - Continuing Calibration Verification - A midrange standard used to verify calibration accuracy periodically during analysis.

CRI - Contract Required detection limit sample for ICP - A low concentration standard used to verify calibration accuracy near the low end of the calibration range.

Duplicate - A second aliquot of a sample that is prepared and analyzed in the same way as the original sample in order to determine the precision of the method.

ICB - Initial Calibration Blank - An analyte-free solution consisting of acidified reagent water used to verify calibration accuracy.

ICP-AES - Inductively Coupled Plasma Atomic Emission Spectroscopy.

ICS - Interference Check Sample - Two standards (ICSA and ICSAB) used to verify the effectiveness of interelement correction and background correction. Solution ICSA contains only interferents (Al, Ca, Fe, and Mg) at high concentrations (200 to

500 mg/L); solution ICSAB contains interferents at the same concentrations as well as analytes at low (20 mg/L or less) concentrations.

ICV - Initial Calibration Verification - A standard made from a source independent from the calibration standards and with analyte concentrations different from those in the CCV; used to verify the accuracy of the instrument calibration.

IDL - Instrument Detection Limit - The lowest concentration of an analyte that can be determined with 99% confidence.

LCS - Laboratory Control Sample - A standard or solid reference material that has been brought through the sample preparation process.

LRS - Linear Range Standard - A high-concentration standard used to determine the upper reporting limit of the ICP calibration.

PB - Preparation Blank - Reagent water that has been brought through the sample preparation process.

PQL - Practical Quantitation Limit - The lowest concentration of an analyte that is routinely reported by the laboratory; nominally three to five times the IDL.

Matrix Spike - An aliquot of a sample to which a known amount of analyte has been added before digestion.

Serial Dilution - The dilution of a sample by a factor of five. When corrected by the dilution factor, the measured analyte concentrations of the diluted sample should agree with those of the original undiluted sample within specified limits. Serial dilution may reflect the influence of interferents.

Hardness – The sum of the calcium and magnesium concentrations, both expressed as calcium carbonate, in mg/L.

1.2 Responsibilities

This method is restricted to use by, or under the supervision of, analysts experienced in ICP analysis by EPA Method 6010. Each analyst must demonstrate and document their ability to generate acceptable results with this method. Refer to Katahdin SOP QA-805, current revision, "Personnel Training & Documentation of Capability".

It is the responsibility of all Katahdin technical personnel involved in ICP analysis by Method 6010 to read and understand this SOP, to adhere to the procedures outlined, and to properly document their data in the appropriate lab notebook. Any deviations from the test or irregularities with the samples should also be recorded in the lab notebook and reported to the group supervisor or designated qualified data reviewer responsible for this data.

It is the responsibility of the Group Supervisor to oversee that members of their group follow this SOP, to ensure that their work is properly documented and to initiate periodic review of the associated logbooks.

1.3 Safety

Users of this procedure must be cognizant of inherent laboratory hazards, proper disposal procedures for contaminated materials and appropriate segregation of hazardous wastes. The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical should be treated as a potential health hazard. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Everyone involved with the procedure must be familiar with the MSDSs for all the materials used in this procedure.

Each qualified analyst or technician must be familiar with Katahdin Analytical Environmental Health and Safety Manual including the Katahdin Hazardous Waste Plan and must follow appropriate procedures. These include the use of appropriate personal protective equipment (PPE) such as safety glasses, gloves and lab coats when working with chemicals or near an instrument and not taking food or drink into the laboratory. Each analyst should know the location of all safety equipment. Each analyst shall receive a safety orientation from their Department Manager, or designee, appropriate for the job functions they will perform.

Samples, sample digestates, standards, and other reagents used in ICP analysis may contain high concentrations of acids and toxic metals. Safety glasses should be worn when changing or adjusting argon tanks.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

Wastes from ICP analysis should be disposed of in a manner appropriate to the hazards they present. Wastes generated during the preparation of samples must be disposed of in accordance with the Katahdin Analytical Environmental Health and Safety Manual I and SOP SD-903, "Sample Disposal," current revision. Expired standards are lab packed, placed in the Katahdin hazardous waste storage area, and disposed of in accordance with this SOP.

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

2.0 SUMMARY OF METHOD

This method describes multielemental determinations by ICP-AES using simultaneous optical systems and radial and axial viewing of the plasma. The basis of the method is the measurement of atomic emission from sample atoms entrained in an argon plasma by optical spectroscopy. Samples are nebulized and the aerosol that is produced is transported to the plasma torch where thermal excitation of entrained atoms and ions occurs. Characteristic atomic-line and ionic-line emission spectra are produced by a radio-frequency inductively coupled plasma (ICP). The spectra are dispersed by a grating and the intensities of the emitted lines are monitored by a solid state charge injection device (CID) camera system. Photocurrents from the CID camera system are measured by a computer system. Element concentrations of unknown samples are quantitated by comparison of sample emission intensities to emission intensities of standards of known concentration. A background correction technique is used to compensate for variable background contribution to the determination of trace elements. Background is measured adjacent to the analyte lines on samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, has been determined by the complexity of the spectrum adjacent to the analytical line. The position used must be relatively free of spectral interference and must reflect the same change in background intensity as occurs at the analyte wavelength. Physical interferences are corrected through the use of an internal standard (yttrium) that is automatically added to all samples and standards prior to nebulization. The possibility of additional interferences (noted in section 3) must be recognized and appropriate corrections applied.

3.0 INTERFERENCES

Several types of interference effects may contribute to inaccuracies in the determination of trace elements. They can be summarized as spectral interferences, physical interferences, and chemical interferences.

Spectral interferences can be categorized as 1) overlap of a spectral line from another element; 2) unresolved overlap of molecular band spectra; 3) background contribution from continuous or recombination phenomena; and 4) background from stray light from the line emission of high concentration elements. The first of these effects is compensated by utilizing the computer correction of raw data, requiring the monitoring and measurement of the interfering element (interelement correction). The second effect is controlled by choosing analytical wavelengths that are free from overlapping molecular emission spectra. The third and fourth effects are usually compensated by a background correction adjacent to the analyte line. Uncorrected spectral interferences may be detected through examination of serial dilution and matrix spike data.

Physical interferences are generally considered to be effects associated with sample nebulization and transport processes. Such properties as changes in viscosity and surface tension can cause significant inaccuracies, especially in samples that may contain high dissolved solids and/or acid concentrations. Matrix matching of standards and samples

and the use of a peristaltic pump may lessen these interferences. If these types of interferences are operative, they must be reduced by dilution of the sample and/or utilization of standard addition techniques. Another problem that can occur from high dissolved solids is salt buildup at the tip of the nebulizer. This affects aerosol flow rate causing instrumental drift. Regular cleaning of nebulizer tips and dilution of samples with high dissolved solids contents are used to control this problem. Physical interferences are also corrected by this laboratory through the use of an internal standard. Uncorrected physical interferences may be detected through examination of serial dilution and matrix spike data. Instrument drift caused by the salting up of nebulizer tips may also be detected by looking for oriented drift in calibration verification standards analyzed regularly throughout the run.

Chemical interferences are characterized by molecular compound formation, ionization effects, and solute vaporization effects. Normally these effects are not pronounced with the ICP technique; however, if observed they can be minimized by careful selection of operating conditions (i.e., incident power, observation position, etc.), by matrix matching, and by standard addition procedures. These types of interferences can be highly dependent on matrix type and the specific analyte element. Uncorrected chemical interferences may be detected through examination of serial dilution data.

4.0 APPARATUS AND MATERIALS

4.1 Computer-controlled inductively-coupled plasma atomic emission spectrometer (plasma viewed radially or axially) equipped for internal standardization, and capable of performing automatic background correction and interelement correction. For more information refer to the current revision of Katahdin SOP CA-632, "Operation and Maintenance of the Thermo ICAP 6500 ICP Spectrophotometer".

4.2 Computer-controlled autosampler.

4.3 Argon gas supply – high purity.

4.4 Volumetric glassware of suitable precision and accuracy.

4.5 Automatic pipets of suitable precision and accuracy. Calibrated Eppendorf Reference pipets and Finn digital pipets are appropriate.

Refer to the appropriate instrument-specific SOP for additional required equipment.

5.0 REAGENTS

5.1 Hydrochloric acid, concentrated (HCl) – spectroscopic grade.

5.2 Nitric acid, concentrated (HNO_3) – spectroscopic grade.

5.3 Reagent water, trace metals free.

5.4 Calibration blank – reagent water containing HCl (5% v/v) and HNO_3 (5% v/v). Calibration blank solution is prepared in large volumes (up to 20 liters) and stored in a carboy. Calibration blank solution is used in establishing the analytical curve, and in all initial and continuing calibration blank determinations. This solution is also used to flush the system between standards and samples. Intermediate and working standards are prepared by diluting stock standards and intermediate standards with calibration blank solution so that all standards and blanks are acid matrix-matched to sample digestates.

5.5 Single element and multielement stock standard solutions – purchased standards prepared from high purity salts or metals, and supplied by the vendors with certificates of purity and analysis. Refer to Tables 3 and 4 for a listing of stock standards required, and to Table 7 for element concentrations in stock standards.

5.6 Intermediate standard solutions – laboratory-prepared multielement standards that are used in the subsequent preparation of working standards. Refer to Table 4 for a listing of intermediate standards required and for preparation instructions. Refer to Table 6 for element concentrations in intermediate standards.

5.7 Working standard solutions – laboratory-prepared multielement standards that are used to calibrate the instrument and to perform all necessary QC checks. Refer to Table 3 for a listing of working standards and for preparation instructions. Refer to Table 5 for element concentrations in working standards.

5.8 5 mg/L yttrium internal standard solution – add 0.5 mL 10000 mg/L yttrium stock standard to a 1000 mL volumetric flask half filled with calibration blank solution. Bring to volume with calibration blank solution.

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Samples to be analyzed for trace metals by ICP should be collected and preserved as described in the following table.

Matrix	Container [1]	Collection Volume/ Weight	Preservation/ Treatment	Holding Time
Aqueous (total)	P, G	250 mL	HNO_3 to pH < 2	6 months
Aqueous (dissolved)	P, G	250 mL	Filter, HNO_3 to pH < 2	6 months
Solid	P, G	10 g	Cool, 4°C	6 months

[1] P = polyethylene or , G = glass

7.0 PROCEDURES

7.1 Begin by following the startup and calibration instructions provided in the current revision of Katahdin SOP CA-632, "Operation and Maintenance of the Thermo ICAP 6500 ICP Spectrophotometer"

7.2 Analysis must proceed in the sequence described in Table 8 to ensure that all necessary quality control samples are analyzed at the appropriate frequencies. A minimum of two replicate integrations is required for all standards and samples. Analysis always begins with the analysis of a calibration blank solution (S0) followed by analysis of a multielement calibration standard (S1 in Table 3) to calibrate the instrument. The system is flushed with calibration blank for two minutes between each sample and standard, and each sample and standard is aspirated for one minute prior to the beginning of emission measurements.

7.3 Analysis continues with analysis of the initial calibration verification standard (ICV) and the initial calibration blank (ICB) to verify the accuracy of the calibration. Refer to Section 8 and Table 1 for additional information.

7.4 A continuing calibration verification standard (CCV) and a continuing calibration blank (CCB) must be analyzed at the beginning of the run, after every ten samples, and at the end of the run to verify the continued accuracy of the calibration. Refer to Section 8 and Table 1 for additional information.

7.5 Interference check standard solutions (ICSA and ICSAB) must be analyzed at the beginning, end, and at periodic intervals (4-6 hours, 30-40 analytical samples) throughout the sample run to verify the accuracy of the IEC factors. Refer to Section 8 and Table 1 for additional information.

7.6 A practical quantitation limit standard (PQL) must be analyzed at the beginning of each run to determine the accuracy of the calibration at the reporting limit. Refer to Section 8 and Table 1 for additional information.

7.7 All sample analytical results for a particular element that are bracketed (preceded or followed) by failing results in a QC sample (ICV, ICB, CCV, CCB, ICSA, or ICSAB) for that element must not be reported. The sample must be reanalyzed for the element in question.

7.8 All samples that exceed the linear dynamic range must be diluted and reanalyzed. This includes samples with interfering elements that exceed the calibration ranges, because accurate quantitation of interfering elements is necessary for reliable interelement correction. For example, if a sample has been submitted to the

laboratory for lead analysis, and the measured aluminum concentration of that sample exceeds the calibration range for aluminum, it must be diluted sufficiently to bring aluminum within the linear dynamic range and the lead result must be reported from that dilution analysis.

7.9 If dilutions of digested samples are performed, the measured element concentrations must be multiplied by the dilution factor prior to reporting. This is accomplished automatically by entering the dilution factor in the autosampler table prior to initiation of analysis.

7.10 All analyses are performed using yttrium as an internal standard to compensate for enhancement or depression of the analytical signal due to matrix effects. Yttrium solution is pumped at a constant rate through one channel of the peristaltic pump. Samples and standards are pumped through a second channel of the pump. The tubing carrying the internal standard is connected to the tubing carrying samples and standards downstream from the pump, and mixing of the two streams is accomplished in a mixing coil downstream from the connection, prior to nebulization. For each sample or standard, the computer that controls the spectrometer divides the detected emission signal for each element by the detected yttrium emission signal prior to quantitation, thus normalizing all emission signals to that of yttrium.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

USEPA Method 6010 requires the laboratory to perform specific quality control checks to assess laboratory performance and data quality. Minimum frequencies, acceptance criteria, and corrective actions for these control checks are tabulated in Table 1 and are described below. Table 1 criteria are intended to be guidelines for analysts. The table does not cover all possible situations. If any of the QC requirements are outside the recovery ranges listed in Table 1, all associated samples must be evaluated against all the QC. In some cases data may be reported, but may be reanalyzed in other cases. Making new reagents and standards may be necessary if the standardization is suspect. The corrective actions listed in Table 1 may rely on analyst experience to make sound scientific judgments. These decisions are based on holding time considerations and client and project specific Data Quality Objectives. The supervisor, Operations Manager, and/or Quality Assurance Officer may be consulted to evaluate data. Some samples may not be able to be reanalyzed within hold time. In these cases "qualified" data with narration may be advisable after consultation with the client.

In some cases the standard QC requirements listed in this section and in Table 1 may not be sufficient to meet the Data Quality Objectives of the specific project. Much of the work performed at the lab is analyzed in accordance with specific QC requirements spelled out in a project specific Quality Assurance Project Plan (QAPP) or in a program specific Quality Systems Manual (QSM). The reporting limits, acceptance criteria and/or corrective actions may be different than those specified in this SOP. In these cases the appropriate information

will be communicated to the Department Manager and/or senior chemists before initiation of the analyses so that specific product codes can be produced for the project. In addition, the work order notes for each project will describe the specific QAPP or QSM to be followed.

INITIAL DEMONSTRATION OF PERFORMANCE

8.1 Instrument detection limits (IDL) are determined quarterly for each analyte analyzed on each instrument. This determination requires seven replicate analyses of a reagent water spiked at 3-5 times the anticipated detection limit for each analyte, performed on three non-consecutive days. The standard deviation of the 21 analyses is multiplied by three to obtain the IDL. For more information on performing IDL determinations, refer to the current revision of Katahdin SOP QA-806.

8.2 Method detection limits (MDL) are determined annually for each analyte analyzed on each instrument. This determination requires at least seven replicate digestions and analyses of a reagent water spiked at 3-5 times the anticipated MDL for each analyte. MDLs differ from IDLs in that the seven replicates are digested prior to analysis, and they may be analyzed on a single day. The standard deviation of the 7 (or more) replicate analyses is multiplied by the Student's t-value to obtain the MDL. For more information on performing MDL determinations, refer to the current revision of Katahdin SOP QA-806.

8.3 A Lower Limit of Quantitation Check (LLQC) sample must be prepared and analyzed annually or on an as-needed basis to confirm the laboratory's Practical Quantitation Limits (PQLs). The LLQC sample is equivalent to the PQL standard (Section 8.10) but is carried through the entire sample preparation and analysis process. Element recoveries for the LLQC sample must fall within 70% to 130% of the expected concentrations to confirm the previously established PQLs.

8.4 The upper limit of the linear dynamic range (LDR) must be established for each wavelength utilized. It must be determined from a linear calibration prepared in the normal manner using the established analytical operating procedure for the instrument. The LDR should be determined by analyzing succeedingly higher standard concentrations of the analyte until the observed analyte concentration differs by no more than 10% from the stated concentration of the standard. Determined LDRs must be documented and kept on file. The LDR which may be used for the analyses of samples should be judged by the analyst from the resulting data. Determined sample analyte concentrations that are greater than the determined upper LDR limit must be diluted and reanalyzed. The LDRs should be verified **every six months** or whenever, in the judgment of the analyst, a change in analytical performance caused by either a change in instrument hardware or operating conditions would dictate they be redetermined.

8.5 The alkali and alkaline earth metals may have non-linear response curves due to ionization and self-absorption effects. These curves may be used for quantitation of samples if the effective range is checked and if the second order curve fit has a correlation coefficient of 0.998 or better. Third order fits are not acceptable. Non-linear response curves must be revalidated and recalculated every six months.

ANALYTICAL RUN QC SAMPLES

8.6 An Initial Calibration Verification (ICV) solution is analyzed after the initial calibration to check calibration accuracy. The ICV solution is prepared by combining compatible elements from a standard source different than that of the calibration standard and at concentrations within the linear working range of the instrument. The results of the ICV must fall within 90% to 110% of the expected values. If the ICV fails, result for the failing elements may not be reported from the run unless the ICV recovery is greater than 110%and the sample result is less than the PQL.

8.7 Continuing Calibration Verification (CCV) solutions are analyzed after the initial calibration, after every ten samples, and at the end of the analytical run. The CCV solution is prepared using the same standards used for calibration at concentrations near the mid-point of the calibration curve. Results of the CCVs must fall within 90% to 110% of the expected values. If a CCV fails, results for the failing elements may not be reported from the run unless the CCV recovery is greater than 110% and the sample result is less than the PQL. Also, for failing elements, all samples analyzed after the last passing CCV must be reanalyzed.

8.8 Calibration blank solution is analyzed after each ICV and CCV. A calibration blank that is analyzed after the ICV is called an Initial Calibration Blank (ICB). A calibration blank that is analyzed after a CCV is called a Continuing Calibration Blank (CCB). The absolute values of results of ICBs and CCBs must be less than the Practical Quantitation Level (PQL) for each element. If an ICB or a CCB fails, results for the failing elements may not be reported from the run until the problem is corrected and a passing ICB or CCB has been analyzed, with the following exception. If the result for a CCB a ICB is greater than the PQL, sample results that are less than the PQL or greater than or equal to ten times the measured CCB concentration may be reported. Also, for failing elements, all samples analyzed after the last passing CCB must be reanalyzed, with the exception noted above.

8.9 Interference check solutions ICSA and ICSAB (refer to Section 1.1) are analyzed at the beginning of each run to verify interelement correction factors and background correction. ICSA contains interferent elements (Al, Ca, Fe, and Mg) only, at concentrations of 200 mg/L to 500 mg/L. Results for interfering elements in the ICSA must fall within 80% to 120% of the expected values. Results for unspiked elements in ICSA must fall within ± PQL if the PQL is greater than 0.01 mg/L, within ± 2xPQL if the PQL is less than or equal to 0.01 mg/L. ICSAB contains interferent elements at concentrations of 200 mg/L to 500 mg/L, and analytes at

concentrations of 20 mg/L or less. Results for all elements (interferents and analytes) in ICSAB must fall within 80% to 120% of the expected values. If the ICSA or ICSAB fails, results for the failing elements may not be reported from the run until the problem is corrected and a passing ICSA or ICSAB has been analyzed.

8.10 A Practical Quantitation Limit (PQL) Check Standard or low level continuing calibration verification (LLCCV) is analyzed at the beginning (after the ICV and ICB samples) and at the end of each run. Element concentrations in this solution are at the laboratories practical quantitation limit. Element recoveries for the PQL check Standard must fall between 70-130% of the expected values. If the PQL Check Standard fails, the results for the failing elements may not be reported from the run, unless the PQL Check Standard recovery is greater than 130% and the samples results are less than the PQL.

PREPARATION BATCH QC SAMPLES

8.11 Each digestion batch of twenty or fewer samples will contain a preparation blank and a laboratory control sample. Each batch will also contain one or more of the following QC samples: laboratory control sample duplicate, sample duplicate, matrix spike sample or matrix spike sample duplicate.

8.12 A preparation blank (PBW or PBS), consisting of reagent water carried through the same process as associated samples, is prepared with each digestion batch of twenty or fewer samples. The results of preparation blanks must be less than the Practical Quantitation Level (PQL) for each element. If a preparation blank fails, results for the failing elements may not be reported from the digestion batch, and all associated samples must be redigested, with the following exception. If the result for a preparation blank is greater than the PQL, associated sample results that are less than the PQL or greater than or equal to ten times the measured preparation blank concentration may be reported.

8.13 A laboratory control sample (LCS), consisting of spiked reagent water or a solid reference material carried through the same process as associated samples, is prepared with each digestion batch of twenty or fewer samples. Results for laboratory control samples must fall within 80% to 120% of the expected value, unless vendor-supplied limits (for solid reference materials) or laboratory-generated statistical limits are available. If a laboratory control sample fails, results for the failing elements may not be reported from the digestion batch, and all associated samples must be redigested with the following exception. If the LCS fails high, sample results less than the PQL may be reported.

SAMPLE MATRIX QC SAMPLES

8.14 Matrix spiked duplicate samples are prepared at a minimum frequency of one per digestion batch. The recovery for each element in a spiked sample or spiked

duplicate sample must fall within 75% to 125% of the actual value if the result for the unspiked sample is less than four times the amount of spike added. If one or both spike recoveries fail, the associated sample result must be flagged on the report of analysis.

The relative percent difference between sample duplicate, matrix spiked duplicate or LCS duplicate, is calculated as follows:

$$\text{RPD (\%)} = \frac{|D_1 - D_2|}{(|D_1 + D_2|)/2} \times 100$$

Where: D_1 = sample result
D_2= duplicate sample result

A control limit of 20% RPD is applied to duplicate analysis if the original sample result is greater than 50X the IDL. If the matrix spike duplicate analysis fails, the associated sample result must be flagged on the report of analysis.

8.15 A serial dilution is analyzed to check for chemical or physical interferences. If the analyte concentration of a sample is sufficiently high (minimally, 50 x IDL), the measured concentration of a serial dilution (1:5 dilution) of the sample should agree within 90% to 110% of the original determination. The percent difference between the original sample and the serial dilution should be calculated as follows:

$$\text{Difference (\%)} = \frac{|L-S|}{S} *100\%$$

where:
L = Serial dilution result (corrected for dilution)
S = Original sample result

If the serial dilution analysis fails, a matrix interference should be suspected. The associated sample result should be flagged on the report of analysis or the sample should be reanalyzed at dilution to eliminate the interference.

9.0 METHOD PERFORMANCE

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The MDLs are determined annually per type of instrument and filed with the Metals Supervisor and with the QAO. Refer to the current revision of Katahdin SOP QA-806, Method Detection Limit and Instrument Detection Limit Studies, for procedures on determining the MDL.

Refer to the current revision of Method 6010 for other method performance parameters and requirements.

