
FINAL

SAMPLING AND ANALYSIS PLAN

MILITARY MUNITIONS RESPONSE PROGRAM

SITE INSPECTIONS

SEPTEMBER 2005

Prepared by:

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FINAL
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ACRONYMS

ADR	Automated Data Review
ARC	Annual Report to Congress
ASR	Archive Search Report
CAR	Corrective Action Report
CENAB	U.S. Army Engineer District, Baltimore
CENWO	U.S. Army Engineer District, Omaha
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESPA	U.S. Army Engineer District, Albuquerque
CESPD	U.S. Army Engineer Division, South Pacific
CLP	Contract Laboratory Protocol
COC	Chain of Custody
CQAR	Chemical Quality Assurance Report
CQCO	Chemical Quality Control Officer
CRQL	Contract Required Quantitation Limit
CSM	Conceptual Site Model
CTC	Cost to Complete
CWM	Chemical Warfare Materiel
DA	Department of the Army
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DMM	Discarded Military Munitions
DoD	Department of Defense
DoD QSM	DoD Quality Systems Manual
DQCR	Daily Quality Control Report
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
FS	Feasibility Study
FSP	Field Sampling Plan
FUDS	Formerly Used Defense Sites
FUDSMIS	FUDS Management Information Center
FY	Fiscal Year
HQ USACE	Headquarters, US Army Corps of Engineers
HRR	Historical Records Review
HRS	Hazard Ranking System
HTRW	Hazardous, Toxic, and Radioactive Waste
HTRW CX	Hazardous, Toxic, and Radioactive Waste Center of Expertise
IAW	In Accordance With
IDIQ	Indefinite Delivery/Indefinite Quantity
IDL	Instruction Detection Limit
IDW	Investigation Derived Waste
IMA	Installation Management Agency
INPR	Inventory Project Report

ITR	Independent Technical Review
LCS	Laboratory Control Sample
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MEC	Munitions and Explosives of Concern
MM CX	Military Munitions Center of Expertise
MM DC	Military Munitions Design Center
MMR	Military Munitions Response
MMRP	Military Munitions Response Program
MRA	Munitions Response Area
MRSPP	Munitions Response Site Prioritization Protocol
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NCP	National Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program
NDAI	No DoD Action Indicated
NTU	Nephelometric Turbidity Unit
OB/OD	Open Burn/Open Detonation
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PARCC	Precision, Accuracy, Representativeness, Completeness, Comparability
PDT	Product Delivery Team
PgMP	Program Management Plan
PMP	Project Management Plan
PM	Project Manager
POC	Point of Contact
Ppb	Parts per billion
PPE	Personal Protective Equipment
Ppm	Parts per million
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
PWS	Performance Work Statement
PSAP	Programmatic Sampling and Analysis Plan
QA	Quality Assurance
QAO	Quality Assurance Objective
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCSR	Quality Control Summary Report
RACER	Remedial Action Cost Engineering & Requirements
RBC	Risk Based Concentration
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference

RSC	Range Support Center
RT	Retention Time
SEDD	Staged Electronic Data Deliverable
SI	Site Inspection
SOP	Standard Operating Procedure
SOW	Statement of Work
SSC	Site Safety Coordinator
SS-FSP	Site-Specific Field Sampling Plan
SS-QAPP	Site-Specific Quality Assurance Project Plan
SS-SAP	Site-Specific Sampling and Analysis Plan
SS-WP	Site-Specific Work Plan
TAL	Target Analyte List
TPP	Technical Project Planning
U.S.	United States
USACE	United States Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USEPA	U.S. Environmental Protection Agency
UXO	Unexploded Ordnance
WP	Work Plan

SYMBOLS

°C	Degrees Celsius
µmhos/cm ²	micromhos per square centimeter
µg/kg	microgram per kilogram
mg/kg	milligram per kilogram

INTRODUCTION

The United States Army Corps of Engineers (USACE) Military Munitions Center of Expertise (MM CX) has prepared the following Programmatic Sampling and Analysis Plan (PSAP) (consisting of the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP)) for