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

10.0 APPLICABLE DOCUMENTS/REFERENCES

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA SW846, 3rd Edition, Final Updates I, II, IIA, IIB, III, IIIA, IIIB and IV, February 2007, Method 6010C.

List of Tables & Figures

Table 1 QC Requirements
Table 2 Summary of Method Modifications
Table 3 Preparation of Calibration and Quality Control Standards
Table 4 Preparation of Intermediate Standards
Table 5 Element Concentrations in Working Standards
Table 6 Element Concentrations in Intermediate Standards
Table 7 Element Concentrations in Stock Standards
Table 8 Required Analytical Sequence
Attachment 1 Hardness by Calculation

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

TABLE 1

QC REQUIREMENTS

Method	QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action
USEPA 6010	Initial Calibration, minimum 1 point plus a calibration blank.	Daily prior to sample analysis.	Correlation coefficient (r) ≥ 0.998	Recalibrate
	Initial Calibration Verification (ICV), prepared from a second source.	Before beginning a sample run.	Recovery within ± 10% of true value.	1) Do not use results for failing elements unless the ICV > 110% and the sample < the PQL. 2) Investigate and correct problem.
	Initial Calibration Blank (ICB)	Immediately after the ICV.	Absolute value of ICB < PQL.	1) Do not use results if ≥ PQL and < 10x CCB level. 2) Investigate and correct problem.
	Continuing Calibration Verification (CCV)	At beginning of run, after every 10 samples, and at end of run.	Recovery within ± 10% of true value.	1) Do not use results for failing elements unless the ICV > 110% and the sample < the PQL. 2) Investigate and correct problem.
	Continuing Calibration Blank (CCB)	After every 10 samples and at end of the run.	Absolute value of CCB < PQL.	1) Do not use results if ≥ PQL and < 10x CCB level. 2) Investigate and correct problem.
	Practical Quantitation Level Check Standard (PQL) (LLCCV)	At beginning and end of run.	Recovery within ± 30% of true value.	1) Do not use results for failing elements unless the ICV > 110% and the sample < the PQL. 2) Investigate and correct problem.
	Interference Check Solution A (ICSA)	At beginning and end of run.	For Al, Ca, Fe, and Mg, recovery within ± 20% of true value. For analytes not spiked, ± PQL, or, if PQL ≤ 0.01 mg/L, ± 2x PQL.	1) Do not use results for failing elements. 2) Investigate and correct problem.
	Interference Check Solution AB (ICSAB)	At beginning and end of run.	Recovery of each analyte within ± 20% of true value.	1) Do not use results for failing elements. 2) Investigate and correct problem.

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

TABLE 1, CONTINUED

QC REQUIREMENTS

Method	QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action
USEPA 6010, continued	Preparation Blank (PBW/PBS)	One per digestion batch of 20 or fewer samples.	Less than PQL.	1) Investigate source of contamination. 2) Redigest and reanalyze all associated samples if sample concentration ≥ PQL and <10x the blank concentration.
	Laboratory Control Sample (LCSW/LCSS)	One per digestion batch of 20 or fewer samples.	Recovery within ± 20% of true value, unless vendor-supplied or statistical limits have been established.	1) Investigate source of problem. 2) Redigest and reanalyze all associated samples.
	Matrix Spike Sample (S)	One per digestion batch of 20 or fewer samples.	Recovery ± 25% of true value, if sample < 4x spike added.	Flag results.
	Matrix Spike Duplicate Sample (P)	One per digestion batch of 20 or fewer samples.	1) Recovery ± 25% of true value, if sample < 4x spike added. 2) RPD ≤20% for duplicate spikes.	Flag results
	Serial Dilution (L)	One per digestion batch.	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.	Flag result or dilute and reanalyzed sample to eliminate interference.
	Instrument Detection Limit (IDL) Study	Quarterly.	IDL < MDL PQL > 2-3 * the IDL	1) Repeat IDL study. 2) Raise PQL.
	Method Detection Limit (MDL) Study	Annually.	M PQL > 2-3 * the MDL	1) Repeat MDL study. 2) Raise PQL.
	Lower Limit of Quantitation Check (LLQC) Sample	Digest and analyze annually or as needed to confirm PQLs	70% - 130% of true value	Reevaluate PQLs
	Linear Range Study	Every six months	Run succeedingly higher stds until recovery not within ± 10%. Use highest passing concentration as upper limit of linear range.	Only accept data to highest passing concentration until next linear range study.

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

TABLE 2

SUMMARY OF METHOD MODIFICATIONS

TOPIC	KATAHDIN SOP CA-608-08	METHOD 6010, current revision
Apparatus/Materials		
Reagents		
Sample preservation/ handling		
Procedures		
QC - Spikes		
QC - LCS		
QC - Accuracy/Precision		
QC - MDL		
QC - Calibration Blanks	Acceptance criteria employed for 6010: ± PQL	Acceptance criteria stated in 6010: less than 10% of PQL

TABLE 3

PREPARATION OF CALIBRATION AND QUALITY CONTROL STANDARDS

Sample or Solution Name	Component Solution Name	Source of Component	Amount of Component Added per 100 mL Final Volume (mL)
Calibration Standard (STD1 or S1)	ICP- intermediate Standard	Lab Prepared (see Table 4)	10.0
	QCS 26	High Purity Standards	1.0
Initial Calibration Verification (ICV)	QCP-CICV-3	Inorganic Ventures	0.96
	1000 mg/L Si	Inorganic Ventures	0.98
	1000 mg/L Al	High Purity Standards	0.96
	IV-28	Inorganic Ventures	0.4
	1000 mg/L Sn	Inorganic Ventures	0.04
Interference Check Sample A (ICSA)	CLPP-ICS-A	Inorganic Ventures	10.0
Interference Check Sample AB (ICSAB)	CLPP-ICS-A	Inorganic Ventures	10.0
	CLPP-ICS-B4	Inorganic Ventures	1.0
	ICSAB-INT	Lab Prepared (see Table 4)	5.0
Continuing Calibration Verification (CCV)	ICP intermediate standard	Lab Prepared (see Table 4)	5.0
	QCS 26	High Purity Standards	0.5
Practical Quantitation Limit Sample (PQL)	PQL-INT	Lab Prepared (see Table 4)	1.0

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

TABLE 4

PREPARATION OF INTERMEDIATE STANDARDS

Sample or Solution Name	Component Solution Name	Source of Component	Amount of Component Added per 100 mL Final Volume (mL)
PQL-INT	1000 mg/L B,Li,Sn,Sr, W, U	H-P or IV	1.0 each
	10000 mg/L K, Na	H-P or IV	1.0 each
	1000 mg/L Ni	High Purity Standards	0.4
	1000 mg/L Co	High Purity Standards	0.3
	1000 mg/L Cu,V,Zn	High Purity Standards	0.25 each
	1000 mg/L Si	High Purity Standards	2.0
	1000 mg/L Cr,Ti,Tl,Ag	High Purity Standards	0.15 each
	1000 mg/L Cd,Se, Mo	High Purity Standards	0.1 each
	10000 mg/L Al	High Purity Standards	0.3
	1000 mg/L As,Sb	High Purity Standards	0.08 each
	1000 mg/L Ba,Be,Mn,Pb	High Purity Standards	0.05 each
	10000 mg/L Ca,Mg	High Purity Standards	0.05 each
	10000 mg/L Fe	High Purity Standards	0.1
ICSAB-INT	10000 mg/L K,Na	H-P or IV	4.0 each
	10000 mg/L B, Li, Mo,Sr,Sn,Ti, W, U	High Purity Standards	1.0 each
	1000 mg/L Si	High Purity Standards	4.0

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

TABLE 5

ELEMENT CONCENTRATIONS IN WORKING STANDARDS

	CONCENTRATION IN SOLUTION, mg/L								
Element	**STD1**	**ICV**	**PQL**	**ICSA**	**ICSAB**	**CCV**	**AL_IEC**	**FE_IEC**	**MN_IEC**
Aluminum	25	10	0.3	500	500	12.5	500		
Antimony	1	0.4	0.008		0.6	0.5			
Arsenic	1	0.4	0.008		0.1	0.5			
Barium	1	0.4	0.005		0.5	0.5			
Beryllium	1	0.4	0.005		0.5	0.5			
Boron	1	0.4	0.1		0.5	0.5			
Cadmium	1	0.4	0.01		1.0	0.5			
Calcium	25	10	0.05	500	500	12.5			
Chromium	1	0.4	0.015		0.5	0.5			
Cobalt	1	0.4	0.03		0.5	0.5			
Copper	1	0.4	0.025		0.5	0.5			
Iron	25	10	0.1	200	200	12.5		200	
Lead	1	0.4	0.005		0.05	0.5			
Lithium	1	0.4	0.1		0.5	0.5			
Magnesium	25	10	0.05	500	500	12.5			
Manganese	1	0.4	0.005		0.5	0.5			10
Molybdenum	1	0.4	0.01		0.5	0.5			
Nickel	1	0.4	0.04		0.5	0.5			
Potassium	25	13.6	1		20	12.5			
Selenium	1	0.4	0.01		0.05	0.5			
Silicon	1	0.4	0.2		2	0.5			
Silver	1	0.4	0.015		0.2	0.5			
Sodium	25	10	1		20	12.5			
Strontium	1	0.4	0.1		0.5	0.5			
Thallium	1	0.4	0.015		0.1	0.5			
Tin	1	0.4	0.1		0.5	0.5			
Titanium	1	0.4	0.015		0.5	0.5			
Tungsten	1	0.4	0.1		0.5	0.5			
Uranium	1	0.4	0.1		0.5	0.5			
Vanadium	1	0.4	0.025		0.5	0.5			
Zinc	1	0.4	0.025		1.0	0.5			

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

TABLE 6

ELEMENT CONCENTRATIONS IN INTERMEDIATE STANDARDS

	CONCENTRATION IN SOLUTION, mg/L			
Element	**ICP Intermed STD**		**PQL-INT**	**ICSAB-INT**
Aluminum	240		30	
Antimony			0.8	
Arsenic			0.8	
Barium			0.5	
Beryllium			0.5	
Boron			10	10
Cadmium			1.0	
Calcium	240		5.0	
Chromium			1.5	
Cobalt			3.0	
Copper			2.5	
Iron	240		10	
Lead			0.5	
Lithium	10		10	10
Magnesium	240		5.0	
Manganese			0.5	
Molybdenum			1.0	10
Nickel			4.0	
Potassium	150		100	400
Selenium			1.0	
Silicon	250		20	40
Silver			1.5	
Sodium	240		100	400
Strontium	10		10	10
Thallium			1.5	
Tin	10		10	10
Titanium			1.5	10
Tungsten	10		10	10
Uranium	10		10	10
Vanadium			2.5	
Zinc			2.5	

TITLE: **TRACE METALS ANALYSIS BY ICP-AES USING USEPA METHOD 6010**

TABLE 7

ELEMENT CONCENTRATIONS IN STOCK STANDARDS

Element	CONCENTRATION IN SOLUTION, mg/L					
	IV-28	QCS-26	2007 ICS-1	CLPP-ICS-A	CLPP-ICS-B4	QCP-CICV-3
Aluminum	100	100		5000		
Antimony	100	100			60	
Arsenic	100	100			10	500
Barium	100	100			50	
Beryllium	100	100			50	
Boron	100	100	500			
Cadmium	100	100			100	250
Calcium	100	100		5000		
Chromium	100	100			50	
Cobalt	100	100			50	
Copper	100	100			50	
Iron	100	100		2000		
Lead	100	100			5	500
Lithium	100					
Magnesium	100	100		5000		
Manganese	100	100			50	
Molybdenum	100	100	300			
Nickel	100	100			100	
Potassium	1000	1000				
Selenium	100	100			5	500
Silicon	50	50	230			
Silver	100	100			20	
Sodium	100	100				
Strontium	100					
Thallium	100	100			10	500
Tin						
Titanium	100	100	1000			
Vanadium	100	100			50	
Zinc	100	100			100	

TABLE 8

REQUIRED ANALYTICAL SEQUENCE

Sequence Number	Standard/Sample	Purpose
1	Blank (Calibration Blank)	Initial calibration
2	S1 (Calibration Standard)	Initial calibration
3	ICV (Initial Calibration Verification)	Check calibration accuracy
4	ICB (Initial Calibration Blank)	Check calibration accuracy
5	PQL (Practical Quantitation Level Sample)	Check calibration accuracy near PQL, repeat before final CCV, CCB
6	ICSA (Interference Check Solution A)	Verify accuracy of IEC factors, repeat before final CCV, CCB
7	ICSAB (Interference Check Solution AB)	Verify accuracy of IEC factors, repeat before final CCV, CCB
8	CCV (Continuing Calibration Verification)	Check calibration stability
9	CCB (Continuing Calibration Blank)	Check calibration stability
10-19	Analyze up to 10 samples	
20	CCV (Continuing Calibration Verification)	Check calibration stability
25	CCB (Continuing Calibration Blank)	Check calibration stability
...	Continue analyzing sequences of up to 10 samples, followed by a CCV and a CCB	

ATTACHMENT 1

HARDNESS BY CALCULATION

As referenced in "Standard Methods for the Examination if Water and Wastewater," Methods 2340 A & B, Hardness Introduction and Hardness by Calculation, American Public Health Association, 18th Edition, Revised 1992, total hardness is the sum of the calcium and magnesium concentrations, both expressed as calcium carbonate, in milligrams per liter.

Once the calcium and magnesium concentrations have been determined by EPA methods 6010, 6020, 200.7 or 200.8, the total hardness of an aqueous sample may be calculated as follows:

$$\text{Total Hardness, mg equivalent } CaCO_3/L = 2.497\ (Ca, mg/L) + 4.118\ (Mg, mg/L)$$

The calcium hardness of an aqueous sample may also be calculated as follows:

$$\text{Calcium Hardness, mg equivalent } CaCO_3/L = 2.497\ (Ca, mg/L)$$

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

SOP Number: CA-741
Revision History
Cover Page
Page 1

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II LLOYD KAHN METHOD

Prepared By: Greg Lull Date: 7/2002

Approved By:

Group Supervisor: Keith Tanguay Date: 091102

Lab Operations Mgr: Joel C. Burton Date: 9/11/02

QA Officer: Deborah J. Nadeau Date: 9.11.02

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
01	Sect. 1-clarified CCB, Sect. 2-clarified phosphoric acid conc. Sect. 7- reworded software and instr. startup, added TS to calc., removed steps not currently in practice. Sect. 8 -updated LCS and CCV information. Updated Table 1	LAD	01/07	01/07
02	Added method SW846 9060 to title and Table 2. Added 9060 quadruplicate sample analysis to sect. 7 and Table 1. Removed D.I. water from MB definition. 5.3-added TIC std. info. Sect. 7.0 - rewrote for clarity on instrument and software instructions. Fixed typos- sect. 2.	LAD	06/08	06/08

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document SOP **CA-741-02**, titled **DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.**

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document SOP **CA-741-02**, titled **DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.**

Recipient: _____ Date: _____

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

1.0 SCOPE AND APPLICATION

This SOP describes the procedures used by Katahdin Analytical Services, Inc. technical personnel to determine Total Organic Carbon (TOC) in solids in accordance with EPA Region II Lloyd Kahn method.

This method is applicable to sediment, sludges, and soil samples. The detection limit for this method is 100 µg C and a method PQL of 400 ug/g.

1.1 Definitions/Acronyms

TC – Total carbon

IC – Inorganic Carbon

TOC – Total Organic Carbon

Method Blank – An empty sample boat with no reagents added that is carried through the entire analytical procedure in the same manner as a sample.

LCS/ICV - Laboratory Control Sample/ Initial Calibration Verification. One LCS/ICV per batch is prepared from a separate source from the CCV and calibration curve standards. LCS/ICV verifies the calibration curve.

CCV - Continuing Calibration Verification. The CCV is made from the same source as the calibration. One CCV is run every ten samples.

CCB - Continuing Calibration Blank. The CCB is an empty sample boat with no reagents added. One CCB is run every ten samples.

1.2 Responsibilities

This method is restricted to use by, or under the supervision of analysts experienced in the analysis of TOC in solids by the Lloyd Kahn Method. Each analyst must demonstrate and document their ability to generate acceptable results with this method. Refer to Katahdin SOP QA-805, current revision, "Personnel Training & Documentation of Capability".

It is the responsibility of all Katahdin technical personnel involved in analysis of TOC in solids by the Lloyd Kahn method to read and understand this SOP, to adhere to the procedures outlined, and to properly document their data in the appropriate lab notebook. Any deviations from the test or irregularities with the samples should also be recorded in the lab notebook and reported to the Department Manager or designated qualified data reviewer responsible for this data.

It is the responsibility of the Department Manager to oversee that members of their group follow this SOP, to ensure that their work is properly documented and to initiate periodic review of the associated logbooks.

1.3 Safety

Users of this procedure must be cognizant of inherent laboratory hazards, proper disposal procedures for contaminated materials and appropriate segregation of hazardous wastes. The toxicity or carcinogenicity of each reagent used in this method have not been precisely defined; however, each chemical should be treated as a potential health hazard. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Everyone involved with the procedure must be familiar with the MSDSs for all the materials used in this procedure.

Each qualified analyst or technician must be familiar with Katahdin Analytical safety procedures and the Katahdin Hazardous Waste Management Plan and must follow appropriate procedures. These include the use of appropriate personal protective equipment (PPE) such as safety glasses, gloves and lab coats when working with chemicals or near an instrument and not taking food or drink into the laboratory. Each analyst should know the location of a respirator and all safety equipment. Each analyst shall receive a safety orientation from their department manager, or designee, appropriate for the job functions they will perform.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

Wastes generated during the preparation of samples must be disposed of in adherence with the Katahdin Hazardous Waste Management and Safety Manual and SOP SD-903, Sample Disposal, current revision. Expired standards are lab packed, placed in the Katahdin hazardous waste storage area, and disposed of in accordance with this SOP SD-903.

2.0 SUMMARY OF METHOD

Total Carbon (TC) is measured utilizing a carbonaceous analyzer with a boat sampling module and 900°C furnace attached. The resulting combustion converts carbon-to-carbon dioxide (CO_2) in the presence of oxygen. The amount of CO_2 derived from a sample is directly proportional to the concentration of carbonaceous material in the sample and is then measured by a non-dispersive infrared detector (NDIR).

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

To determine **Total Organic Carbon** (TOC), however, carbonate and bicarbonate ions contributing to the TC result must be accounted for. This is achieved by adding 1:1 phosphoric acid to the sample and combusting it at 103° C for 10 minutes to remove any **Inorganic Carbon** (IC) before analyzing the sample. The **Total Carbon** result then equals the **Total Organic Carbon.**

3.0 INTERFERENCES

Volatile organics in the sediment may be lost in the decarbonation step resulting in a low bias.

4.0 APPARATUS AND MATERIALS

4.1 Shimadzu model TOC-Vcph with NDIR.

4.2 SSM-5000A 970°C furnace with boat sampling module.

4.3 Mettler AE 100 balance (accurate to 0.1 mg) or equivalent.

4.4 Ceramic boats.

4.5 Drying oven capable of maintaining 103-105°C

4.6 Oxygen gas

5.0 REAGENTS

5.1 Dextrose Solid (40% Carbon by weight = 400,000 ug/g C)

Calibration Standards:

0.0 mg - Calibration Blank
1.0 mg - 400ugC
5.0 mg - 2000ugC
10.0 mg - 4000ugC
20.0 mg - 8000ugC
60.0 mg - 24,000ugC
(Upper range limit for TC is 30,000ugC)

5.2 Dextrose Solid (40% Carbon by weight = 400,000 ug/g C) used as LCS run at 8000-12000ugC (20-30mg). Standard must be a source different from CCV source.

5.3 Sodium Carbonate, anhydrous (11.3% Carbon by weight = 113,000 ug/gC)

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

Calibration Standards:

0.0 mg	-	Calibration Blank
3.5 mg	-	400ugC
17.7 mg	-	2000ugC
35.3 mg	-	4000ugC
70.7 mg	-	8000ugC
212.0 mg	-	24,000ugC

(Upper range limit for IC is 25,000 ugC)

5.4 1:1 Phosphoric acid / DI water solution

5.5 Sodium Hydrogen Carbonate (14.28% Carbon by weight = 142,857ug/gC) used as LCS run at 4000ugC level (28 mg).

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Collect sediments in a glass jar with Teflon or aluminum foil. Cool and maintain at 4° (±2) C. Analyze within 14 days.

7.0 PROCEDURES

SET UP AND CALIBRATION

7.1. Turn on TOC-Vcph analyzer, SSM-5000Afurnace, and oxygen supply and connect to the TOC software program.

7.2. Start the TOC-V software program by double clicking the TOC-V icon on the desktop and selecting sample table editor. Enter user name, passwords and press **OK**. Click the "new" icon followed by "sample run". Choose SSM-5000A from the pull down menu. This activates a sample field spreadsheet in which calibrations, controls, and samples can be inserted and run. Click the "connect" icon and choose "Settings on PC". This will start the gas flows through both units and will activate the NDIR. Wait for the TC furnace to read 970°C before beginning analysis. The gauges on the soil module for the gas lines should read 150psi and 200psi from right to left. Also place any sample boats that will be used in the furnace for several minutes to bake off any remaining residue.

7.3. To run a calibration, minimize the sample run. Click the "New" icon followed by "calibration curve". This activates the calibration curve wizard.

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

7.4. Choose SSM-5000A next to system by using the pull down menu, the click **NEXT** twice. Type in the file name (analysis and date), and then click **NEXT**. Using the pull down menu select ug as the units and click **NEXT**.

7.5. A 6-point curve (for either TC or IC) must be run at least every 3 months to verify the calibration. The instrument must recover ± 10 % of these true values. The calibration may also be updated as necessary as demonstrated by failure of the Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV). An ICV is run at the beginning of every sample sequence and a CCV is run every 10 samples. To verify baseline stability and demonstrate any cross contamination issues, a boat blank or Continuing Calibration Blank (CCB) is run at the beginning of a sample sequence and every ten samples as well. A laboratory control sample (LCS) and duplicate (LCSD) are run at the beginning of a sample sequence and every 20 samples as a secondary source calibration check. To add the points to the curve select "(1)" then click **ADD**. In the highlighted **Conc:** box type in the concentration of the first point (24000), and then press **OK**. Click on the next point "(2)" and **ADD**. Continue with previous steps until all 6-points have been entered. Click **NEXT** twice and then **FINISH**. Now the curve needs to be run.

7.6. Maximize the sample run and highlight the first row. Select insert, from the top menu, and calibration curve. Select the calibration curve that was just saved and click **OK**. The calibration curve will be renamed with the date and time once analyzed.

7.7. Once all the boxes on the top of the sample run say "Ready", click the green traffic light on the menu bar. Once the calibration has been started the instrument will prompt two windows.

7.8. The first will state which point will be running, verify the point and press **OK**. The second window will ask for the exact amount of dextrose that has been weighed out. For the last point, the blank point, a empty sample boat is used and 100ug is used for the weight.

7.9. Once entered click **OK** and the instrument will prompt a message to move the sample boat to the measure position.

7.10. Open the TC sample port and insert the boat. Close the port tight and set timer for two (2) minutes. These two minutes ensures that the CO2 that entered the instrument has had enough time to go completely through the detector and not give any false positives. When the timer goes off slide the sample boat to the measurement position.

7.11. Once the instrument is done analyzing the sample, about 4-5 minutes, there will be a message prompt to slide the sample boat to the cooling position. After a few minutes it will then prompt again to move the sample boat back in to the port. As soon as the

boat has been pulled all the way back the instrument will automatically start the process for the next point. Repeat steps 7.8 to 7.10 for the rest of the calibration.

7.12. When the entire curve is complete, print the sample report and check the curve and its linearity. The value of the calibration checks must fall within the control limits (80-120% recovery). If not rerun the sample up to two more times. If the calibration check is still out of the acceptable recovery range, recalibrate the instrument and repeat the procedure. If problem persists, remake the standards and repeat the procedure or perform instrument maintenance.

7.13. Once there is a calibration curve, samples are ready to run. Select "new" file icon one the menu bar and, then click on sample run. Highlight the first row on the sample run. Select insert, and sample. This will prompt a dialogue box, in which the analysis is choose and the sample name is entered. Once completed the information will be on the sample run.

7.14. Using a calibrated analytical balance weigh out 100-200 mg, wet weight, of the sample into a tarred ceramic boat. Using a disposable pipet add 1:1 phosphoric acid to the sample until there is no more effervescing, usually 2-4 drops. If a sample concentration is greater than 24000 ug/g, a smaller sample amount must be used to achieve a concentration that is within the curve. Samples that require less than 50 mg must be analyzed in quadruplicate and the standard deviations calculated. Three times the standard deviation must not be exceeded.

NOTE: Samples analyzed by method SW846 9060 must be analyzed in quadruplicate.

7.15. Dry the sample in a 103° - 105° C oven for ten minutes. This process removes the inorganic carbon from the sample. For the sample blanks, LCS, and/or CCV, no 1:1 phosphoric acid or drying is needed. For sample that require TC or Percent TC 1:1 phosphoric acid nor drying is not needed.

7.16. To start the analysis click the green traffic light and follow steps 7.10 to 7.11 throughout the batch.

7.17. Calculate the TC or IC (whichever is being preformed) concentration using the following equation:

$$\frac{\text{Abs C value (instrument reading) in ug}}{\text{Sample Weight (g)}} \times \frac{100}{\%TS} = \text{TC or IC result in ug/g C}$$

7.18. Workgroup samples and get run ID. Enter true values for the LCS and MS and save. Go back to the spreadsheet and enter "LLOYD", "Percent", or "TOC" in the comments section for the samples you wish to report. Change QC to match workgroup. Data is then exported by selecting the ASCII export option from the file

menu. Select "save as" and choose parsefiles on LVSlims. Select TOC and type file name. Click save and wait for data to export, then review data in wetrev.\

7.19. A batch sheet is generated (Figure 4). Raw data, calibrations, and batch sheets are reviewed for completeness and accuracy by the Wet Chemistry supervisor or other qualified designee.

7.20. Analysts file printouts of instrument calibrations and sample data in the lab for approximately 3 months for reference. Prior calibrations are archived and all are available for retrieval.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

See below and refer to Table 1 for a summary of QC requirements, acceptance criteria, and corrective actions. These criteria are intended to be guidelines for analysts. The table does not cover all possible situations. If any of the QC requirements are outside the recovery ranges listed below and in Table 1, all associated samples must be evaluated against all the QC. In some cases data may be reported, but may be reanalyzed in other cases. Making new reagents and standards may be necessary if the standardization is suspect. The corrective actions listed in Table 1 may rely on analyst experience to make sound scientific judgements. These decisions are based on holding time considerations and client and project specific Data Quality Objectives. The department Manager, Operations Manager, and/or Quality Assurance Officer may be consulted to evaluate data. Some samples may not be able to be reanalyzed within hold time. In these cases "qualified" data with narration may be advisable after consultation with the client.

In some cases the standard QC requirements listed in this section and in Table 1 may not be sufficient to meet the Data Quality Objectives of the specific project. Much of the work performed at the lab is analyzed in accordance with specific QC requirements spelled out in a project specific Quality Assurance Project Plan (QAPP) or in a program specific Quality Systems Manual (QSM). The reporting limits, acceptance criteria and/or corrective actions may be different than those specified in this SOP. In these cases the appropriate information will be communicated to the Department Manager and/or senior chemists before initiation of the analyses so that specific product codes can be produced for the project. In addition, the work order notes for each project will describe the specific QAPP or QSM to be followed.

8.1 An ICB is analyzed at the beginning of the run and a CCB is analyzed every ten samples thereafter. The ICB and CCBs are boat blanks. The boat should be analyzed empty.

8.2 Analyze an LCS and LCSD (20-30 mg of Dextrose = 8000-12000ugC for TC) / (28 mg Sodium Hydogen Carbonate = 4000 ug C for IC) with each batch of 20 samples. Acceptance criteria is 80-120% of expected value.

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

8.3 Run a CCV (20-30 mg Dextrose = 8000-12000 ug C for TC) / (35.3 mg Hydrogen Carbonate = 4000 ug C for IC) every 10 samples and at the end of each batch. Acceptance criteria is 80-120% of expected value. Run a CCB or boat blank every 10 samples. Results for this blank must not be greater than the reporting limit (PQL).

8.4 Run a duplicate every 20 samples. Run a matrix spike every 10 samples by weighing out the sample and adding 10 mg of dextrose to it for the TC spike or 35.3 mg of hydrogen carbonate for the IC spike. The recovery can be determined by calculating the theoretical yield from the sample result based on the weight as compared to the native result and adding 4000 ug C that was added from the spike component. The actual yield divided by the theoretical yield will give the recovery.

9.0 METHOD PERFORMANCE

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The MDL's are determined annually per type of instrument filed with the Inorganic Department Manager and with the QAO. The MDL standards are prepared following the procedures outlined in this SOP.

Refer to the current revision of Katahdin SOP QA-806, Method Detection Limit and Instrument Detection Limit Studies, for procedures on determining the MDL. Refer to the current revision of EPA 9060 and the Lloyd Kahn method for other method performance parameters and requirements.

10.0 APPLICABLE DOCUMENTS/REFERENCES

Determination of Total Organic Carbon in Sediment, Lloyd Kahn, USEPA Region II, 7/88.

"Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods", SW-846, third Edition, Final Update III, December 1996, Method 9060.

TOC-V series SSM-5000A user's manual.

Installation and Operation of Shimadzu's Solid Sample Module.

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

LIST OF TABLES AND FIGURES

Table 1 QC Requirements
Table 2 Summary of Method Modifications
Figure 1 Example of TOC Soil Logbook Page
Figure 2 Example of TOC Soil Instrument Spreadsheet Printout
Figure 3 Example of TOC Soil Instrument Results Printout
Figure 4 Example of TOC Soil Batch Sheet

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

TABLE 1

QC REQUIREMENTS – LLOYD KAHN

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method blank	One per prep batch	No analyte detected >PQL	(1) Investigate source of contamination (2) Evaluate the samples and associated QC: i.e. If the blank results are above the PQL, report sample results which are <PQL or > 10X the blank concentration. Otherwise, reprep a blank and the remaining samples.
LCS	One per prep batch	80-120% recovery	(1) Investigate source of problem. (2) If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples.
ICV/CCV	ICV at the beginning of the analysis and one after every 10 samples: same conc. as LCS/ICV	80-120% recovery	(1) Investigate source of problem. (2) If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reanalyze all samples back to last acceptable CCV recovery
Sample Quadruplicate	One every twenty samples. SW 9060 – all samples are analyzed in quadruplicate	≤ 30% RPD and < 3 times the standard deviation	(1) If lab QC in criteria and matrix interference suspected, flag data (2) Else, reanalyze
Matrix spike	One MS per ten samples	75-125% recovery	(1) If LCS in criteria and matrix interference suspected, flag data (2) Else, reanalyze
Demonstration of analyst proficiency; accuracy and precision	One time demonstration by each analyst performing the method	Must pass all applicable QC for method	Repeat analysis until able to perform passing QC; document successful performance in personal training file
MDL study	Once per year	Ideally, PQL = 3 to 5 X the MDL.	Repeat MDL

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

TABLE 2

SUMMARY OF METHOD MODIFICATIONS

Topic	Katahdin SOP CA-741-02	METHOD LLOYD KAHN/SW846 9060
Apparatus/Materials		
Reagents	Glucose solid for TC calibration (Dextrose for LCS) Sodium Carbonate for IC calibration (Sodium Hydrogen Carbonate for LCS)	Potassium Hydrogen Phthalate solution used for calibration.
Sample preservation/ handling		
Procedures		
QC - Spikes		
QC - LCS		
QC - Accuracy/Precision		
QC - MDL		

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

FIGURE 1

EXAMPLE OF TOC SOLIDS LOGBOOK PAGE

Katahdin Analytical Services, Inc.

Carbon Analysis of Solid Samples - Shimadzu TOC-V_{CPH} / SSM-5000A

Analysis Type and Method (Check One)	
____Total Carbon (SW846 9060M)	____Total Inorganic Carbon (SW846 9060M)
____Total Organic Carbon (SW846 9060)	____Other (Specify):
X Total Organic Carbon (Lloyd Kahn)	

Spiking Information	
LCS Spike Source ID / Compound:	~~Dextrose~~ SWL1628
CCV Spike Source ID / Compound:	SWL449
MS Spike Source ID / Compound:	SWL1628

Calibration Information	
Calibration Date:	082206
Calibration Analyst:	AmB

KATAHDIN Sample Number	Sample Wt. (mg)	Sample Type * (Circle One)	Spike Added (mg)
Blank		Wet Dry	
LCS		Wet Dry	29.3 TV=1720
1 WW4746-7	191.5	Wet Dry	
2 -7 Dup	190.7	Wet Dry	
3 -7 Dup	190.0	Wet Dry	
1 -7 Dup	190.6	Wet Dry	
-8	166.8	Wet Dry	
-8 MS	164.8	Wet Dry	9.9 TV=3400
-9	183.2	Wet Dry	
-10	190.8	Wet Dry	
WW4774-1	168.8	Wet Dry	
-2	176.1	Wet Dry	
CCV		Wet Dry	26.0 TV1040
CCB		Wet Dry	
		Wet Dry	
		Wet Dry	
		Wet Dry	
		Wet Dry	
		Wet Dry	
		Wet Dry	
		Wet Dry	
		Wet Dry	

* "Wet" = field-moist sample (as received). "Dry" = oven-dried sample.

Analyst: AmB	Analysis Date: 091606
Reviewer:	Review Date:

QAWL400

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

FIGURE 2

EXAMPLE OF TOC SOLIDS INSTRUMENT PRINTOUT

	Analysis	Sample Name	Dilutio	Result	Comment	Status	Action	Date / Time
1	SSM-TC	Blank	1.000	SSM-TC:0.000 u		Completed		09/16/06 03:54:48
2	SSM-TC	LCS	1.000	SSM-TC:11408		Completed		09/16/06 04:05:21
3	SSM-TC	WW4746-7	1.000	SSM-TC:7.795 u		Completed		09/16/06 04:15:24
4	SSM-TC	WW4746-7D	1.000	SSM-TC:2.308 u		Completed		09/16/06 04:22:10
5	SSM-TC	WW4746-7D	1.000	SSM-TC:10.76 u		Completed		09/16/06 04:33:49
6	SSM-TC	WW4746-7D	1.000	SSM-TC:10.26 u		Completed		09/16/06 04:46:24
7	SSM-TC	WW4746-8	1.000	SSM-TC:0.8961		Completed		09/16/06 04:53:53
8	SSM-TC	WW4746-8M	1.000	SSM-TC:4050 u		Completed		09/16/06 05:06:32
9	SSM-TC	WW4746-9	1.000	SSM-TC:19.84 u		Completed		09/16/06 05:16:14
10	SSM-TC	WW4746-10	1.000	SSM-TC:71.33 u		Completed		09/16/06 05:27:15
11	SSM-TC	WW4774-1	1.000	SSM-TC:4.253 u		Completed		09/16/06 05:35:55
12	SSM-TC	WW4774-2	1.000	SSM-TC:21.96 u		Completed		09/16/06 05:43:31
13	SSM-TC	CCV	1.000	SSM-TC:9766 u		Completed		09/16/06 05:56:03
14	SSM-TC	CCB	1.000	SSM-TC:0.000 u		Completed		09/16/06 06:03:06
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

FIGURE 3

EXAMPLE OF TOC SOIL INSTRUMENT RESULTS PRINTOUT

AMB 01/24/07 01:53:34 PM lloyd091606.t32

Instr.Information

System	SSM-5000A
Detector	Combustion
Catalyst	Regular Sensitivity
Cell Length	short

Sample

Sample Name:	Blank
Sample ID:	< Untitled >
Origin:	tc method SOILS.met
Chk. Result	

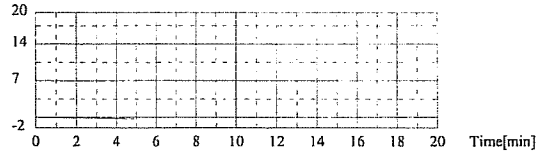
Type	Anal.	Dil.	Density	Result
Unknown	SSM-TC	1.000	1.000mg/uL	SSM-TC:0.000 ug

1. Det

Anal.: SSM-TC

No.	Area	CNV	Abs C	Conc.	Weight	Volume	Ex.	Cal. Curve	Date / Time
1	0.000	0.000	0.000ug	0.000ug	100.0mg	100uL		tccal082206a.2006_08_22_15_58_36.cal	09/16/06 03:54:48 PM

Mean Area 0.000
Mean CNV 0.000
Mean Conc. 0.000ug



Sample

Sample Name:	LCS
Sample ID:	< Untitled >
Origin:	tc method SOILS.met
Chk. Result	

Type	Anal.	Dil.	Density	Result
Unknown	SSM-TC	1.000	1.000mg/uL	SSM-TC:11408 ug

1. Det

Anal.: SSM-TC

1/8

FIGURE 4

TITLE: DETERMINATION OF TOTAL ORGANIC CARBON IN SOLIDS USING THE EPA REGION II METHOD LLOYD KAHN AND SW846 9060 MOD.

EXAMPLE OF TOC SOLIDS BATCH SHEET

WET CHEMISTRY BATCH REPORT
Sep 20 2006, 03:32 pm
Batch: WG32156

Parameter: TOC In Soil

Date Analyzed: 18-SEP-06

Analyst Initials: CP

Prep Date: N/A

Prep Method: N/A

Prep Chemist: N/A

Sample	Samp Type	Method	Initial Amt.	Final Amt.	Rpt. DF	Result	Rpt Result	TS(%)	PQL	MDL	Adj PQL	RPD	%Rec
WG32156-1	MBLANK	LLOYDKAHN	100mg	200.00ug	1	0	U400 ug/g	NA	400	85	400		
WG32156-2	LCS	LLOYDKAHN	22.2mg	200.00ug	1	401576.57658	400000 ug/g	NA	400	85	400		100
WG32156-3	DUP	LLOYDKAHN	186.1mg	200.00ug	1	329.64731	U500 ug/g	NA	400	110	500	NC	
WG32156-4	MS	LLOYDKAHN	177.3mg	200.00ug	1	33309.59213	33000 ug/g	NA	400	110	500		114
WW4746-1	SAMP	LLOYDKAHN	164.7mg	200.00ug	1	786.64612	790 ug/g	86.	400	99	470		
WW4746-3	SAMP	LLOYDKAHN	171.6mg	200.00ug	1	599.57589	600 ug/g	81.	400	100	490		
WW4746-4	SAMP	LLOYDKAHN	102.3mg	200.00ug	1	1360.58295	1400 ug/g	88.	400	96	460		
WW4746-5	SAMP	LLOYDKAHN	125.5mg	200.00ug	1	877.6473	880 ug/g	91.	400	93	440		
WW4746-6	SAMP	LLOYDKAHN	158.4mg	200.00ug	1	426.98726	U500 ug/g	80.	400	100	500		
WW4774-10	SAMP	LLOYDKAHN	155.4mg	200.00ug	1	1518.4076	1500 ug/g	78.	400	110	510		
WW4774-9	SAMP	LLOYDKAHN	182.3mg	200.00ug	1	248.95448	U500 ug/g	79.	400	110	500		
WW4840-1	SAMP	LLOYDKAHN	138.5mg	200.00ug	1	1121.12466	1100 ug/g	83.	400	100	480		
WW4840-10	SAMP	LLOYDKAHN	133.8mg	200.00ug	1	1264.58905	1300 ug/g	81.	400	100	500		
WW4840-11	SAMP	LLOYDKAHN	151.6mg	200.00ug	1	539.39017	540 ug/g	89.	400	95	450		
WW4840-12	SAMP	LLOYDKAHN	157.3mg	200.00ug	1	371.4859	U450 ug/g	89.	400	95	450		
WW4840-13	SAMP	LLOYDKAHN	132.3mg	200.00ug	1	911.67713	910 ug/g	80.	400	100	500		
WW4840-2	SAMP	LLOYDKAHN	137.2mg	200.00ug	1	666.21547	670 ug/g	81.	400	100	490		
WW4840-3	SAMP	LLOYDKAHN	131.5mg	200.00ug	1	1364.60047	1400 ug/g	84.	400	100	480		
WW4840-4	SAMP	LLOYDKAHN	140.8mg	200.00ug	1	1886.46341	1900 ug/g	81.	400	100	490		
WW4840-5	SAMP	LLOYDKAHN	156.2mg	200.00ug	1	444.89933	U520 ug/g	76.	400	110	520		
WW4840-6	SAMP	LLOYDKAHN	180.8mg	200.00ug	1	421.3455	U510 ug/g	79.	400	110	510		
WW4840-7	SAMP	LLOYDKAHN	141.4mg	200.00ug	1	599.5476	600 ug/g	81.	400	100	500		
WW4840-8	SAMP	LLOYDKAHN	162.6mg	200.00ug	1	1138.64589	1100 ug/g	80.	400	100	500		
WW4840-9	SAMP	LLOYDKAHN	173.4mg	200.00ug	1	930.27902	930 ug/g	80.	400	100	500		

Comments:

WG32156-1	WW4774-9
WG32156-2	WW4774-9
WG32156-3	WW4774-9
WG32156-4	WW4774-9

Entered by: CP Date: 9/20/06 Accepted by: KAK Date: 092506

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

SOP Number: SD-902
Revision History
Cover Page
Page 1

TITLE: **SAMPLE RECEIPT AND INTERNAL CONTROL**

Prepared By: Andrea Colby Date: 6/2002

Approved By:

Group Supervisor: Andrea Colby Date: 6/6/02

Lab Operations Mgr: Joel C. Burton Date: 6/5/02

QA Officer: Deborah J. Nadeau Date: 6.6.02

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
04	Changed cover sheet, minor changes to sections 7.1, 7.6 7.7.4, 7.10 + 7.20. Complete rewrite of sections 7.11 + 7.12 to comply with new KIMS	DN	6.6.02	6.6.02
05	Added verbal date entry to KIMS. Added reference to immediate internal COC book. Added Department Manager reference. Added section 7.7.3. Updated new incoming	DN	05.04	05.04
06	Added procedure + logbook page for checking turbidity of drinking water samples. Changed wet chem shorts board to a book (included example page). Added custody procedures for food/micro. Added VOA soil freezer storage.	DN	01.26.04	01.26.04
07	Added instructions to create lettered labels. Changed sample locations to reflect new building. Removed Figures 8 and 10. Updated Table and Figures w/ current ones. Added wording to Sect. 7.7.5 to clarify how pH measurements are taken.	LAD	02/07	02/07
08	Added summary stating sample acceptance policy. Deleted all references to radiation checks (not performed). Add IR gun usage. Reorganized section 7.0 to prioritize time sensitive tasks. Added wireless thermometer monitoring. Updated SRCR. Other minor changes.	DN	05/09	05/09

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document **SD-902-08**, titled **Sample Receipt and Internal Control**.

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document **SD-902-08**, titled **Sample Receipt and Internal Control**.

Recipient: _____ Date: _____

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

1.0 SCOPE AND APPLICATION

Katahdin Analytical Services, Inc. requires the use of specific receiving, acceptance, identification, storage, and distribution procedures for samples it accepts for analyses. These procedures assure that:

- samples are uniquely identified,
- samples are protected from loss or damage,
- essential sample characteristics are preserved,
- any alteration of samples (e.g., filtration, preservation) is documented,
- the correct samples are analyzed, and
- a record of continuous sample custody and utilization is established.

The purpose of this SOP is to describe the procedures used for the receipt and tracking of samples received by Katahdin Analytical Services, Inc. (Katahdin).

1.1 Definitions

SDG: Sample Delivery Group – A group of samples to be reported as one data package.

1.2 Responsibilities

It is the responsibility of all Katahdin staff who receive samples or handle samples in the course of analysis to follow the procedures set forth in this SOP, to document their understanding of the procedures in their training files (refer to Katahdin SOP QA-805, current revision, "Personnel Training & Documentation of Capability"), and to suggest changes and revisions when appropriate. All technical staff are responsible for monitoring their immediate areas, stopping an activity when a problem is detected or suspected, initiating corrective action when needed, documenting any actions taken, and notifying the appropriate individual (e.g., Department Manager, Operations Manager, QAO). The primary responsibility for implementing real-time corrective actions and maintaining an effective QA self-inspection system resides with Katahdin staff. When problems are identified Katahdin personnel are expected to attempt to resolve situations within the scope of their technical knowledge, and to seek assistance from peers and the Department Manager as necessary.

It is the responsibility of Department Managers to oversee the adherence to Katahdin QC practices and internal documentation of laboratory activities within their area, to take corrective actions where needed and communicate problems to the Operations Manager, QAO or Vice President/President when warranted.

It is the responsibility of the Operations Manager to oversee adherence to Katahdin QA/QC practices by all laboratory groups under his/her authority, to help identify

problems and assure resolution, to facilitate corrective action where needed, and to communicate problems and concerns to the QAO and Vice President/President.

It is the responsibility of the Quality Assurance Officer (QAO) to oversee adherence to this SOP, to conduct periodic audits of each laboratory, to track corrective action reports, resolution, and documentation, and to communicate concerns and report findings to the Vice President/President. The QA Officer shall function independently from laboratory operations and be able to evaluate data objectively and perform assessments without outside influence. The QA Officer has the authority to independently halt production operations (including data reporting) if warranted by quality problems.

1.3 Safety

Users of this procedure must be cognizant of inherent laboratory hazards, proper disposal procedures for contaminated materials and appropriate segregation of hazardous wastes. The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical should be treated as a potential health hazard. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Everyone involved with the procedure must be familiar with the MSDSs for all the materials used in this procedure.

Each qualified analyst or technician must be familiar with Katahdin Analytical safety procedures and the Katahdin Environmental Health & Safety Manual and must follow appropriate procedures. These include the use of appropriate personal protective equipment (PPE) such as safety glasses, gloves and lab coats when working with chemicals or near an instrument and not taking food or drink into the laboratory. Each analyst should know the location of all safety equipment. Each analyst shall receive a safety orientation from their Department Manager, or designee, appropriate for the job functions they will perform.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

Wastes generated during the receipt of samples must be disposed of in accordance with the Katahdin Environmental Health & Safety Manual and SOPs SD-903, "Sample Disposal" and CA-107, "The Management of Hazardous Waste as it Relates to the Disposal of Laboratory Process Waste, Reagents, Solvents and

Standards," current revisions. Expired standards are placed in the Katahdin hazardous waste storage area, and disposed of in accordance with these SOPs.

2.0 SUMMARY OF METHOD

Regulatory, program, and/or method requirements dictate the specifics of sample acceptance. These requirements include, but are not limited to, temperature upon receipt, chemical preservation, container type, sample amount, holding time considerations and complete and accurate documentation of all of these conditions, as well as sample identification. Katahdin's sample acceptance policy is to note any anomalies, discrepancies or non-compliances concerning the receipt of samples. The client is always notified with these issues to direct Katahdin on how and whether to proceed with analysis. All guidance from the client is recorded in the project phone logs and/or on the Sample Receipt Condition Report, which becomes part of the final report. Conditions or analyses performed which do not meet the necessary requirements are narrated or notated as described in the individual analytical SOPs.

3.0 INTERFERENCES

Not applicable.

4.0 APPARATUS AND MATERIALS

4.1 Thermometer – Oakton® Non-Contact Infrared Thermometer, or equivalent, capable of reading 0.1°C and digital probe style capable of reading 0.1°C (used for back-up).

4.2 Capillary tubes – 75 mm Hematocrit Tubes, disposable

4.3 Wide range pH test strips, pH 0 to 14 pH, EMD ColorpHast or equivalent.

4.4 Narrow range pH test strips, pH 0 to 2.5 pH, EMD ColorpHast or equivalent.

4.5 Narrow range pH test strips, pH 11 to 13 pH, EMD ColorpHast or equivalent.

5.0 REAGENTS

Preservatives - refer to Table 1, Sampling and Preservation Requirements, for specifics.

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Refer to Table 1, Sampling and Preservation Requirements, for specifics.

7.0 PROCEDURES

PROCEDURES FOR SAMPLE CUSTODIAN

The following procedures include all steps to be completed for satisfactory receipt and acceptance of samples at Katahdin. These steps do not necessarily have to be performed in the exact order as described. Sample deliveries occur constantly throughout the day, so the sample custodian must multi-task and move back and forth between different procedures to accomplish the most critical tasks of checking receipt temperatures and checking for "RUSH" or quick hold time parameters.

7.1 When samples (except for non-environmental food samples) are dropped off, by either a delivery service (i.e. FEDEX or UPS) or by the client, the Chain-of-Custody (COC) should be signed immediately. The client (who is delivering or that has shipped samples with a delivery service) shall sign (at the lab upon delivery or prior to shipment of samples) that they have relinquished custody to the laboratory. The laboratory shall sign and record the date and time that custody is accepted. (Refer to Figures 1-3 for a Katahdin standard COC, a Katahdin Homeowner COC, and a Katahdin Food/Microbiology COC).

7.2 Cut custody seals and open all coolers. Remove the packets containing the client Chains-of-Custody (COCs).

7.3 Using the COCs, enter the date and time of sample receipt and the client name into the next available work order/login number in the sample receipt logbook (Figure 4). Initial each entry (line) to maintain a record of the individual who assigned each group of samples a discreet lab work order/login number. Record the assigned work order numbers in the appropriate space on the client COCs. Complete the log-in entry date and time once samples are logged in as described below.

7.4 Inventory the COCs for any "RUSH" or quick hold time analyses. Notify the appropriate section managers of these analyses. List any samples for analyses that have short hold times in the "Wet Chemistry Shorts and Rushes Logbook" (Figure 5) in the wet chemistry laboratory. Be sure to list the client, number of samples and date and time of the earliest sample. GC or GC/MS personnel must be informed when ENCORES are received so that they may be scheduled for extrusion. Microbiology personnel should also be informed of any microbiology samples that arrive. Parameters that routinely require short analytical hold times are:

Coliforms	Color	pH
Nitrate/Nitrite	Dissolved Oxygen	Turbidity
Ferrous iron	Orthophosphate	Hex. Chromium
MBAS	TBOD	Free CO_2
Sulfite	ENCORE soil samples	Settleable Solids
Odor	Residual Chlorine	CBOD

7.5 Inspect the condition of custody seals, cooler, ice condition and samples received. Note any non-intact conditions on the Sample Receipt Condition Report (SRCR - Figure 6). Notify the Katahdin project manager (PM) of any discrepancies or problems with sample receipt. The PM contacts the client as necessary. If breakage of a potentially hazardous sample is discovered, close and seal the packing container with all the samples inside and move to a hood in the organic extractions area or to the smaller hood in the login area if space permits. One of the three Katahdin Emergency Response Coordinators or the Katahdin Environmental Health & Safety Manager must be notified. Disposition of the broken and other possibly contaminated samples will be determined on a case-by-case basis in accordance with the laboratory's handling procedures for hazardous waste as outlined in the Katahdin Environmental Health & Safety Manual. Generally, when a sample has broken and has mixed with any ice in the cooler, that liquid will be poured off into 2 liter plastic containers and labeled as "do not use". These containers will be disposed of as soon as the disposition of the appropriate samples has been determined through analysis.

7.6 If there is no breakage of a potentially hazardous sample:

Check cooler temperatures using the IR thermometer assigned to the sample receipt area. If a cooler temperature blank is present, aim the IR gun at the temperature blank; otherwise aim the IR gun at any sample in the cooler if no temperature blank is present. Be sure that the IR gun is within 6 inches of the bottle and not aimed at a label on the bottle. Press the trigger on the handle and be sure the red dot is visible on the bottle surface. The IR gun has been set to read in degrees celcius. If checking the temperature of a plastic bottle, set the emissivity at 0.90. If checking the temperature of a glass bottle (either amber or clear), set the emissivity at 0.85. Refer to Figure 7 for manufacturer's instructions on changing the emissivity. Record the temperature on the Sample Receipt Condition Report. Receipt temperatures should be <6 °C, without freezing. Any temperature falling outside of this range must be noted on the SRCR and reported to the appropriate Katahdin project manager.

Note: Samples received for metals analysis only do not have to meet any temperature receipt requirements.

Note: A probe type thermometer is retained as back-up in case there is a problem with the IR thermometer.

7.7 Note the condition of the ice or ice packs. If the ice has melted and the temperature is out of acceptance criteria, note this on the SRCR. For samples that are hand delivered to the laboratory immediately after collection (i.e. sample collection times are <6 hours old), the temperature blank and/or cooler temperature will most likely not meet the acceptance criteria. The samples shall be considered acceptable if there is evidence that the chilling process has begun such as arrival on ice. Note this on the SRCR. If samples (that were just collected) have not arrived on ice, note this on the SRCR, and start the cooling process as soon as possible after arrival at the laboratory.

Note: All clients must be notified when samples are received that do not meet the appropriate temperature requirements. In these cases, certain regulatory requirements may not be met and may invalidate certain data.

7.8 Inventory the samples against the chain of custody (COC). If the COC is incomplete, the sample custodian must inform the appropriate Katahdin project manager (PM). The PM may make changes to correct or complete the COC, but all changes must be initialed and dated. Changes must be noted on the SRCR. Any discrepancies between the samples and the COC must also be noted on the SRCR.

7.9 Using the Sampling and Preservation Requirements Table (Table 1) as a reference, check if samples are in proper containers and received correct pretreatment (e.g., filtration, preservation) for the analyses requested. For aqueous parameters requiring preservation, check pH by inserting a clean capillary tube into the sample and dabbing the tube on wide range pH paper. If the pH is not clearly either less than 2 or greater than 12, the appropriate narrow range pH paper must be used. NOTE: The pH of volatile organic (VOA) samples is checked and recorded by the analyst after completion of analysis and not by sample receipt personnel. The used capillary tube is discarded and a new capillary tube is used for each sample.

Additional preservative is added to samples if the pH is not in the range specified in the Sampling and Preservation Requirements Table. No more than 10% of the original sample volume should be added as preservative. If the client has noted that the sample reacts violently (i.e., foams and bubbles) upon preservation, add no more preservative to the sample. Some clients may wish to be contacted if their samples are found to be improperly preserved. Record all preservation discrepancies on the Sample Receipt Condition Report including the lot number of the preservative added. If additional preservative is added, a sticker with the type of preservative must be placed on the sample container.

Note: Preservatives are obtained from the larger containers in the bottle preparation area.

Note: If samples are received unpreserved for 200.7 or 200.8 analysis, the samples must be preserved to pH <2 with nitric acid. Samples must be held for 16 hours after preservation before sample preparation can begin.

7.10 For samples requiring filtration as pretreatment (i.e. for dissolved metals), the work order/login numbers are recorded in the filtration logbook (see Figure 8). The samples are filtered by the Metals Group.

7.10.1 A 500 mL filter flask and filter funnel are acid rinsed three times in a 10% nitric acid bath, then three times with Laboratory Reagent Grade Water.

7.10.2 A vacuum pump is attached.

7.10.3 A 0.45 micron filter is rinsed three times with 5% nitric acid and three times with Laboratory Reagent Grade Water. The rinsate is discarded.

7.10.4 A sufficient sample aliquot is filtered and preserved with concentrated nitric acid to pH <2.

7.10.5 The bottles are labeled with the work order/login number and other sample information and stored at <6 ° C until the time of digestion.

7.11 Using the Sampling and Preservation Requirements Table (Table 1) as a reference, determine if sufficient volume of sample is present for analysis. Note discrepancies on the SRCR.

7.12 For drinking water samples, enter the appropriate information (work order, date, etc.) into the Measured Turbidity and Preservation of Incoming Samples Logbook. Inform the appropriate analyst of the sample. The turbidity must be measured prior to sample preparation. If the turbidity is <1 NTU, the sample does not have to be digested prior to metals analysis. If the turbidity is >1 NTU, the sample must be digested prior to metals analysis. The sample must be preserved after the turbidity measurement is taken. Record the appropriate information in the logbook (Figure 9).

7.13 Notify the PM immediately if there are any discrepancies or problems with sample receipt. The PM will contact the client for information and resolution as necessary.

7.14 Review any additional paperwork that accompanies the sample(s) submitted for analysis along with laboratory-generated information. This includes shipping forms, letters, chain-of-custody forms, sample labels, Incoming Sample Information Sheets (ISIS), quotes, memos, etc. These forms may provide details on specific client requests. The ISIS will provide information on specifics for log-in. Refer to Figure 10 for an example.

7.15 Resolve any questions or concerns raised by steps 7.1-7.14 by consulting the correspondence files or client services personnel or communicating directly with the

client. Note in the notes section of the SRCR any deviations from normal sample handling or analytical procedures (e.g., client requests analysis although hold-time expired).

7.16 When non-environmental food samples are delivered to the laboratory, they are taken immediately to the food/microbiology laboratory and stored in the refrigerators there. A copy of the Chain-of-Custody is left with the analysts. The original paperwork is forwarded to sample log in where the job is logged into the KIMS system.

7.17 The following information is documented via the Katahdin Information Management System (KIMS) and a work order/login COC report (Figure 11) is generated for the samples received:

7.17.1 Log onto KIMS by entering employee ID under "Username", employee specific password under "Password" and KIMS under "Database".

7.17.2 Once logged onto KIMS select "Sample Management" and then "Login".

7.17.3 Select "New" and the next available Login ID number will automatically be entered. Select "OK" and the Sample Definition screen will open.

Note: If a Work Order number has already been opened, select "change" and type in the appropriate number to access the information.

7.17.4 In the Sample Definition Screen, enter the following information.

Client ID -	Enter client sample description.
ReceiveDate -	Enter in date that samples were received in the lab in the format YY-Month-DD.
CollectDate -	Enter in date that samples were collected in the format YY-Month-DDTIME.
TAT -	Enter TAT for hardcopy report.
DueDate -	Due date will automatically be calculated based on calendar days.
VerbalDate -	Manually type in verbal due date.
QuoteRef -	Enter quote number if applicable.
Project -	Enter project number if applicable.
Account -	Enter client specific account number.

Account Name -	Account name will automatically be entered.
Collected By -	Enter name/initials of sampler listed on COC. If unknown, enter "Client".
Locator -	May be used for client ID information when requested by the project manager.
Site -	Enter project site name.
Description -	May be used for long client Ids when requested by the project manager.
Discount -	No entry-not currently used.
Priority -	No entry-not currently used.
Fact. -	No entry-not currently used.
Expected -	No entry-not currently used.
Comments -	Enter MS/MSD, verbal due date and any sample irregularities if applicable.
OrderDate -	Current date is automatically entered.
Matrix -	Enter sample matrix code where AQ = Aqueous SL = Solid, Soil, Sludge FP = Free Product WP = Wipe NOAQ = NonAqueous DW = Drinking Water SLD = Food Solid AR = Air SWAB = Swab SAL = Saline TIS = Tissue
Product Code -	Enter analysis code per test requested on COC.
Type -	Product code type will automatically be entered where S = Stand alone P = Parent C = Children
Fact. -	No entry-default is 1.

Price - This is left as is by sample log-in. During project management review of the work order, the prices are entered based on quotes or standard prices.

Cost - No entry needed.

Lev - No entry needed.

Type - Container type will automatically be entered.

Bot - Enter number of containers per test for printing of labels.

Login Info - Parameter Data Screen will open. Enter following information

KAS Proj. Manager-	Initials of Katahdin person overseeing the project.
Client PO#-	Client purchase order.
Project-	Project name.
Cooler Temperature-	Temperature blanks or cooler temps.
Delivery Services-	Method of delivery to the lab.
QC Level-	QC Level of report and regulatory agency (ie., IV NFESC).
SDG ID-	Sample Delivery Group ID if applicable.
SDG Status-	Begin, Continue or End.
Analysis Instructions-	PM will enter special instructions regarding project.
Report Instructions-	PM will enter special instructions regarding project.
Regulatory List-	Used for federal programs.
EDD Format-	Specific KAS EDD format.

Select "SAVE" and then "CANCEL".

Addresses - Select "Addresses" and the Address Links screen will open. The billing address is the default address of the account. Enter the client account code under "Project/Account" and select the report to contact under "Address Type". Select the appropriate boxes for report, report CC and invoice CC. Select "SAVE" and then "CLOSE".

Create Containers - Select "Create Containers". Letters will be assigned to each sample number. Select "OK" until letters have been assigned to each sample number. To manually assign letters, Select "Enter Container IDs" and "OK". Enter sample numbers including letters and select "OK", "Close", "Yes" to save changes, "Cancel" and "Cancel".

7.17.5 To print the login report, select "Reports", "Login" and "Login COC". Enter login number under "Login Number". Select "OK", "Run Report" and then "Print".

7.18 To print labels unique to each bottle, select "Reports", "Login" and "Labels". Enter login number under "Login/Prelogin", select "Background (IDXL)" and select F9 on keyboard under "Select Sample Label". Select "OK" and then "Print". After labels print out select "Cancel".

7.19 Affix permanent sample number labels to sample containers, assuring that sample IDs on labels correspond to sample bottle IDs. Do not obscure client ID on the bottles.

7.20 Place samples in their designated storage locations and log them in, noting initials, date and time, work order/login and sample numbers, and storage location on the internal laboratory chain of custody form (Figure 12). Place form in the appropriate binder in the log in area. Non-environmental food samples do not get an internal COC and are taken immediately to the food/microbiology lab for storage.

Storage location of the samples is determined by type of sample and/or type of analysis, as outlined below. Most samples are stored in the walk-in cooler, which is organized by test type and work order/login number.

Specific storage locations are described below.

7.20.1 Aqueous samples for wet chemistry (except hardness, see 7.19.4 below) - left aisle, both sides, as you enter walk-in cooler. TOC vials are to be stored in the trays designated for TOC samples.

7.20.2 Aqueous samples for organic extractions – right aisle, left side, as you enter walk-in cooler.

7.20.3 Non-aqueous samples (all analyses except volatile organics) - to the right and towards the back as you enter walk-in cooler. Non-aqueous samples for volatile organics are stored in "VOA Refrigerator 2" located in the Volatiles Laboratory.

7.20.4 Aqueous samples for metals and/or hardness analyses – right aisle, right side towards the front as you enter walk-in cooler.

7.20.5 Samples (aqueous and solid) for volatile organics analyses (VOA) – All aqueous samples and soil samples in VOA vials (preserved with methanol or sodium bisulfate) are stored in "VOA Refrigerator 1" in the Volatiles Laboratory. VOA soils in jars or ENCORE samplers are stored in "VOA Refrigerator 2" in the Volatiles Laboratory. VOA samples known or suspected to be hazardous (such that cross-contamination of other samples might occur) are placed in a "paint can" and stored in the walk-in.

7.20.6 Soil samples for volatile organics analyses (VOA) that are unpreserved or preserved with Laboratory Reagent Grade Water are stored in "VOA Freezer 1" in the volatiles laboratory.

7.21 Sample Receipt gives the Work order/login COC report and confirmation of the job, as logged-in, to the appropriate Katahdin project manager. All chain-of-custody and other receipt documentation must accompany the job. The project manager reviews the job for accuracy and completeness. Any unresolved issues should be resolved at this time. Any project or program specific forms should be included with the paperwork at this time. These forms may include CLP forms or state-specific forms. The project manager then dispatches the work order/login to the individual department worklists. The dispatched work order/login package is then filed in Data Management where the complete package will eventually be compiled.

7.22 The temperature of all sample storage refrigerators and freezers is recorded daily by assigned individuals. Notebooks containing a record of each refrigerator and freezer temperature history are used for this purpose and are maintained by the assigned individuals. Temperatures above or below the acceptance range are to be brought to the attention of a Department Manager, Operations Manager, or Quality Assurance Officer. Such an occurrence and the actions taken to correct it must be noted in the comments column of the temperature recording notebook next to the temperature measurement. (See Figure 13).

Additionally, temperatures of storage units are monitored continuously by wireless thermometers. A temperature is recorded electronically every 10 minutes. The QAO can generate a specified report as needed, including every reading or maximum/minimum temperatures for a given timeframe. These monitoring devices ensure continual compliance seven days per week. The data can be used to check for problems.

PROCEDURES FOR CHEMISTS

7.23 When removing a sample from its storage location, record on the laboratory internal chain-of-custody (from the appropriate department) the sample number, date and

time it was removed, chemist who removed it, and the analysis to be conducted or reason for removal.

7.24 If the samples have not been logged in yet and they need to be pulled in order to analyze short holding time parameters, the analyst taking the sample must use the designated logbook (Immediate Internal COC – Figure 14) to sign the samples out. Many circumstances lead to analysts having to pull samples before they are logged into the KIMS system. It is everyone's responsibility to ensure that all samples can be accounted for at all times. Failure to do so can create confusion and bottle necks for others trying to access the samples. Samples that are pulled before log-in must be returned to the designated bin in the sample receipt area.

7.25 If a sample is not consumed by an analysis, return the remaining sample to its assigned storage location and enter the date and time returned on the laboratory internal chain-of-custody record.

7.26 If analysis consumes the entire sample, indicate this on the laboratory internal chain-of-custody record.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

Each thermometer used to monitor sample storage or cooler temperatures must be calibrated annually against a NIST traceable thermometer. The QAO is responsible for ensuring that the thermometer(s) are scheduled for annual calibration and for maintaining the calibration records. All other procedures and documentation listed in this SOP must be followed at all times.

9.0 METHOD PERFORMANCE

Not applicable.

10.0 APPLICABLE DOCUMENTS/REFERENCES

"Handbook for Analytical Quality Control in Water and Wastewater Laboratories," U.S. EPA EMSL Office of Research and Development, March 1979.

Code of Federal Regulations 40, Parts 136 and 141.

"Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," SW-846 Chapters 1 & 2, USEPA, Third Edition, including Updates I, II, IIA, and IIB, III June, 1997.

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

Katahdin Analytical Services, Inc., Environmental Health & Safety Manual, current revision.

LIST OF TABLES & FIGURES

Table 1 Sampling and Preservation Requirements
Figure 1 Example of Standard Katahdin Chain-of-Custody Form
Figure 2 Example of Homeowner Katahdin Chain-of-Custody Form
Figure 3 Example of Food/Microbiology Katahdin Chain-of-Custody Form
Figure 4 Example of Sample Receiving Logbook
Figure 5 Example of Wet Chemistry Shorts and Rushes Logbook
Figure 6 Example of Katahdin Sample Receipt Condition Report
Figure 7 IR Thermometer Manufacturer's Instructions for Changing Emissivity
Figure 8 Example of Sample Filtration Logbook
Figure 9 Measured Turbidity and Preservation of Incoming Samples Logbook
Figure 10 Example of Laboratory Incoming Sample Information Sheet (ISIS)
Figure 11 Example Katahdin Work order/login COC Report
Figure 12 Example of Katahdin Internal Chain-of-Custody Form
Figure 13 Example of Refrigerator Temperature Logbook
Figure 14 Example of Immediate Internal COC Logbook

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

TABLE 1

SAMPLING AND PRESERVATION REQUIREMENTS

PARAMETER – AQUEOUS MATRICES	METHOD	QUANTITY	CONTAINER	PRSV	HOLD TIME
GENERAL CHEMICAL ANALYSES					
Acidity	305.1	100 mL	P,G	1,2	14 days
Alkalinity-Manual Titrimetric	310.1	100 mL	P,G	1,2	14 days
Ammonia-Nitrogen with distill-Auto. Phenate	350.1	1 L	P,G	1,3	28 days
Ammonia-Nitrogen-Automated Phenate	350.1, 350.2	250 mL	P,G	1,3	28 days
Anions (Cl, Br, SO4, NO2, NO3)	300.0	250 mL	P, G	1	48hr/28days
Bicarbonate, Carbonate (see pH & alkalinity)	calc.				
Biochemical Oxygen Demand-Carbonaceous	405.1	1 L	P,G	1	48 hours
Biochemical Oxygen Demand-Total	405.1	1 L	P,G	1	48 hours
Bromide	320.1	500 mL	P,G	1	28 days
Chemical Oxygen Demand-Manual Colorimetric	410.4	100 mL	P,G	1,3	28 days
Chloride-Automated Ferricyanide	325.2	100 mL	P,G	1	28 days
Chlorine, Residual	SM4500-Cl G	100 mL	P,G	1,9	ASAP
Chromium, Hexavalent	SM3500Cr D / SW7196	200 mL	P,G	1,9	24 hours
Color, Apparent	110.2	100 mL	P,G	1,2	48 hours
Cyanide, Amenable-Spectrophotometric	335.1	250 mL	P,G	1,5	14 days
Cyanide, Total-Spectrophotometric	SM4500CN C 335.3, 335.4	250 mL	P,G	1,5	14 days
Dissolved Oxygen(Lab)-Membrane Electrode	360.1	500 mL	G	1	ASAP
Ferrous Iron - Colorimetric	SM3500-Fe D	250mL	P	1	24 hrs
Fluoride with distillation, Potentiometric ISE	SM4500F C/340.2	500 mL	P only	1	28 days
Fluoride, Potentiometric ISE	340.2	200 mL	P only	1	28 days
Free CO_2	SM4500-CO_2 C	250mL	P	1	24 hrs.
Hardness, Total-Manual Titrimetric	130.2,SM2340C	250 mL	P,G	4	6 months
MBAS, Extraction-Colorimetric	SM5540C	1 L	P,G	1	48 hours
Nitrate+Nitrite-Automated Cadmium Reduction	353.2	100 mL	P,G	1,3	28 days
Nitrate-Automated Cadmium Red./Diazotization	353.2	100 mL	P,G	1	48 hours
Nitrite-Automated Diazotization	353.2	100 mL	P,G	1	48 hours
Oil & Grease-Total Recoverable, Gravimetric N-Hexane extractable material N-Hexane extractable material w/ silica gel cleanup	1664	(2) 1 L	glass only	1,11	28 days
pH (Laboratory)	150.1	100 mL	P,G	1,2	24 hours
Phenolics, Total Recoverable-Manual 4AAP	420.1	1000 mL	glass only	1,3	28 days
Phosphate, Ortho- Ascorbic Acid	365.2	100 mL	P,G	1	48 hours
Phosphate,Total	365.4	100 mL	P,G	1,3	28 days
Solids-Filterable Residue (TDS),Gravimetric180	160.1	250 mL	P,G	1	7 days
Solids-Nonfilterable Residue (TSS)	160.2	500 mL	P,G	1	7 days
Solids-Settleable Solids (SS)	160.5	1 L	P,G	1	48 hours

TABLE 1 (cont.)

SAMPLING AND PRESERVATION REQUIREMENTS

PARAMETER – AQUEOUS MATRICES	METHOD	QUANTITY	CONTAINER	PRSV	HOLD TIME
GENERAL CHEMICAL ANALYSES					
Solids-Total Solids	160.3	250 mL	P,G	1	7 days
Solids-Total Volatile (TVS)	160.4	250mL	P,G	1	7 days
Solids-Volatile Filterable Residue (VDS)	160.1/160.4	250 mL	P,G	1	7 days
Solids-Volatile Nonfilterable Residue (VSS)	SM 2540 F	500 mL	P,G	1	7 days
Specific Conductance-Wheatstone Bridge	120.1	100 mL	P,G	1,2	28 days
Sulfate-Turbidimetric	375.4	100 mL	P,G	1	28 days
Sulfide-Iodometric	376.1	500 mL	P,G	1,7	7 days
Sulfite-Titrimetric	377.1	500 mL	P,G	1,9	ASAP
Tannin/Lignin-Colorimetric	SM 5550 B	100 mL	P,G	1	7 days
TKN-Auto Block Digest, Spect.	351.2	100 mL	P,G	1,3	28 days
Total Inorganic Carbon	415.1	(2) 40 mL	VOA vial	1	28 days
Total Inorganic Carbon if with TOC	415.1	(2) 40 mL	VOA vial	1	28 days
Total Organic Carbon-Oxidation	415.1	(2) 40 mL	VOA vial	1,3	28 days
Total Organic Halogen	9020	500 mL	Amber Glass	1,3	28 days
Turbidity	180.1	100 mL	P,G	1	48 hours
ELEMENTAL ANALYSES					
Chromium, Hexavalent	7196/6010	500 mL	P,G	1,9	24 hrs
GFAA(Furnace) Elements	SM 3113/ 200 series	500 mL	P,G	4	6 months
ICP Elements	200.7/6010	500 mL	P,G	4	6 months
ICP MS Elements	200.8/6020	500 mL	P,G	4	6 months
Low Level Mercury	1631	500 mL	G	NA	90 days
Mercury	245.1/7470	500 mL	P,G	4	28 days
GC ORGANIC ANALYSES					
BTEX & MTBE	602 & 8021	(2) 40 mL	VOA vial	1,8,9	14 days(~)
EDB, DBCP & 1,2,3-TCP	504.1	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Extractable Petroleum Hydrocarbons	MADEP/EPH	(2) 1000 mL	Amber Glass	12	14days/40days
Formaldehyde	556	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Fuel Oil in Water	8015Modified	(2) 1000 mL	Amber Glass	1,8	7days/40days
Fuel Oil in Water	ME HETL 4.1.25	(2) 1000 mL	Amber Glass	1,8	7days/40days
Gasoline in Water	8015Modified	(2) 40 mL	VOA vial	1,8	14 days
Gasoline in Water	ME HETL 4.2.17	(2) 40 mL	VOA vial	1,8	14 days
Glycols	8015Modified	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Herbicides	8151	(2) 1000 mL	Amber Glass	1	7days/ 40days
Methane, Ethane & ethene	RSK 175	(2) 40 mL	VOA vial	1,8,9	14 days(~)
PCB's (& Congeners)	608 & 8082	(2) 1000 mL	Amber Glass	1	7days/40days

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

TABLE 1 (cont.)

SAMPLING AND PRESERVATION REQUIREMENTS

PARAMETER – AQUEOUS MATRICES	METHOD	QUANTITY	CONTAINER	PRSV	HOLD TIME
GC ORGANIC ANALYSES					
Pesticides	608 & 8081	(2) 1000 mL	Amber Glass	1	7days/40days
Pesticides and PCB's	608 & 8081/8082	(2) 1000 mL	Amber Glass	1	7days/40days
Purgeable Aromatics	602 & 8021	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Purgeable Halocarbons	601 & 8021	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Purgeables, Total	601 & 602	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Purgeables, Total	8021	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Solvents (Direct Injection)	8015M	(2) 40 mL	VOA vial	1	14 days
Volatile Petroleum Hydrocarbons	MADEP/VPH	(2) 40 mL	VOA vial	11	14days
GC/MS ORGANIC ANALYSES					
Acid Extractables-Priority Pollutants	625	(2) 1000 mL	Amber Glass	1	7days/40days
Acid Extractables-TCL	8270	(2) 1000 mL	Amber Glass	1	7days/40days
Base Neutral Extract.-Priority Pollutants	625	(2) 1000 mL	Amber Glass	1	7days/40days
Base Neutral Extractables-TCL	8270	(2) 1000 mL	Amber Glass	1	7days/40days
Drinking Water Volatiles - Low Level	524.2	(3) 40 mL	VOA vial	1,8,9,10	14 days(~)
PCB Homologues	680	(2) 1000 mL	Amber Glass	1	7days/40days
Polyaromatic Hydrocarbons	8270/8270 SIM	(2) 1000 mL	Amber Glass	1	7days/40days
Semivolatile Extractables-Priority Pollutants	625	(2) 1000 mL	Amber Glass	1	7days/40days
Semivolatile Extractables-TCL	8270	(2) 1000 mL	Amber Glass	1	7days/40days
Volatile Organics	8260	(2) 40 mL	VOA vial	1,8,9	14 days(~)
Volatile Organics-Priority Pollutants	624	(2) 40 mL	VOA vial	1,8,9	14 days(~)
HPLC ANALYSES					
HPLC-Explosives	8330, 8332	(2) 1000 mL	Amber Glass	1	7days/40days
MICROBIOLOGICAL ANALYSES					
Coliform, Fecal	SM 9222D, SM 9213D Mod.	100 mL	P,G	1,6	6 hours
Coliform, Total	SM 9222B	100 mL	P,G	1,6	30 hours
Coliform and E-coli, Total	SM9223B/Colitag	100 mL	P,G	1,6	30 hours
E-coli	SM9213D, Colilert/Quantitray	100 mL	P,G	1,6	6 hours
Heterotrophic Plate Count	SM9215B SIMPLATE	100 mL	P,G	1,6	30 hours

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

TABLE 1 (cont.)

SAMPLING AND PRESERVATION REQUIREMENTS

PARAMETER – SOLID MATRICES	METHOD	QUANTITY	CONTAINER	PRSV	HOLD TIME
GENERAL CHEMICAL ANALYSES		**4 oz=100 g**			
% Carbon	9060 mod.	4 oz	Soil Jar	1	28 days
Ammonia-Nitrogen-Automated Phenate	350.1 mod.	4 oz	Soil Jar	1	28 days (^)
Anions	9056	4 oz	Soil Jar	1	48hrs to 28 days from slurry (^)
Cation Exchange Capacity	9081	4 oz	Soil Jar	1	14days/7days (^)
Chloride-Automated Ferricyanide	9251/300.0	4 oz	Soil Jar	1	28days from slurry (^)
Cyanide, Amenable-Spectrophotometric	9012	4 oz	Soil Jar	1	14 days
Cyanide, Total-Spectrophotometric	9012	4 oz	Soil Jar	1	14 days
Fluoride, Potentiometric ISE	300.0 mod./340.2	4 oz	Soil Jar	1	28 days (^)
Lime Equivalency	310.1 mod.	4 oz	Soil Jar	1	28 days (^)
Nitrate+Nitrite-Automated Cadmium Reduction	300.0 mod./353.2	4 oz	Soil Jar	1	28 days (^)
Nitrate-Automated Cadmium Red./Diazotization	300.0 mod./353.2	4 oz	Soil Jar	1	48 hrs from slurry (^)
Nitrite-Automated Diazotization	300.0 mod./353.2	4 oz	Soil Jar	1	48 hrs from slurry (^)
Oil & Grease-Total Recoverable, Gravimetric N-Hexane extractable material N-Hexane extractable material w/ silica gel cleanup	9071	4 oz	Soil Jar	1	28 days (^)
Organic Nitrogen-Auto. Block Digest.,Spectro.	350.1/351.2 mod.	4 oz	Soil Jar	1	28 days (^)
pH (Laboratory)	9045	4 oz	Soil Jar	1	24 hours (^)
Phenolics, Total Recoverable-Manual 4AAP	Mod. 9065	4 oz	Soil Jar	1	28 days (^)
Phosphate, Ortho- Ascorbic Acid	300.0 mod./365.2	4 oz	Soil Jar	1	48 hrs from slurry (^)
Phosphate,Tot.-Auto Ascorbic Acid/Block Dig.	Mod. 365.4	4 oz	Soil Jar	1	28 days (^)
Solids-Ash	SM 2540 F	4 oz	Soil Jar	1	28 days (^)
Solids-Total Solids	CLP-CIP	4 oz	Soil Jar	1	28 days (^)
Solids-Volatile Solids	SM 2540 F	4 oz	Soil Jar	1	28 days (^)
Specific Conductance-Wheatstone Bridge	Mod. 9050	4 oz	Soil Jar	1	28 days (^)
Sulfate-Turbidimetric	9036/9038	4 oz	Soil Jar	1	28 days from slurry (^)
Sulfide-Iodometric	9030	4 oz	Soil Jar	1	7days from slurry (^)
Sulfide-Monier-Williams	40CFR-425	4 oz	Soil Jar	1	28 days (^)
Sulfite-Titrimetric	ASTM D3987/377.1 mod.	4 oz	Soil Jar	1	24 hrs from slurry (^)
TKN-Auto Block Digest,Spectro.	351.2 mod.	4 oz	Soil Jar	1	28 days (^)
Total Organic Halogen	9020/9021	4 oz	Soil Jar	1	28 days (^)
Total Petroleum Hydrocarbons-Extraction, IR	9071	4 oz	Soil Jar	1	28 days (^)
ELEMENTAL ANALYSES					
ICP Elements	6010	4 oz	Soil Jar	1	6 months
ICP MS ELements	6020	4 oz	Soil Jar	1	6 months
GFAA(Furnace) Elements	7000series	4 oz	Soil Jar	1	6 months
Mercury	7471	4 oz	Soil Jar	1	28 days

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

TABLE 1 (cont.)

SAMPLING AND PRESERVATION REQUIREMENTS

PARAMETER – SOLID MATRICES	**METHOD**	**QUANTITY**	**CONTAINER**	**PRSV**	**HOLD TIME**
ELEMENTAL ANALYSES **(cont.)**		**4 oz=100 g**			
Chromium, Hexavalent	3060/7196	4 oz	Soil Jar	1	30dys/24hrs
GC ORGANIC ANALYSES					
BTEX & MTBE	8021	(2) 40 mL	VOA Vial	1	14 days
Explosives - HPLC	8330, 8332	4 oz	Soil Jar	1	14days/40days
Extractable Petroleum Hydrocarbons	MADEP/EPH	4 oz	Soil Jar	1	7days/40days
Fuel Oil	ME HETL 4.1.25	4 oz	Soil Jar	1	14days/40days
Fule Oil	8015 mod.	4 oz	Soil Jar	1	14days/40days
Gasoline	ME HETL 4.2.17	(2) 40 mL	VOA Vial	1	14 days
Gasoline	8015 mod.	(2) 40 mL	VOA Vial	1	14 days
Herbicides	8151	4 oz	Soil Jar	1	14days/40days
PCB's (& Congeners)	8082	4 oz	Soil Jar	1	14days/40days
PCB's in Oil	8082	4 oz	VOA Vial	1	40 days
Pesticides	8081	4 oz	Soil Jar	1	14days/40days
Pesticides and PCB's	8081/8082	4 oz	Soil Jar	1	14days/40days
Purgeable Aromatics	8021	(2) 40 mL	VOA Vial	1	14 days
Purgeable Halocarbons	8021	(2) 40 mL	VOA Vial	1	14 days
Purgeables, Total	8021	(2) 40 mL	VOA Vial	1	14 days
Solvents (Direct Injection)	8015M	(2) 40 mL	VOA Vial	1	14 days
Volatile Petroleum Hydrocarbons	MADEP/VPH	(2)40 mL	VOA vial	13	28days
HPLC ANALYSES					
HPLC-Explosives	8330, 8332	4 oz	Soil Jar	1	7days/40days
GC/MS ANALYSES					
Acid Extractables-Priority Pollutants	8270	4 oz	Soil Jar	1	14 days/40 days
Acid Extractables-TCL	8270	4 oz	Soil Jar	1	14 days/40 days
Base Neutral Extractables-Priority Pollutants	8270	4 oz	Soil Jar	1	14 days/40 days
Base Neutral Extractables-TCL	8270	4 oz	Soil Jar	1	14 days/40 days
Polyaromatic Hydrocarbons	8270/8270SIM	4 oz	Soil Jar	1	14 days/40 days
Semivolatile Extractables-Priority Pollutants	8270	4 oz	Soil Jar	1	14 days/40 days
Semivolatile Extractables-TCL	8270	4 oz	Soil Jar	1	14 days/40 days
Volatile Organics – High Soil (>200 ug/kg)	5035/8260	Please refer to Table 6-2	Encore or similar sampler or VOA Vial or soil jar	14	Extruded w/in 48 hrs. Analyzed w/in 14 days
Volatile Organics – Low Soil (<200 ug/kg)	5035/8260	Please refer to Table 6-2	Encore or similar sampler or VOA Vial	14 or 15	Extruded w/in 48 hrs. Analyzed w/in 14 days
Volatile Organics-Priority Pollutants	8260	(2) 40 mL	VOA Vial	1	14 days
Volatile Organics-TCL	8260	(2) 40 mL	VOA Vial	1	14 days

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

TABLE 1 (cont.)

SAMPLING AND PRESERVATION REQUIREMENTS

PARAMETER – SOLID MATRICES	METHOD	QUANTITY	CONTAINER	PRSV	HOLD TIME
RCRA - HAZARDOUS WASTE CHARAC.					
Corrosivity-pH	9045	4 oz	Soil Jar	1	24 hours (^)
Ignitability-Flash Point (closed cup)	1010	4 oz	Soil Jar	1	14 days (^)
Reactivity-Reactive Cyanide	7.3.3.2	4 oz	Soil Jar	1	14 days
Reactivity-Reactive Sulfide	7.3.4.1	4 oz	Soil Jar	1	7 days
TCLP					
TCLP Extraction-Volatile Organics	1311	100 g	Soil Jar	1	14 days
TCLP Extraction-Semivolatiles	1311	200 g	Soil Jar	1	14 days
TCLP Extraction-Pesticides & Herbicides	1311	400 g	Soil Jar	1	14 days
TCLP Extraction-Metals	1311	200 g	Soil Jar	1	28 days
TCLP Analysis-Volatile Organics	8260	see above	Soil Jar	1	14 days
TCLP Analysis-Metals	6010/6020	see above	Soil Jar	1	180 days
TCLP Analysis-Mercury	7470	see above	Soil Jar	1	28 days
TCLP Analysis-Semivolatiles	8270	see above	Soil Jar	1	7 days/40 days
TCLP Analysis-Pesticides	8081	see above	Soil Jar	1	7 days/40 days
TCLP Analysis-Herbicides	8151	see above	Soil Jar	1	7 days/40 days

METHODS OF PRESERVATION
1 = Cool at 4 Degrees Celsius
2 = Settled
3 = H2SO4 to pH<2
4 = HNO3 to pH<2
5 = NaOH to pH>12
6 = 1 mL 0.1M Na2S2O3 or 1 10 mg pellet
7 = 1 m/L 2NZnAc/L & NaOH
8 = 2 drops 1:1 HCl
9 = No headspace
10 = Na2S2O3, if chlorinated
11 = HCl to pH < 2
12 = 5 mL of HCL
13 = 15 mL of methanol
14 = methanol
15 = sodium bisulfate

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 1

EXAMPLE OF STANDARD KATAHDIN CHAIN-OF-CUSTODY FORM

Katahdin ANALYTICAL SERVICES
600 Technology Way
Scarborough, ME 04074
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

PLEASE BEAR DOWN AND PRINT LEGIBLY IN PEN

Page ____ of ____

Client | Contact | Phone # ( ) | Fax # ( )

Address | City | State | Zip Code

Purchase Order # | Proj. Name / No. | Katahdin Quote #

Bill (if different than above) | Address

Sampler (Print / Sign) | Copies To:

LAB USE ONLY WORK ORDER #:

KATAHDIN PROJECT NUMBER _____

REMARKS: _____

SHIPPING INFO: ☐ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO: _____

TEMP°C _____ ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

ANALYSIS AND CONTAINER TYPE PRESERVATIVES

Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												
	/												

COMMENTS

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

THE TERMS AND CONDITIONS ON THE REVERSE SIDE HEREOF SHALL GOVERN SERVICES, EXCEPT WHEN A SIGNED CONTRACTUAL AGREEMENT EXISTS

ORIGINAL

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 2

EXAMPLE OF HOMEOWNER KATAHDIN CHAIN-OF-CUSTODY FORM

Katahdin
ANALYTICAL SERVICES

600 Technology Way
P.O. Box 540
Scarborough, ME 04070
Tel: (207) 874-2400 Fax: (207) 775-4029

Homeowner Chain of Custody

Client:	Contact:	Phone:	Fax:
Address:	City:	State:	Zip:
Purchase Order #:	Project Name/No.:	E-mail:	
Billing Address (if different):			
Sampler (Print/Sign):		Copies To:	

***Test results are for compliance and will be reported to the state (see statement below). yes no | Compliance samples must be received on ice.

Lab Use Only | Work Order #: | KAS Project Manager:

Shipping: UPS Fed-Ex Mail Drop-Off

Sample(s) Received on Ice? Yes No Temperature if Iced:

Requested Services

Sample Description (Sample Identification and/or Lot #)	Date Collected	Time Collected	No. of Cntrs.	Standard Homeowner	Arsenic	Total Coliforms	Lead	Safely Test – coliform & N+N	FHA/MSH	Fluoride	Uranium		What's Included in the Standard Test and the FHA/MSH Test.
													Standard Homeowner Total Coliform/e-coli Nitrate, Nitrite Chloride, pH Hardness Copper, Iron Manganese Sodium
													FHA/MSH Standard plus Lead Turbidity Color Odor

Relinquished By:	Date/Time:	Received By:	Relinquished By:	Date/Time:	Received By:

Per the National Environmental Laboratory Accreditation Program (NELAP) Standards, Katahdin is required to accept samples that have been properly preserved. All sample containers provided to you have been properly preserved, but the proper preservation also requires samples to be received at <6 degrees celcius. The Safe Drinking Water Act regulations only require this for compliance samples (i.e., results that are submitted to the state). By circling no for compliance (above), you acknowledge that the samples described above are not for compliance purposes, and thus may not meet the temperature receipt requirements.

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 3

EXAMPLE OF FOOD/MICROBIOLOGY KATAHDIN CHAIN-OF-CUSTODY FORM

Katahdin
ANALYTICAL SERVICES

600 Technology Way
P.O. Box 540
Scarbrough, ME 04070
Tel: (207) 874-2400 Fax: (207) 775-4029

Chain of Custody

Client: Contact: Phone: Fax:

Address: City: State: Zip:

Purchase Order #: Project Name/No.: E-mail:

Billing Address (if different):

Sampler (Print/Sign): Copies To:

Lab Use Only | Work Order #: KAS Project Manager:

Shipping: UPS Fed-Ex Airbill No.:

Temperature:

Food & Microbiological Services

Sample Description (Sample Identification and/or Lot #)	Date/Time Collected	Matrix	No. of Cntrs.	Plate Count (A/H/S)	Listeria	Yeast and Mold	Salmonella	E-Coli	E-Coli 0157:H7	Staph	Vibrio	Total Coliforms	Campylobacter	Shelf Life	Challenge Study		

Relinquished By:	Date/Time:	Received By:	Relinquished By:	Date/Time:	Received By:

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 4

EXAMPLE OF KATAHDIN SAMPLE RECEIPT LOGBBOK

KATAHDIN ANALYTICAL SERVICES, INC.

SAMPLE LOG IN

Date Received	Time Received	Date Logged In	Time Logged In	Work Order	Client	Initials
				SA 0094		
				SA 0095		
				SA 0096		
				SA 0097		
				SA 0098		
				SA 0099		
				SA 0100		
				SA 0101		
				SA 0102		
				SA 0103		
				SA 0104		
				SA 0105		
				SA 0106		
				SA 0107		
				SA 0108		
				SA 0109		
				SA 0110		
				SA 0111		
				SA 0112		
				SA 0113		
				SA 0114		
				SA 0115		
				SA 0116		
				SA 0117		
				SA 0118		
				SA 0119		
				SA 0120		
				SA 0121		
				SA 0122		
				SA 0123		
				SA 0124		

Signed By:_____ Date :_____

Reviewed By:_____ Date:_____

0000004

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 5

EXAMPLE OF WET CHEMISTRY SHORTS AND RUSHES LOGBOOK

WET CHEMISTRY SHORTS & RUSHES **Receipt Date:**

HOLDING TIME					Immediate			24 Hr		48 Hr								
Work Order / Client	Matrix	Earliest Sampling Date	Earliest Sampling Time	Rush Parameters	pH	DO	Sulfite	Fe +2	Cr+6	Total BOD	Carbon. BOD	Color	Nitrate	Nitrite	OPO4	Set. Solids	Turbidity	Comments (Quick TAT, MS/MSD, etc.)

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 6

EXAMPLE OF SAMPLE RECEIPT CONDITION REPORT FORM

Katahdin Analytical Services, Inc. **Sample Receipt Condition Report**

Client:	KAS PM:	Sampled By:
Project:	KIMS Entry By:	Delivered By:
KAS Work Order#:	KIMS Review By:	Received By:
SDG #:	Cooler: _____ of _____	Date/Time Rec.:

Receipt Criteria	Y	N	EX*	NA	Comments and/or Resolution
1. Custody seals present / intact?					
2. Chain of Custody present in cooler?					
3. Chain of Custody signed by client?					
4. Chain of Custody matches samples?					
5. Temperature Blanks present? If not, take temperature of any sample w/ IR gun.					Temp (°C):
Samples received at <6 °C w/o freezing?					Note: Not required for metals analysis.
Ice packs or ice present?					The lack of ice or ice packs (i.e. no attempt to begin cooling process) may not meet certain regulatory requirements and may invalidate certain data.
If not, has the cooling process begun (i.e. ice or packs present) and sample collection times <2hrs., but samples are not yet cool?					Note: No cooling process required for metals analysis.
6. Volatiles free of headspace: **Aqueous:** No bubble larger than a pea					
Soil/Sediment: Received in airtight container?					
Received in methanol?					
Methanol covering soil?					
7. Trip Blank present in cooler?					
8. Proper sample containers and volume?					
9. Samples within hold time upon receipt?					
10. Aqueous samples properly preserved? Metals, COD, NH3, TKN, O/G, phenol, TPO4, N+N, TOC, DRO, TPH – pH <2					
Sulfide - >9					
Cyanide – pH >12					

* Log-In Notes to Exceptions: document any problems with samples or discrepancies or pH adjustments

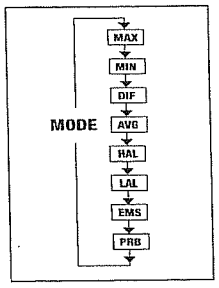
TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

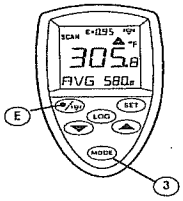
FIGURE 7

IR THERMOMETER MANUFACTURER'S INSTRUCTIONS FOR CHANGING EMISSIVITY

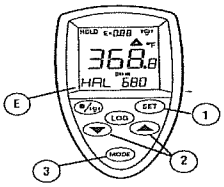
MODE Button Functions
Your infrared thermometer measures Maximum (MAX), Minimum (MIN), Differential (DIF)*, and Average (AVG)** temperatures each time you take a reading. This data is stored and can be recalled with the MODE button (3) until a new measurement is taken. (See "Hold and Recall" for information on how to recall stored data.) When the trigger is pulled again, the unit will begin measuring in the last mode selected. Pressing the MODE button also allows you to access the High Alarm (HAL), Low Alarm (LAL), Emissivity (EMS), Probe temperature (PRB—only available when the probe is connected), and Data logger (LOG). Each time you press MODE, you advance through the mode cycle. The diagram shows the sequence of functions in the Mode cycle.
Note: PRB (probe) is only available in the MODE loop when the contact probe is connected to the unit.

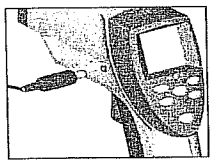
*DIF shows the difference between the maximum and minimum temperatures measured.
**AVG shows the average temperature reading for each time the trigger is pulled or the unit is locked on.

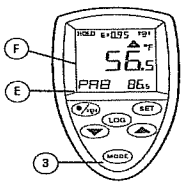




Selecting a Function
To Select the MAX, MIN, DIF, or AVG mode, pull the trigger. While holding the trigger, press the MODE button (3) until the appropriate code appears in the lower left corner of the display (E). Each time you press MODE, you advance through the MODE cycle. The MODE cycle is shown above.







Setting the High Alarm, Low Alarm, and Emissivity
To set values for the High Alarm (HAL), Low Alarm (LAL), and Emissivity, pull the trigger or press the MODE button (3) to activate the display. Press the MODE button until the appropriate code appears in the lower left corner of the display (E). Use the up and down keys (2) to adjust the desired values. To activate the alarms, press SET (1). To deactivate the alarms, press SET again.

Using a Probe (PRB)
Connect the probe to the input on the side of the unit (as shown).
PRB automatically appears in the lower left corner of the display (E, below). The probe temperature is shown in the lower right part of the display. The current infrared temperature continues to show in the center of the display (F). While the probe is connected, you may still cycle through the mode functions by pressing MODE (3).

Note: PRB is only available in the MODE loop when a probe is connected to the unit; the probe temperature will not activate the high alarm or low alarm.

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 8

EXAMPLE OF KATAHDIN SAMPLE FILTRATION LOGBOOK

KATAHDIN ANALYTICAL SERVICES, INC.
Sample Filtration Logbook

Katahdin Sample No.	Site ID	Filtration Requested By:		Filtered and Preserved By:		
List Individually	(Optional)	Initials	Date	Initials	Date	Time

Reviewed and Approved by: _____ Date: _____

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 9

MEASURED TURBIDITY AND PRESERVATION OF INCOMING SAMPLES LOGBOOK

KATAHDIN ANALYTICAL SERVICES

Measured Turbidity and Preservation of Incoming Samples

KAS Lab Sample ID	Measured Turbidity (NTU)	Turbidity Date	Turbidity Analyst	Preservation Date	Preservation Time	Preservation Analyst
WW6757-9A	0.22	12-19-06		12/14/06	~~1830~~-1400	DM
↓ -10A	0.18	↓		↓	↓	↓
WW6758-1A	4.80					
WW6776-1A	0.68	12-20-06		12/20/06	1000	DM
WW6855-1A	0.92	12-26-06		12/26/06	1600	DM
WW6860-1A	2.40	↓		↓	↓	↓
SA0027-1A	0.52	1-3-07		01/03/07	1445	DM
SA0028-1A	0.72	1-3-07		↓	↓	↓
SA0087-1A	0.26	1-5-07		01/05/07	1645	DM
SA0088-1A	10.4	1-5-07		↓	↓	↓
SA0110-1A	0.47	1-8-07		01/08/07	1430	DM
SA0109-1A	0.32	1-8-07		↓	↓	↓
SA0138-1A	0.12	1-09-07		01/09/07	1700	DM
SA0262-1A	0.14	1-18-07		01/18/07	0930	DM
SA0263-1A	0.33	1-18-07		↓	↓	↓
SA0267-1A	0.30	1-18-07		01/18/07	0950	DM
SA0313-1A	0.58	1-22-07		01/22/07	1030	↓
SA0316-1A	1.70	1-22-07		01/22/07	1345	DM

REVIEWED BY: DATE:

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 10

EXAMPLE OF LABORATORY INCOMING SAMPLE INFORMATION SHEET (ISIS)

KATAHDIN ANALYTICAL SERVICES, INC. – INCOMING SAMPLE INFORMATION SHEET

CLIENT:	ATTENTION:
ADDRESS:	
TELEPHONE:	FAX:
OTHER CLIENT CONTACTS:	
REPORT CC:	PM/SALES CONTACT:
PO #:	CLIENT ACCOUNT:
KAS QUOTE #:	KIMS QUOTE #:
PROJECT NAME:	KIMS PROJECT REF.:
SDG:	APPLICABLE CERTIFICATION:
RECEIPT DATE:	MEANS OF DELIVERY:

METHOD OR KIMS PRODUCT	MATRIX	# OF SAMPLES	SPECIAL INSTRUCTIONS (I.E LIMITS, PREPS)

SUBCONTRACT PARAMETER	SUBCONTRACT LABORATORY

QC LEVEL:	EDD:
RUSH/VERBAL TAT:	HARDCOPY TAT:
HISTORY:	
OTHER:	

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 11

EXAMPLE OF KATAHDIN WORK ORDER/LOGIN COC REPORT

Katahdin
ANALYTICAL SERVICES

Katahdin Analytical Services
Login Chain of Custody Report (lno1)
Jan. 26, 2007
03:51 PM

Page: 1 of 1

Login Number: SA0395
Account:KATAHD001 Web
Katahdin Analytical Services

Project:

Primary Report Address:
Leslie Dimond
Katahdin Analytical Services
600 Technology Way
P.O. Box 540
Scarborough,ME 04070

Primary Invoice Address:
Accounts Payable
Katahdin Analytical Services
600 Technology Way
P.O. Box 540
Scarborough,ME 04070

Report CC Addresses:
Invoice CC Addresses:

Login Information

ANALYSIS INSTRUCTIONS	:
CHECK NO.	:
CLIENT PO#	:
COOLER TEMPERATURE	: n/a
DELIVERY SERVICES	: In House
EDD FORMAT	:
MAIL DATE	:
PM	: LAD
PROJECT NAME	: QC Holding Blanks
QC LEVEL	: I
REGULATORY LIST	:
REPORT INSTRUCTIONS	:
SDG ID	:
SDG STATUS	:

Laboratory Sample ID	Client Sample Number	Collect Date/Time	Receive Date	PR	Verbal Date	Due Date	Comments
SA0395-1	WHITE FRIDGE	26-JAN-07 15:50	26-JAN-07			08-FEB-07	
Matrix	*Product*	*Hold Date (shortest)*	*Bottle Type*		*Bottle Count*		
Aqueous	S SW8260FULL5ML	09-FEB-07			2		
SA0395-2	BLUE FRIDGE	26-JAN-07 15:50	26-JAN-07			08-FEB-07	
Matrix	*Product*	*Hold Date (shortest)*	*Bottle Type*		*Bottle Count*		
Aqueous	S SW8260FULL5ML	09-FEB-07			2		

Total Samples: 2 ***Total Analyses:*** 2

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 12

EXAMPLE OF LABORATORY INTERNAL CHAIN-OF-CUSTODY FORM

Katahdin Analytical Services, Inc.
Internal Custody Record

EXTRACTIONS (AQ) Work Order #:_____

Sample Numbers Involved	Placed in refrigeration by: Initials
	Date
	Time

Sample Numbers	Analysis	Removed			Returned			Consumed?	
		Initials	Date	Time	Initials	Date	Time	Yes	No

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 13

EXAMPLE OF REFRIGERATOR TEMPERATURE LOGBOOK

KATAHDIN ANALYTICAL SERVICES, INC.

SAMPLE RECEIPT WALK-IN TEMPERATURE LOG

Corrective Action: Note in the "comments" column and notify the QAO or supervisor; document corrective actions taken and return to control.

Thermometer Location		Sample Receipt Walk-in 1	Comments
Acceptance Criteria		2 to 6 °C	
Date	Initials	Temp (°C)	
02/2/07	NDA	3.7	
02/05/07	DWM	5.8	
02/06/07	DWM	5.8	
02/07/07	DWM	5.8	
02/08/07	DWM	3.8	
02/09/07	DWM	3.5	
02/12/07	DWM	3.5	
02/13/07	DWM	3.5	

TITLE: SAMPLE RECEIPT AND INTERNAL CONTROL

FIGURE 14

EXAMPLE OF IMMEDIATE INTERNAL COC LOGBOOK

KATAHDIN ANALYTICAL SERVICES, INC.
INTERNAL CUSTODY RECORD FOR IMMEDIATES

CLIENT	PROJECT	CLIENT ID &/or WORK ORDER #	ANALYSIS	OUT date/time	IN date/time	INIT	Consumed?
Jacobs		WW4813-1A, -2A	ICP	9/13/06 0930 →	0935	DJJ	yes no
Jacobs		WW4883-1A	ICP	9/16/06 0900 →	1000	DJJ	yes no
CES		WW4965	BOD	9/20/06 0900	9/20/06 1000	CP	yes no
CCAR		WW4969	BOD	9/20/06 1000	↓	CP	yes no
GEMF		WW4970	BOD	↓	↓	CP	yes no
Jacobs		WW4962-1A, -2A	ICP	9/20/06 0900 →	1000	DJJ	yes no
Irving		WW4994	BOD	9/21/06 1000	9/21/06 1045	CP	yes no
Highlimer		WW4992 ②	BOD	9/21/06 1045		CP	yes no
NATIONAL		WW5000	TS, PERCHLORIDE PH, SP.COND	9/21/06 1100	9/21/06 1217	[illegible]	yes no
W+C		WW5001	BOD	9/21/06 1300		CP	yes no
Aliens		WW5016	NO7	9/22/06 1100 NO7	09/22/06 1100	[illegible]	yes no
RASSOM		WW5010	↓	↓ ↓	↓	↓	yes no
EcoMaine		WW5029	BOD	9/22/06 1100		CP	yes no

QAQC143

0000095

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

SOP Number: SD-903
Revision History
Cover Page
Page 1

TITLE: **SAMPLE DISPOSAL**

Prepared By: _____ Date: 2/01

Approved By:

Group Supervisor: _____ Date: _____

Operations Manager: Jal C. Burton Date: 2/01

QA Officer: Deborah J. Nadeau Date: 2.01

General Manager: _____ Date: 2/01

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
01	Format changes, ~~added pollution prevention~~, added updated log-book and greater detail on dis-posal.	DN	2.01	2/01
02	Major rewrite to include more detail on hazardous waste regu-lations + to reflect current practices.	DN	02/05	02/05
03	Rewrite of section 7 to comply with current practices in new facility. Updated Figures 1 to 3.	DN	02.08	02.08
04	Added elementary neutralization to section 7.0. Other minor edits.	DN	05.09	0509

TITLE: SAMPLE DISPOSAL

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document **SD-903-04**, titled **SAMPLE DISPOSAL**.

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document **SD-903-04**, titled **SAMPLE DISPOSAL**.

Recipient: _____ Date: _____

TITLE: SAMPLE DISPOSAL

1.0 SCOPE AND APPLICATION

Katahdin Analytical Services, Inc. requires strict adherence to specific procedures for the disposal of samples. The procedures are designed to categorize waste materials, provide for their safe and timely disposal and to ensure compliance with local and federal regulations pertaining to disposal of chemicals and environmental samples. Any other means of disposal not described in this SOP is prohibited without consent from the Katahdin Environmental Health & Safety Officer and/or the Katahdin Environmental Compliance Officer.

The purpose of this SOP is to describe the procedures utilized by Katahdin Analytical personnel for the disposal of samples. These procedures apply to the disposal of all samples received or processed by Katahdin. Refer to the current revision of Katahdin SOP CA-107 regarding the disposal of spent preparation and analysis reagents, standards, sample extracts, distillates, or digestates.

1.1 Definitions

Hazardous Waste – A "Solid Waste" which displays a hazardous characteristic or is specifically listed as hazardous waste.

Solid Waste – Any discarded material that is not excluded from the definition of hazardous waste.

Discarded Material – Material that is abandoned, recycled or inherently waste-like.

Waste (State of Maine) –

- Any useless, unwanted, or discarded substance or material, whether or not such substance or material has any other future use.
- Any substance or material that is spilled, leaked, pumped, poured, emptied or dumped onto the land or into the water or ambient air.
- Materials which are used in a matter constituting disposal, burned for energy recovery, reclaimed, or accumulated speculatively.

Ignitable Hazardous Waste – EPA Waste Code D001

- Liquids with a flash point less than 140°F or 60°C.
- Solids capable of spontaneous combustion under normal temperature and pressure.
- Ignitable compressed gas.
- Oxidizers.

Corrosive Hazardous Waste - Liquids with a pH less than or equal to 2.0 or greater than or equal to 12.5. EPA waste code D002.

Reactive Hazardous Waste – EPA waste code D003.

- A material that reacts violently with water.
- A material that generates toxic gases or fumes.
- Explosives.

Toxic Hazardous Waste – A material that exceeds certain concentration levels based on the toxicity characteristic leaching procedure (TCLP). See Figure 3 for the chemicals and concentration levels covered under this definition.

Listed Wastes – Lists of chemicals that are considered hazardous based on the following criteria

- Virgin chemical or unused product.
- Sole active ingredient.
- Single substance spill debris.

Listed wastes are divided into 5 subcategories

- F-wastes – Describe hazardous waste from non-specific sources usually containing halogenated and non-halogenated solvents.
- K-wastes – Describe hazardous wastes created by specific processes.
- U-wastes – Describe toxic or non-acute hazardous wastes.
- P-wastes – Describe acute hazardous wastes. (Note: Maine considers a material to be a P-listed waste if it contains 10% or more of any P-listed chemical.
- State listed wastes – Maine lists any material with a concentration of greater than 50 ppm Polychlorinated Biphenyls (PCB) as a hazardous waste.

Organics hit – A liquid sample containing greater than 1 mg/L of organic contaminants or a soil sample containing greater than 20 mg/kg of organic contaminants.

1.2 Responsibilities

Only designated analysts/technicians trained in these procedures may dispose of samples or analytical by-products. Each analyst or technician must be familiar with Katahdin Analytical safety procedures. Gloves, safety glasses, lab coats and/or other protective clothing must be worn at all times.

It is the responsibility of the designated Katahdin personnel involved in the disposal of samples to read and understand this SOP, to adhere to the procedures outlined, to properly document their activities in the appropriate lab notebook and file the necessary manifests and reports to outside agencies in the required manner. Refer to

Katahdin SOP QA-805, "Personnel Training & Documentation of Capability," current revision.

It is the responsibility of the Department Managers to oversee that members of their group follow this SOP, to ensure that their work is properly documented and to initiate periodic review of the associated logbooks.

It is the responsibility of the Katahdin Environmental Health & Safety Officer (EHSO) to manage the proper classification and disposal of samples. Katahdin is responsible for regulatory compliance of Katahdin's waste storage areas (less than 90 day storage). The EHSO ensures compliance of the waste storage areas with applicable state and federal regulations. The EHSO is responsible for providing the appropriate training to all individuals involved in the proper classification and/or disposal of samples. The EHSO is responsible for working with the Laboratory Operations Manager/Environmental Compliance Officer to help identify problems and assure resolution, to facilitate corrective action where needed, and to communicate unresolved problems and concerns to the Laboratory Vice President.

It is the responsibility of the Operations Manager/Environmental Compliance Officer to oversee adherence to Katahdin sample disposal and hazardous waste practices by all laboratory groups under his/her authority, to help identify problems and assure resolution, to facilitate corrective action where needed, and to communicate problems and concerns to the EHSO and/or the Laboratory Vice President.

It is the responsibility of the Laboratory Vice President to provide the necessary resources to meet the regulatory requirements of proper classification and disposal of samples.

2.0 SUMMARY OF METHOD

Not applicable.

3.0 INTERFERENCES

Not applicable.

4.0 APPARATUS AND MATERIALS

Not applicable.

5.0 REAGENTS

Not applicable.

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Not applicable.

7.0 PROCEDURES

7.1 Sample purging is the removal of samples from laboratory refrigerated storage. Sample storage areas where samples are removed (purged) from include wet chemistry, organic extractables, metals, volatiles, total organic carbon and soils. Wet chemistry, aqueous metals, organic extractables, total organic carbon, and soils can all be found in the walk-in refrigerator. Aqueous and soil volatiles can be found in the volatiles laboratory refrigerators/freezer.

7.2 Samples are purged from storage, after analysis and reporting, on a routine basis to make room for incoming samples. Samples are to be kept in storage for a duration of 30 days past the report mailed date. Some samples must be kept for 60 or 90 days beyond the report mailed date, depending on specific client requests and contracts.

7.3 The first step in disposing of samples is to generate a disposal list. The disposal list contains sample analysis information stored in the Katahdin Information Management System (KIMS). The analytical data for the samples is compared to the hazardous waste criteria specified in 40CFR Part 261 and to local wastewater discharge criteria. Refer to Figure 4 for 40 CFR Part 261 Characteristic Hazardous Waste Criteria. Based on this comparison, the report displays information on the classification/category for disposal of each sample. The disposal report should be reviewed against the data reports for accuracy. Refer to Figure 2 for an example of a KIMS generated disposal list. The primary disposal categories listed in the report are: non-hazardous, high organics, high metals, flashpoint, high mercury, high PCBs, and high cyanide. Katahdin has established 14 waste stream profiles with a 3rd party waste transporter/waste disposal firm for sample disposal based on these categories. As required, new or special temporary waste profiles are established based on the characteristics of samples.

7.4 Sorting through samples and preparing them for disposal is a crucial quality checkpoint. Samples put into the incorrect waste stream could not only produce adverse environmental effects, but, could also interrupt the 3rd party's waste treatment efficiency, or endanger an individual handling the waste stream. Therefore, when sorting through samples pay close attention to which waste stream each sample falls into.

7.5 Once you are ready to dispose of the samples of interest (the oldest samples that have been purged), these samples must be sorted, logged, and the classification/category (sample knowledge) information recorded.

Sample storage times (as listed in section 7.2) and space should be taken into consideration when purging samples. It is important to make room for future samples, but to make sure that samples are not purged too early. Samples should be pulled from the walk-in or the volatiles refrigerators to make room for new samples. When purging, chose a section that needs extra space the most and remove the oldest samples.

Safety glasses, nitrile gloves, lab coat, and a splash apron must be worn when handing samples during disposal

7.6 Remove the designated purge samples from the shelf one by one and line them up on the countertop in the log-in area. Generally, removing two cartloads at a time is a good amount to purge at one time. For volatile samples in 40mL vials, 5 or 6 vial trays should be purged at a time. Samples should be lined up across the counter with the earliest sample to the left and building up to the right, organizing the samples according to work order and sample number. After the samples are lined up, they should be recorded in the Sample Disposal Logbook (SDL). Refer to Figure 1 for an example SDL page. The location the samples were removed from should also be recorded. Sample storage areas are recorded with the following designations:

VOA (Aq)	Aqueous Volatiles(VOA)
VOA (SL)	Solid Volatiles(VOA)
M	Metals
EXT	Extractables (Organic)
TOC	Total Organic Carbon
WC	Wet Chemistry
S	Soils

7.7 The next step is to use the sample disposal list to determine the earliest release date of the reports and to determine each samples appropriate waste classification/characterization. As stated in section 7.3, the primary disposal categories listed in the report are: non-hazardous, high organics, high metals, flashpoint, high mercury, high PCBs, and high cyanide.

Using the information from the KIMS disposal list, record the appropriate classification for each sample in the SDL. If multiple categories are identified as being present then a single category is selected as controlling. The order of precedence is PCB's, metals and then organics. If another scenario is found, the individual should bring it to the EHSO for a determination of the acceptable waste stream designation or a determination that it should be lab packed separately.

If samples have been sorted that have not been in storage for the 30 days beyond the release date (60 or 90 for certain clients), then these samples need to be placed back in storage and it should be noted in the SDL.

7.8 As stated above, a sample may be categorized into a waste stream based upon the analytes it contains as determined by laboratory testing. In addition, many samples are also categorized as hazardous waste based upon the preservative that they contain. Since many samples contain preservatives, caution must be used when dumping samples. It is also important to ensure that the sample container is empty. This can be accomplished by holding the container upside down and shaking gently until liquid is no longer observed coming out of the container.

7.9 Once waste categories have been determined and entered into the SDL, The following waste categories are disposed of as follows:

7.9.1 Dumping non-hazardous samples (as determined by laboratory testing)

Non-hazardous samples (non-preserved) are poured directly into the sink in the warehouse.

Non-hazardous solid samples are disposed of with the general trash, which is picked up by commercial trash collectors and ultimately disposed of in a waste-to-energy incinerator.

Sample containers from non-hazardous samples are disposed of with the general trash.

7.9.2 Dumping Samples with high Organics (as determined by laboratory testing)

Aqueous samples get dumped into waste stream "K". Containers are disposed of with general trash. Solid samples are placed into waste stream "I" with their containers. The disposal date is recorded in the SDL.

7.9.3 Dumping samples high in metals, including mercury (as determined by the by laboratory testing)

Aqueous samples get disposed of in waste stream "A". Containers are disposed of with general trash. Solid samples are placed in waste stream "L" with their containers. The disposal date is recorded in the SDL.

7.9.4 Dumping Acidic Samples that do not contain any other hazardous waste constituents (as determined by the acidic preservative or by laboratory testing)

Refer to section 7.10 below.

7.9.5 Dumping Basic samples (as determined by the basic preservative or by laboratory testing)

Aqueous samples get disposed of in waste stream "NHi". Containers are disposed of with general trash. The disposal date is recorded in the SDL.

7.9.6 Dumping samples with high PCBs (as determined by laboratory testing)

Aqueous samples are disposed of in waste stream "Q". Containers are disposed of with general trash. Solid samples get disposed of in waste stream "F" with their containers. The disposal date is recorded in the SDL.

7.9.7 Dumping samples with low flashpoints (as determined by laboratory testing)

Aqueous samples are disposed of in waste stream "O". Containers are disposed of with general trash. Solid samples get disposed of in waste stream "I" with their containers. The disposal date is recorded in the SDL.

7.9.8 Dumping samples with high cyanide (as determined by laboratory testing)

Aqueous samples are disposed of in waste stream "NHi". Containers are disposed of with general trash. Solid samples should be set aside for labpack. The disposal date is recorded in the SDL.

7.9.9 Miscellaneous Disposal (as determined by the preservative)

Sodium Bisulfate: Sodium Bisulfate often comes in vials, but may also come in the 2-4oz glass jars. Dump the Sodium Bisulfate out of the container into waste stream "A". There may be remaining soil left in the sample container. The soil's waste stream and dump date will be dictated by the SDL. The disposal date is recorded in the SDL.

Methanol / Free Products: This often comes in vials, but may also come in the 2-4oz glass jars. Dump the methanol out of the container into the mix-flammables accumulation. When this satellite accumulation container gets full it can be dumped into the "O" waste stream. There may be remaining soil left in the sample container. The soil's waste stream and dump date will be dictated by the SDL. Lastly, samples marked "free product" on the Katahdin sample ID label can be dumped into the mixed flammables stream. The disposal date is recorded in the SDL.

7.10 Pursuant to Maine DEP regulations, Katahdin has the necessary agreements, processes and documentation in place to neutralize samples without a license. Refer to the current revision of the Katahdin Environmental Health & Safety Manual for additional information. Generally, the following procedures are followed.

7.10.1 Samples that have been determined to be hazardous due **solely** to the corrosivity characteristic are neutralized using sodium hydroxide pellets. In the warehouse, samples are emptied into a five gallon heavy duty carboy to about 60% capacity. The carboy is kept in a secondary container. Sodium hydroxide pellets are added slowly to the carboy (about 5 grams at a time) and stirred with a long glass stirring rod. The pH is checked with pH paper.

7.10.2 This process is continued until the pH is between 7 and 8. This normally takes about 30-40 grams of sodium hydroxide pellets, but may vary depending on the buffering capacity of the individual samples.

7.10.3 The carboy is emptied into the sink in the warehouse. The tap water is run at the same time as the neutralized material is disposed of. An eyewash station and spill material is located at this sink.

7.10.4 All neutralization activities are documented, including the date and time of neutralization, the name of the person doing the neutralizing, the amount of neutralized liquid discharged, details on the inspection of the drain area and the date and nature of any significant repairs or corrective actions. This documentation is maintained by the EHSO. Refer to Figure 5 for an example logbook page of neutralization documentation.

7.11 Every 3 to 5 weeks a pickup of hazardous waste is scheduled with the 3rd party waste transporter/waste disposal firm. An inventory is faxed to the transporter summarizing the number of drums and waste streams/profiles. As required, a "lab pack" of expired chemicals or orphan samples is organized as necessary. A designated individual, with applicable Hazardous Waste (RCRA) and Department of Transportation (DOT) training, oversees the waste pickup and signs the hazardous manifests and land ban documentation. Within 7 days a copy is forwarded to the Maine Department of Environmental Protection (MEDEP) and the environmental agency in the designation state (if required by that state). Once the report is received at the disposal facility a copy is returned to KATAHDIN and the MEDEP.

7.12 Prior to March 31 of each year, the laboratory prepares the Annual Hazardous Waste Report (i.e., MEDEP modified EPA Form 8700-13A) as required by MEDEP Hazardous Waste Management Rules. The complete report is reviewed by the Katahdin Environmental Compliance Officer and then forwarded to the following address:

Maine Department of Environmental Protection
Bureau of Remediation & Waste Management
State House Station #17
Augusta, ME. 04333
Attn: Annual Hazardous Waste Report

TITLE: SAMPLE DISPOSAL

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

On a daily basis, a designated individual performs quality checks in all hazardous waste storage areas. The daily check documentation is located in login. Any discrepancy is copied to the Operations Manager and the Katahdin Vice President for corrective action. Refer to the current revision of Katahdin SOP CA-107, *The Management of Hazardous Waste as it Relates to the Disposal of Laboratory Process Waste, Reagents, Solvents & Standards*, for more information. Refer to Figure 3 for a copy of the daily check documentation.

9.0 METHOD PERFORMANCE

Not applicable.

10.0 APPLICABLE DOCUMENTS/REFERENCES

USEPA Code of Federal Regulations, 40 CFR Part 261.

Maine Department of Environmental Protection (ME DEP) Hazardous Waste Management Rules

ME DEP modified EPA Form 8700-13A

LIST OF TABLES AND FIGURES

Figure 1 Example of Sample Disposal Logbook
Figure 2 Example of KIMS Generated Waste Disposal Report
Figure 3 Example Of Hazardous Waste Area Daily Check Documentation
Figure 4 Characteristic Toxic Hazardous Waste and TCLP concentrations
Figure 5 Example of Elementary Neutralization Logbook

TITLE: SAMPLE DISPOSAL

FIGURE 1

EXAMPLE OF SAMPLE DISPOSAL LOGBOOK (SDL)

KATAHDIN ANALYTICAL SERVICES, INC. –SAMPLE STORAGE/DISPOSAL LOGBOOK

WORK ORDER/ SAMPLE NUMBERS	DEPARTMENT	EARLIEST RELEASE DATE	< CRITERIA	SAMPLE KNOWLEDGE									DATE DISPOSED	INITIALS
			CLEAN	WL	ORG	METS	CN	FP	HG	PCBS				
SAS783-1	WC	10-17-07	✓										1-22-08	GN
SAS786-1		10-17-07	✓											
SAS787-1,2,4		10-17-07	✓											
SAS790-1		10-19-07		✓										
SAS793-1		10-17-07	✓											
SAS795-1-9		10-23-07	✓											
SAS797-1		10-23-07	✓											
SAS798-1,2		10-25-07			✓									
SAS799-1-5		10-31-07	✓											
SAS804-1,2		10-25-07	✓											
SAS809-1,2		10-23-07	1			2				2				
SAS810-1-4	✓	10-23-07	✓										✓	

QAQC354

0000022

TITLE: SAMPLE DISPOSAL

FIGURE 2

EXAMPLE OF KIMS GENERATED WASTE DISPOSAL REPORT

SAMPLE DISPOSAL REPORT

Query by: Login SA6501 to SA7000
Date : 15-JAN-08

Sample	SDG	Status	Mail Date	Parameter	Value		
SA6605-1		NEED	12/02/07				
SA6606-1		NEED	12/02/07				
SA6607-1		NEED	11/15/07				
SA6608-1		NEED	12/06/07				
				ORG	1.17	MG/L	(HIGH)
SA6608-1		NEED	12/06/07				
SA6608-2		NEED	12/06/07				
				AA	13	MG/KG	(HIGH)
SA6609-1		NEED	11/26/07				
SA6609-1		NEED	11/26/07				
SA6610-1		NEED	11/30/07				
SA6611-1	FCS-020	NEED	12/07/07				
SA6611-2	FCS-020	NEED	12/07/07				
SA6611-3	FCS-020	NEED	12/07/07				
SA6611-4	FCS-020	NEED	12/07/07				
SA6611-5	FCS-020	NEED	12/07/07				
SA6611-6	FCS-020	NEED	12/07/07				
SA6611-7	FCS-020	NEED	12/07/07				
SA6611-8	FCS-020	NEED	12/07/07				
SA6612-1	NSA-030	NEED	12/07/07				
SA6612-2	NSA-030	NEED	12/07/07				
SA6612-3	NSA-030	NEED	12/07/07				
SA6612-4	NSA-030	NEED	12/07/07				
				ORG	1.70735	MG/L	(HIGH)
SA6612-5	NSA-030	NEED	12/07/07				
				ORG	1.0481	MG/L	(HIGH)

Page 24 of 99

TITLE: SAMPLE DISPOSAL

FIGURE 3

EXAMPLE OF HAZARDOUS WASTE STORAGE AREA DAILY CHECK

Daily Checklist for
HAZARDOUS WASTE STORAGE AREA

Week of: 1-28, 20 08

Item/Day:	Monday	Tuesday	Wednesday	Thursday	Friday
1. Are containers closed? (Except when waste is being added)	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
2. Are containers properly labeled with a hazardous waste label?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
3. Do you have access to each container and can you read the label? (36" aisle?)	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
4. Is each container marked with the date storage began?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
5. Are the dates on the containers less than 90 days old?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
6. Is container free of dents, bulges, rust, spills or leaks?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
7. Are all containers on a firm working surface?	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
8. Inspection by: Name (No Initials)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9. Time of Inspection	16:35	15:00	14:45	14:15	16:25
10. Verification of Inspection (Name/Date)	[illegible] 1-28-08	[illegible] 1-29-08	[illegible] 1-30-08	[illegible] 1-31-08	[illegible] 2-01-08

Deficiency noted:					
Corrective action:					
By (Name/Date):					

QAQC315

0000060

FIGURE 4

CHARACTERISTIC TOXIC HAZARDOUS WASTE AND TCLP CONCENTRATIONS

Chemical Name	CAS Number	Waste Code	TCLP conc. liquid	Equivalent conc. In Soil
Arsenic	7440-38-2	D004	5.0 mg/L	100 mg/kg
Barium	7440-39-3	D005	100 mg/L	2000 mg/kg
Cadmium	7440-43-9	D006	1.0 mg/L	20 mg/kg
Chromium	7440-47-3	D007	5.0 mg/L	100 mg/kg
Lead	7439-92-1	D008	5.0 mg/L	100 mg/kg
Mercury	7439-97-6	D009	0.2 mg/L	4 mg/kg
Selenium	7782-49-2	D010	1.0 mg/L	100 mg/kg
Silver	7440-22-4	D011	5.0 mg/L	20 mg/kg
Endrin	72-20-8	D012	0.02 mg/L	0.4 mg/kg
Lindane	58-89-9	D013	0.4 mg/L	8 mg/kg
Methoxychlor	72-43-5	D014	10 mg/L	200 mg/kg
Toxaphene	8001-35-2	D015	0.5 mg/L	10 mg/kg
2,4-D	94-75-7	D016	10 mg/L	200 mg/kg
2,4,5-TP (Silvex)	93-72-1	D017	1.0 mg/L	20 mg/kg
Benzene	71-43-2	D018	0.5 mg/L	10 mg/kg
Carbon Tetrachloride	56-23-5	D019	0.5 mg/L	10 mg/kg
Chlordane	57-74-9	D020	0.03 mg/L	0.6 mg/kg
Chlorobenzene	108-90-7	D021	100 mg/L	2000 mg/kg
Chloroform	67-66-3	D022	6.0 mg/L	120 mg/kg
o-Cresol	95-48-7	D023	200 mg/L	4000 mg/kg
m-Cresol	108-39-4	D024	200 mg/L	4000 mg/kg
p-Cresol	106-44-5	D025	200 mg/L	4000 mg/kg
Cresol	1319-77-3	D026	200 mg/L	4000 mg/kg
1,4-Dichlorobenzene	106-46-7	D027	7.5 mg/L	150 mg/kg
1,2-Dichloroethane	107-06-2	D028	0.5 mg/L	10 mg/kg
1,1-Dichloroethylene	75-35-4	D029	0.7 mg/L	14 mg/kg
2,4-Dinitrotoluene	121-14-2	D030	0.13 mg/L	2.6 mg/kg
Heptachlor	76-44-8	D031	0.008 mg/L	0.16 mg/kg
Hexachlorobenzene	118-74-1	D032	0.13 mg/L	2.6 mg/kg
Hexachlorobutadiene	87-68-3	D033	0.5 mg/L	10 mg/kg
Hexachloroethane	67-72-1	D034	3.0 mg/L	60 mg/kg
Methyl Ethyl Ketone	78-93-3	D035	200 mg/L	4000 mg/kg
Nitrobenzene	98-95-3	D036	2.0 mg/L	40 mg/kg
Pentachlorophenol	87-86-5	D037	100 mg/L	2000 mg/kg
Pyridine	110-86-1	D038	5.0 mg/L	100 mg/kg
Tetrachloroethylene	127-18-4	D039	0.7 mg/L	14 mg/kg
Trichloroethylene	79-01-6	D040	0.5 mg/L	10 mg/kg

FIGURE 4, cont'd

CHARACTERISTIC TOXIC HAZARDOUS WASTE AND TCLP CONCENTRATIONS

Chemical Name	CAS Number	Waste Code	TCLP conc. liquid	Equivalent conc. In Soil
2,4,5-Trichlorophenol	95-95-4	D041	400 mg/L	8000 mg/kg
2,4,6-Trichlorophenol	88-06-2	D042	2.0 mg/L	40 mg/kg
Vinyl Chloride	75-01-4	D043	0.2 mg/L	4.0 mg/kg

TITLE: SAMPLE DISPOSAL

FIGURE 5

EXAMPLE OF ELEMENTARY NEUTRALIZATION LOGBOOK

Katahdin Analytical Services, Inc. – Elementary Neutralization Logbook

Date: 3-4-09		**Time:** 12:00	**Analyst:** GN
# of gallons neutralized	Final pH	Condition of drain and sink area before and after neutralization.	Significant Repairs or Corrective Actions
5	5	good	
6	7	good	
6	5	good	
6	6	good	
2	8	good	

25
240

Date: 3-10-09		**Time:** 13:45	**Analyst:** GN
# of gallons neutralized	Final pH	Condition of drain and sink area before and after neutralization.	Significant Repairs or Corrective Actions
6	7	good	
6	6	good	
5	6	good	
6	8	good	
6	5	good	
6	8	good	
5	5	good	
6	7	good	
3	5	good	

49
289

SOP No: G.22

Title: General laboratory Multi Incremental Sampling (MIS) sub-sampling procedure.

Scope: This SOP addresses the laboratory's procedures for drying, particle size reduction, and sub-sampling of multi-incremental soil samples for metals or/and explosives samples.

1.0 METHOD SUMMARY

1.1 The purpose of this Standard Operating Procedure is to describe in detail the methodology and protocol used in obtaining representative environmental samples. It describes in detail sample handling preparing, drying, sieving grinding, and pulverizing. It also describes the procedure for sub-sampling of the processed samples.

2.0 REFERENCES

- SW846 Method 8330B revision 2 October 2006.
- EPA/600/R-03/027, Guidance for Obtaining Representative Laboratory Analytical Subsamples from particulate Laboratory Samples, November 2003.
- ASTM D6323 Standard guide for laboratory for laboratory subsampling of Media Related to Waste Management Activities.

3.0 INTERFERENCES

3.1 Sample processing hardware must be clean to minimize interferences.

4.0 APPARATUS AND MATERIAL

- Puck Mill (LABTECHNICS Type LM1-P)
- Flying saucer bowls (Part #1658-000160)
- Puck-off-center hole.
- Bowl lid.
- Sieve appropriate sizes mesh (Brass, USA Std. Testing Sieve, ASTM E-11 specification.)
- Drying tray (Steel or Aluminum, 18" x 26", 1" deep)

- Tray rack (Rubbermaid model# 3320)
- Tray rack (Restaurant Product model# 511-012)
- Tongue Depressor (Wooden spatulas)
- Sub-Sampling 7" spoon .25 TSP/ 1.23 ml (Polystyrene, flat bottomed. Fisher part# 14-375-254.)
- Balance capable of weighing 10kg sample with 2g precision (Taylor TE22)
- Ottowa Sand.
- Plastic film.
- Tray liner paper (Lab Soaker VWR item #52857-120)

5.0 REAGENTS AND STANDARDS.

5.1 Reagents.

5.1.1 HPLC Grade Acetonitrile.

5.2 Laboratory Control Spike solutions.

5.2.1 Laboratory Control Spike solutions are obtained as single component standards for 14 compounds at varied concentrations (See appendix B). Typically 100-200ug/mL. The standards for the matrix spike solution must be from a separate vendor or a different lot than the standards used for the calibration solutions.

5.2.2 Nitroglycerine standard is obtained as a single component at a concentration 5.0 mg/Kg. (See appendix C).

5.2.3 PETN standard is obtained as a single component at a concentration 5.0 mg/Kg. (See appendix D)

5.2.4 3,5-Dinitroanoline d standard is obtained as a single component at a concentration 5.0 mg/Kg. (See appendix E)

5.2.5 These amputated standards are good for six months or the date assigned by the manufacturer.

5.2.6 All the above solutions must be refrigerated at 4°C (± 2°C) and stored in the dark.

6.0 SOIL AND SEDIMENTS SAMPLE PREPARATION

6.1 Samples are expected to arrive in plastic bags or other suitable containers, with an average weight of 1-4kg. Empty the entire sample onto a drying tray, lined with liner paper. If the sample is particularly wet, liner paper may not be suitable. In this case, plastic film will be used. Moist soil samples are broken up into small pieces with a gloved hand prior to drying. Air-dry the soil sample at room temperature being careful not to expose the samples to direct sunlight. Record the date and time. The drying tray rack must be located in a well-ventilated room,

with the ventilating system in operation. **The total weight of the sample (prior to any exclusions such as vegetation, metal fragments, particles greater than 2mm) will be recorded in the MIS sample preparation logbook.**

6.1.1 **For DOD samples, record date, time, and ambient temperature on a daily basis while drying samples.**

6.2 To ensure that the drying process is completed, the sample weight is monitored and recorded in the MIS sample preparation logbook. The drying process is considered complete when the weight change over a period of at least ½ hour is <1%. Record the initial and subsequent results.

6.3 Pass the samples through a #10 (2mm) sieve. Any clumps and agglomerates of soil are broken up into small pieces with a gloved hand. In addition, mosses and other types of fine vegetation will be physically shredded while sieving to release entrapped fibrous residues. Remove the oversized fraction of the sample that was retained on the #10 (2mm) sieve. Weigh both fractions and record both weights in a logbook. The oversized fraction is retained with the original sample, but is not ground or extracted unless specified in the project requirements.

6.3.1 For Navy samples, vegetation is not to be intentionally included in the portion of the sample that passes through the sieve unless this is a project-specific requirement.

6.4 To prevent cross contamination of samples, each sieve must be cleaned thoroughly and dried before new sample is loaded. Refer to GPL SOP G.2 sections 7.3-7.5 for specific instructions

6.5 If required by the project, the fraction that did not pass through the sieve is processed to reduce the particle size to <2mm and added to the sample prior to grinding as follows. Vegetable matter is removed and processed in a laboratory blender until it will pass through the #10 sieve. Any non-vegetable matter, as well as any material that could not be reduced in the blender is shipped to Penniman and Brown in Baltimore, MD for pulverization. The returned sample is passed through the #10 sieve and added to the remainder of the sample. If any material remains that still will not pass through the #10 sieve, the client will be contacted for further instructions.

6.6 Samples are now ready for further preparation or sub-sampling, depending on specific project requirements.

6.7 If analysis requested are only for explosives, proceed to section 8.0.

7.0 Sample Splitting for Explosives and Metals Analyses

7.1 If independent (separate) samples containers are not collected for metals. The existing dried and sieved samples will sub-sampled for Metals analysis prior to sample grind. Five-gram sub-sample will be needed to perform Metals digestion and analysis. The five-gram sample will be sub-sampled in the following manner. Using the sub-sampler scoop, take about ¼ scoop sample from randomly chosen locations, by sampling the whole profile of the sample tray. Approximately 15-20 different sub-sampled scoops will be necessary to obtain the five-gram sub-sample. Repeat the process and collect a duplicate sample, should re-digestion is necessary. Record the exact weight of the sub-sample in the appropriate sample digestion logbook and digest the entire sample. Proceed with metal digestion as described in SOP H.21. The entire sub-sampled must be

digested. The remainder of the sample (if explosive analysis by 8330B are necessary) will be processed further, using the grinding process outlined in section 8.0.

8.0 GRINDING SAMPLE FOR SOIL AND SEDIMENTS USING PUCK MILL.

8.1 To prepare samples for explosive analysis, place a portion of the sample (up to 500g) in the grinder bowl of the Puck Mill and grind the samples for 60 second. Empty the ground sample portion on to a clean lined tray. Repeat the process, until the entire sample is ground. To prevent the Puck mill from warming up to the temperatures where some energetic compounds may be lost, allow a three minutes cool down time period between five 60 seconds grinding cycles. To demonstrate that the process is complete, pass a portion of ground sample and passed through a #200 sieve. If the sample portion does not pass through the #200 sieve, continue the process above, until the sample portion passes through.

8.2 To prevent cross contamination of samples, each bowl, puck, lid and sieve must be cleaned thoroughly and dried before new sample is loaded. Refer to GPL SOP G.2 sections 7.3-7.5 for specific instructions

9.0 SUB-SAMPLING OF SOIL AND SEDIMENTS SAMPLES FOR EXPLOSIVE ANALYSIS.

9.1 The soil or sediment sample (the fine powder) is emptied back onto clean drying tray, freshly lined with liner paper. Using a wooden spatula, evenly distribute the ground sample on the tray.

9.2 Sub-sampling is performed using a flat-bottomed, straight walled scoop.

9.3 A 10-gram sub-sample will be collected for subsequent sonication and analysis of explosives. The 10g sub-sample will be collected in the same manner that is disribed in section 7.1. A total of 30-40 sub-sampling increments will be necessary to obtain the 10g required for sonication and analysis. Record the exact weight of each sub-sample in the appropriate sample extraction logbook and sonicate the entire portion of the sub-sample.

10.0 QUALITY CONTROL.

10.1 To ensure that the process does not introduce target analytes or other interferences into the ground samples, each batch of samples will include one bottle containing 500g of Ottowa sand, which is dried, sieved, and ground with the same equipment and methodology as the client samples. This blank material is then sub-sampled in the same manner as the client samples to obtain the background matrix for the Method Blank.

10.2 If the contamination in the blank mentioned in section 10.1 is > ½ reporting limit, all samples associated with contaminated blank must be re-extracted and re-analyzed if sufficient sample exists or all samples associated with the contaminated blank must be qualified with " B " qualifier.

10.3 To demonstrate that the grinding process does not cause undue analyte loss, each batch of samples will include Laboratory Control Sample (LCS) spiked with target compound prior to grinding. The LCS will be comprise of 500g of Ottawa sand spiked as followed:

10.3.1 Using a syringe, spike 2.5 ml of the LCS spike solution (Appendix B), 0.5 ml of Nitroglycerine solution (Appendix C), 0.05 ml of PETN solution (Appendix D), 0.25 ml of 3,5-Dinitrotolune solution (Appendix E)

10.4 The LCS standard must meet criteria for recovery as described in the DoD QSM. If QC criteria specified in the DoD QSM are not met, all samples associated with LCS will be re-analyzed and the data will be flagged as prescribed in the DoD QSM.

10.5 To demonstrate that the process adequately homogenizes and accurately sub-samples each multi-incremental sample, for every twenty-field samples processed under this SOP, one sample is sub-sampled in triplicate and analyzed. The triplicate analyses must yield a RSD of 20% or less. If the %RSD IS >20%, the sample will be re-digest/re-extract and re-analyzed if additional sample volume is available.

10.6 A separate sample is also sub-sampled in triplicate for MS/MSD or MD/MS extraction, as specified by the relevant analytical method. The MS/MSD are spiked after grinding at sample extraction level as specified by GPL SOP S.11. The percent recoveries of MS/MSD must meet the LCS limits. The MS/MSD analyses must yield a RPD of 20% or less. If the RPD exceeds 20%, corrective action as specified in the DoD QSM will be followed. **Triplicate sampling cannot be performed on any type of blank sample.**

Appendix B
Explosives analytes

ANALYTE	SPIKE level
	ug/Kg
1,3,5-Trinitrobenzene	100
1,3-Dinitrobenzene	100
2,4,6-Trinitrotoluene	100
2,4-Dinitrotoluene	100
2,6-Dinitrotoluene	100
2-Amino-4,6-dinitrotoluene	100
4-Amino-2,6-dinitrotoluene	100
HMX	200
RDX	200
Tetryl	200
2-Nitrotoluene	200
3-Nitrotoluene	200
4-Nitrotoluene	200

Appendix C	ug/kg
Nitroglycerin	5000

Appendix D	ug/kg
PETN	5000

Appendix E	ug/kg
3,5-Dinitroaniline	1000

MIS Sample Preparation for GPL Analysis	
Work Order # :	Client:

Note:

Equipment: 2.0mm Sieve (#10), Scale readable to 1 grams.

		Moisture Calculation for Drying Process							
GPL Fraction	Mass (g) Tray & Paper	Wet Mass (g) Sample + Tray	1 Dry Mass (g) Sample + Tray	2 Dry Mass (g) Sample + Tray	3 Dry Mass (g) Sample + Tray	4 Dry Mass (g) Sample + Tray	5 Dry Mass (g) Sample + Tray	Oversized Mass (g) Sample Only[1]	Sample Mass (g) Sample Only[2]
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

mments: _____

Analyst: _____ Date: _____

Supervisor: _____ Date: _____

[1]Sample material which did not pass through a 10-mesh sieve

[2]Sample material which passed through a 10-mesh sieve

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

SOP Number: CA-709
Revision History
Cover Page
Page 1

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045.**

Prepared By: Wet Chemistry Date: 8/96

Approved By:

Group Supervisor: Keith Tangney Date: 021301

Operations Manager: John C. Burton Date: 2/13/01

QA Officer: Deborah J. Nadeau Date: 2·13·01

General Manager: Dennis P. Lufkin Date: 2/12/01

Revision History:

SOP Revision	Changes	Approval Initials	Approval Date	Effective Date
03 9045C	Format changes, added pollution prevention, database and operation of Accumet pH meter and calibration.	DN	2·13·01	2·13·01
04 9045C	Addition to Scope and Application to include reference for 9040B use when aqueous phase is >20%	DN	8·27·02	8·27·02
05 9045C	added KIMS Minor changes throughout added wording to sect. 6 New fig. 1 and 2	LAD	120104	120104
06 9045C	Added SW-846 reference. Minor formatting changes throughout.	LAD	03/07	03/07
07 9045D	Section 7.18 - Renamed "Equipment Maintenance" and revised for current practices. Add Wet Chem. Data Entry SOP reference. Updated references in Section 10. Updated log book example.	LAD	08/09	08/09

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

Please acknowledge receipt of this standard operating procedure by signing and dating both of the spaces provided. Return the bottom half of this sheet to the QA Department.

I acknowledge receipt of copy ___ of document **CA-709-07**, titled **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**.

Recipient: _____ Date: _____

KATAHDIN ANALYTICAL SERVICES, INC.
STANDARD OPERATING PROCEDURE

I acknowledge receipt of copy ___ of document **CA-709-07**, titled **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**.

Recipient: _____ Date: _____

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

1.0 SCOPE AND APPLICATION

The purpose of this SOP is to describe the procedures and techniques followed by Katahdin Analytical Services, Inc. personnel to determine the pH of soils and waste samples in accordance with EPA method 9045 (current promulgated revision). Method 9045 is an electrometric procedure for measuring pH in soils and waste samples. Wastes may be solids, sludges, or non-aqueous liquids. If water is present, it must constitute less than 20% of the total volume of the sample. If the aqueous phase is greater than 20%, pH determination should be performed in accordance with EPA method 9040 (current promulgated revision). Refer to the current revision of Katahdin SOP CA-708, pH Concentration Measurements in Aqueous Samples.

The procedures in this SOP are applicable to all non-CLP pH measurements performed for all soil matrices analyzed in the laboratory.

1.1 Definitions

pH - A measure of the acidity or alkalinity of a solution, defined as -log $[H^+]$.

1.2 Responsibilities

This method is restricted to use by, or under the supervision of analysts experienced in the analysis of pH in solids by EPA Method 9045. Each analyst must demonstrate and document their ability to generate acceptable results with this method. Refer to Katahdin SOP QA-805, current revision, "Personnel Training & Documentation of Capability".

It is the responsibility of all Katahdin technical personnel involved in the determination of pH concentration measurements in solid matrices to read and understand this SOP, to adhere to the procedures outlined, and to properly document their data in the appropriate lab notebook. Any deviations from the test or irregularities with the samples should also be recorded in the lab notebook and reported to the Department Manager or designated qualified data reviewer responsible for pH data.

It is the responsibility of the Department Manager to oversee that members of their group follow this SOP, to ensure that their work is properly documented and to indicate periodic review of the associated logbooks.

1.3 Safety

Users of this procedure must be cognizant of inherent laboratory hazards, proper disposal procedures for contaminated materials and appropriate segregation of hazardous wastes. The toxicity or carcinogenicity of each reagent used in this method

has not been precisely defined; however, each chemical should be treated as a potential health hazard. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Everyone involved with the procedure must be familiar with the MSDSs for all the materials used in this procedure.

Each qualified analyst or technician must be familiar with Katahdin Analytical Environmental Health and Safety Manual including the Katahdin Hazardous Waste Management Plan and must follow appropriate procedures. These include the use of appropriate personal protective equipment (PPE) such as safety glasses, gloves and lab coats when working with chemicals or near an instrument and not taking food or drink into the laboratory. Each analyst should know the location of a respirator and all safety equipment. Each analyst shall receive a safety orientation from their Department Manager, or designee, appropriate for the job functions they will perform.

1.4 Pollution Prevention/Waste Disposal

Whenever possible, laboratory personnel should use pollution prevention techniques to address their waste generation. Refer to the current revision of the Katahdin Hazardous Waste Management Program for further details on pollution prevention techniques.

Wastes generated during the preparation of samples must be disposed of in accordance with the Katahdin Chemical Hygiene Plan and Safety Manual and SOP SD-903, "Sample Disposal," current revision. Expired standards are lab packed, placed in the Katahdin hazardous waste storage area, and disposed of in accordance with this SOP.

2.0 SUMMARY OF METHOD

A representative aliquot of sample, measured in grams, is mixed with an equivalent volume of laboratory reagent grade water, measured in mL. The solution is allowed to settle, and the pH of the standing water (decanted) is determined electrometrically.

3.0 INTERFERENCES

3.1 Samples with very low or very high pH may give incorrect readings on the meter. For samples with a true pH of >10, the measured pH may be incorrectly low. This error can be minimized by using a low-sodium-error electrode. Strong acid solutions, with a true pH of <1, may give incorrectly high pH measurements.

3.2 Temperature fluctuations will cause measurement errors.

3.3 Errors will occur when the electrodes become coated with an oily material. See section 7.18 for special cleaning instructions.

4.0 APPARATUS AND MATERIALS

4.1 pH meter, Accumet Model 20 or equivalent with Automatic Temperature Compensation (ATC)

4.2 Glass beakers, 25 mL and 400 mL

4.3 25 mL dose cups

4.4 Teflon coated stir-bars

4.5 Stir-bar retriever

4.6 Magnetic stirplate

4.7 Shaker, 12 place

4.8 Analytical balance, capable of weighing to 0.1 g

5.0 REAGENTS

5.1 Buffer solutions (pH 4.0, 6.0, 7.0, 8.0, 10.0, 12.0)

5.2 Laboratory reagent grade water (Lab Water)

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

Samples are collected in soil jars and stored at 4°C until analysis. Since there are no published holding times for this method, sample analysis should be performed as soon as possible.

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

7.0 PROCEDURES

SAMPLE PREPARATION

7.1 Mix samples thoroughly. Discard any foreign objects such as sticks, leaves and rocks. Decant any standing liquid. Using the balance, weigh out 20.0 g of sample into a 400 mL glass beaker. Record weight in pH logbook (Figure 1).

7.2 Add 20 mL of laboratory reagent grade water to the sample. Cover the top of the beaker with parafilm.

7.3 Place the sample on the shaker and allow it to shake, at medium speed, for one hour.

7.4 After one hour, remove the sample from the shaker and allow it to settle for one hour.

7.5 After one hour, decant the standing liquid into a 25 mL beaker. If no standing liquid is present, add sufficient laboratory reagent grade water to result in standing water, cover with parafilm, and repeat steps 7.3 through 7.5.

7.6 Record total volume of laboratory reagent grade water added to sample in pH logbook. If volume of laboratory reagent grade water (in mL) added to sample exceeds the initial gram weight of the sample, flag sample data in pH logbook with reason for addition of excess laboratory reagent grade water (eg. minimum volume of water required in order to cover pH probe).

CALIBRATION OF PH METER

7.7 NORMAL RANGE CALIBRATION (pH range 3.5 - 10.5)

7.7.1 Meter should be calibrated daily. As described in the following steps, conduct a two-point calibration with pH buffers 4 and 10. Perform a calibration check using pH 7 buffer. The source/lot number of each solution at the time of analysis must be recorded in the logbook (Figure 1).

7.7.2 Dispose of buffer solutions used the previous day (see Waste Disposal, section 1.4). Put about 20 mL of the appropriate buffer solution into new dose cups. Place a tiny stir bar in each new cup.

7.7.3 Rinse probe (i.e., electrode) with laboratory DI laboratory reagent grade water. Gently blot dry with kimwipe.

7.7.4 Place pH 4 buffer on stir plate. Turn stir plate on so that the stir bar spins without creating a vortex. Push *1* key (meaning add a standard). Then push *4* (calibrate). Record the value in the pH logbook.

7.7.5 Remove pH 4 buffer. Rinse probe. Blot dry.

7.7.6 Repeat step 7.7.4 with the pH 10 buffer. Record the value in the pH logbook. Remove pH 10 buffer. Rinse and dry probe.

7.7.7 With the pH 7 buffer, repeat step 7.7.4, but DO NOT press any keys as this reading is a calibration check. Record reading in pH logbook. Results must be

within 0.05 pH units of the true value for analysis to proceed.

NOTE: If buffer readings are not within 0.05 pH units of expected values (4.00, 7.00 and 10.00) the electrode may need cleaning. Rerun and enter in pH lab notebook that meter was recalibrated with the pH 4 and 10 buffers, with the pH 7 buffer used as a calibration check. Also record any maintenance performed.

7.8 LOW RANGE CALIBRATION

7.8.1 If pH of a sample as is less than 3.5, the instrument must be recalibrated using buffers that bracket the expected pH of the sample, as described below. The source/lot number and temperature of each solution at the time of analysis must be recorded in the logbook (Figure 1).

7.8.2 Rinse probe (i.e., electrode) with laboratory reagent grade water.

7.8.3 . Gently blot dry with kimwipe.

7.8.4 Place pH 2 buffer on stir plate. Turn stir plate on so that the stir bar spins without creating a vortex. Push *1* key (meaning add a standard). Then push *4* (calibrate). Record the value in the pH logbook.

7.8.5 Remove pH 2 buffer. Rinse probe. Blot dry.

7.8.6 Repeat step 7.8.3 with the pH 7 buffer. Record the value in the pH logbook. Remove pH 7 buffer. Rinse and dry probe.

7.8.7 With the pH 4 buffer, repeat step 7.8.3, but DO NOT press any keys as this reading is a calibration check. Record reading in pH logbook. Results must be within 0.05 pH units of the true value for analysis to proceed.

NOTE: If buffer readings are not within 0.05 pH units of expected values (2.00, 4.00 and 7.00) the electrode may need cleaning. Rerun and enter in pH lab notebook that meter was recalibrated with the pH 2 and 7 buffers, with the

pH 4 buffer used as a calibration check. Also record any maintenance performed.

7.9 HIGH RANGE CALIBRATION

7.9.1 If pH of a sample as determined in Sections 7.10 through 7.17 is greater than 10.5, the instrument must be recalibrated using buffers that bracket the expected pH of the sample, as described below. The source/lot number and temperature of each solution at the time of analysis must be recorded in the logbook (Figure 1).

7.9.2 Rinse probe (i.e., electrode) with laboratory reagent grade water. Gently blot dry with kimwipe.

7.9.3 Place pH 7 buffer on a stirplate. Turn stir plate on so that the stir bar spins without creating a vortex. Push *1* key (meaning add a standard). Then push *4* (calibrate). Record the value in the pH logbook.

7.9.4 Remove pH 7 buffer. Rinse probe. Blot dry.

7.9.5 Repeat step 7.9.3 with the pH 12 buffer. Record the value in the pH logbook. Remove pH 12 buffer. Rinse and dry probe.

7.9.6 With the pH 10 buffer, repeat step 7.9.3, but DO NOT press any keys as this reading is a calibration check. Record reading in pH logbook. Results must be within 0.05 pH units of the true value for analysis to proceed.

NOTE: If buffer readings are not within 0.05 pH units of expected values (7.00, 10.00 and 12.00) the electrode may need cleaning. Rerun and enter in pH lab notebook that meter was recalibrated with the pH 7 and 12 buffers, with the pH 10 buffer used as a calibration check. Also record any maintenance performed.

ANALYSIS OF SAMPLES

7.10 Sample analysis may proceed once the meter has been calibrated for the day with two buffers that bracket the expected pH of the sample, and after checking the calibration with a mid-range solution between the two buffers used for calibration of the meter (refer to sections 7.7, 7.8, and/or 7.9 as applicable).

7.11 For the range being used, rerun the appropriate calibration check point as the laboratory control sample (LCS) for the analytical batch. An LCS is required at the beginning of every batch of twenty or fewer samples.

7.12 Record date, time and initials for this analytical session.

7.13 The decanted samples should be equilibrated to room temperature prior to analysis (i.e., at the same temperature as the calibration buffers, ±2 °C). A more accurate pH reading will be achieved when the buffers and the samples are at the same temperature. However, the Accumet® pH meter is equipped with automatic temperature compensation (ATC) for when samples and buffers are not at the same temperature. Refer to the Accumet® Model 20 pH/Conductivity Meter operating Instructions, #300143.3 (Revision C) for information on the ATC probe.

7.14 Pour about 25 ml of the supernatant into a clean dose cup. Place a tiny stir bar in cup. Place on stir plate, turn on stir plate and immerse probes.

7.15 When meter locks, record value displayed.

7.16 Rinse probe with laboratory reagent grade water and blot dry between samples.

7.17 Place probe in pH 4 buffer solution to store until next analysis.

EQUIPMENT MAINTENANCE

7.18 If an electrode becomes coated with an oily material that will not rinse free, the electrode can either (refer to instrument manual):

- be cleaned with an ultrasonic bath, or
- be washed with detergent, rinsed several times with laboratory reagent grade water, placed in 1:10 HCl so that the lower third of the electrode is submerged, and then thoroughly rinsed with laboratory reagent grade water.

An electrode that will not calibrate properly must be replaced.

REPORTING OF RESULTS

7.19 All pH measurements less than 10.0 are to be reported using two significant figures.

Examples: 2.46 = 2.5
6.32 = 6.3
9.94 = 9.9

7.20 All pH measurements which are at or greater than or round up to 10.0 are to be reported to three significant figures.

Examples: 9.95 = 10.0
12.25 = 12.3
13.76 = 13.8
11.95 = 12.0

7.21 When a sample duplicate is analyzed, both the original result and duplicate result are recorded in the pH logbook; however, the original sample result is to be reported to the client.

7.22 After completion of each test, the logbook must be signed and dated by the person performing the test. All unused lines are to be "z-ed" out and initialed and dated.

7.23 The sample data results, with any appropriate notations, are entered into KIMS by the analyst. Refer to the current revision of SOP CA-762 for instructions on data entry. A batch sheet is generated (Figure 2). Raw data and batch sheets are reviewed for completeness and accuracy by the Inorganic Department Manager or other qualified designee.

7.24 All batch sheets and copies of the raw logbook data are filed with the Inorganic Department Manager for approximately 3 months, for reference by analysts. Prior data are archived.

8.0 QUALITY CONTROL AND ACCEPTANCE CRITERIA

Refer to Table 1 for a summary of QC requirements, acceptance criteria, and corrective actions. Table 1 criteria are intended to be guidelines for analysts. The table does not cover all possible situations. If any of the QC requirements are outside the recovery ranges listed in Table 1, all associated samples must be evaluated against all the QC. In some cases data may be reported, but may be reanalyzed in other cases. Making new reagents and standards may be necessary if the standardization is suspect. The corrective actions listed in Table 1 may rely on analyst experience to make sound scientific judgements. These decisions are based on holding time considerations, remaining sample volume and client and project specific Data Quality Objectives. The Department Manager, Operations Manager, and/or Quality Assurance Officer may be consulted to evaluate data. Some samples may not be able to be reanalyzed within hold time. In these cases "qualified" data with narration may be advisable after consultation with the client.

In some cases the standard QC requirements listed in this section and in Table 1 may not be sufficient to meet the Data Quality Objectives of the specific project. Much of the work performed at the lab is analyzed in accordance with specific QC requirements spelled out in a project specific Quality Assurance Project Plan (QAPP) or in a program specific Quality Systems Manual (QSM). The reporting limits, acceptance criteria and/or corrective actions may be different than those specified in this SOP. In these cases the appropriate information

will be communicated to the Department Manager and/or senior chemists before initiation of the analyses so that specific product codes can be produced for the project. In addition, the work order notes for each project will describe the specific QAPP or QSM to be followed.

8.1 One sample duplicate is to be analyzed per batch or every 10 sample analyses.

8.1.1 Acceptance criteria for duplicates is a difference of less than or equal to 20% relative percent difference between sample and duplicate results.

8.1.2. If criterion is not met, check calibration and reanalyze sample in duplicate.

8.2 One Laboratory Control Sample (LCS) is to be analyzed per batch or every 20 samples.

8.2.1 The LCS must be within 90-110% recovery for analysis to proceed.

8.2.2 If criteria are not met, recalibrate.

9.0 METHOD PERFORMANCE

Refer to method 9045.

10.0 APPLICABLE DOCUMENTS/REFERENCES

"Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods", SW-846, third Edition, Final Updates I, II, IIA, IIB, III, IIIA, IIIB, revised November 2004, Method 9045D.

Katahdin SOP CA-101, Equipment Maintenance

Katahdin SOP CA-762, Wet Chemistry Data Entry and Review Using Katahdin Information Management System (KIMS)

Department of Defense Quality Systems Manual for Environmental Laboratories (DoD QSM), Version 4.1, 04/22/09

The National Environmental Laboratory Accreditation Conference (NELAC) Standards, June 2003

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

LIST OF TABLES AND FIGURES

Table 1 QC Requirements
Table 2 Summary of Method Modifications
Figure 1 Example of pH - Soils Logbook Page
Figure 2 Example of Batch Sheet for pH

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

TABLE 1

QC REQUIREMENTS

Analytical Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW9045	PH (soil)	2-point calibration with pH buffers with a midrange cal. check	Once per day, prior to use	± 0.05 pH units for each buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration
		LCS	One per batch of twenty or fewer samples	90-110% recovery	Correct problem, recalibrate
		Sample duplicate	One sample duplicate per every ten field samples	RPD ≤20%	(1) Investigate problem and reanalyze sample in duplicate (2) If RPD is still unacceptable, report original result with notation or narration.

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

TABLE 2

SUMMARY OF METHOD MODIFICATIONS

TOPIC	KATAHDIN SOP CA-709-07	METHOD SW846 9045, current revision
Apparatus/Materials		
Reagents		
Sample preservation/ handling		
Procedures	1) Shake, at medium speed, for one hour. 2) Add more liquid after shaking and settling if there is no standing liquid left. 3) All buffers and samples are analyzed at room temperature. pH meter is equipped with automatic temperature compensation.	1) Continuously stir the suspension for five minutes. 2) No guidance for samples with no standing liquid left. 3) Report both pH and temperature at the time of analysis.
QC – Spikes		
QC – LCS		
QC - Accuracy/Precision		

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

FIGURE 1

EXAMPLE OF pH LOGBOOK PAGE

KATAHDIN ANALYTICAL SERVICES, INC.

CORROSIVITY pH / pH Soil

Accumet 20 pH Meter - SN - C0024321 **pH Probe SN -** 81271408

SW 846 9045D ✓ **CLP SOW** ____

CALIBRATION STDS:	CALIBRATED TO:	LOT NO:	
pH 7.00	7.00	SWL 2685	
pH 4.00	4.00	SWL 2740	
pH 5.00			
pH 10.00	10.00	SWL 2655	
pH 8.00			
pH 12.00			

LAB SAMPLE ID	ANALYSIS TIME	SAMPLE VOL (mL)	SAMPLE WEIGHT(g)	pH	REPORTED pH
LCS WG 12345	12:20	20.0	20.0000	7.01	7.0
SC1234-5	12:22	20.0	20.008	6.80	6.8
DUP WG 1234-6	12:24	20.0	20.006	6.81	6.8
SC1234-6	12:26	20.0	20.001	7.79	7.8
↓ -7	12:28	20.0	19.998	6.31	6.3
↓ -8	12:30	20.0	19.997	5.19	5.2

LAD 08.04.09

ANALYST: LAD DATE: 08.04.09
CHECKED BY: DATE:

TITLE: **pH CONCENTRATION MEASUREMENTS IN SOIL MATRICES - SW 846 METHOD 9045**

FIGURE 2

EXAMPLE OF BATCH SHEET FOR pH

WET CHEMISTRY BATCH REPORT
Apr 06 2009, 08:12 am
Batch: WG62267

Parameter: pH(Soil)

Date Analyzed: 02-APR-09

Analyst Initials: JF

Prep Date: 02-APR-09

Prep Method: SW846 9045C

Prep Chemist: JF

Sample	Samp Type	Method	Initial Amt.	Final Amt.	Rpt. DF	Result	Rpt Result	TS(%)	PQL	MDL	Adj PQL	RPD	%Rec
SC1497-1	SAMP	SW846 9045C	20.176g	20mL	1	8.7	8.7 pH	96.	.1	.1	.1		
SC1497-2	SAMP	SW846 9045C	20.051g	20mL	1	7.62	7.6 pH	89.	.1	.1	.1		
SC1497-3	SAMP	SW846 9045C	20.193g	20mL	1	7.55	7.6 pH	88.	.1	.1	.1		
WG62267-1	LCS	SW846 9045C	20g	20mL	1	7	7.0 pH	NA	.1	.1	.1		100
WG62267-2	DUP	SW846 9045C	20.173g	20mL	1	8.69	8.7 pH	NA	.1	.1	.1	0	

Comments:

WG62267-1 SC1497-1
WG62267-2 SC1497-1

Entered by: [signature] Date: 4-6-09 Accepted by: CP Date: 4/6/09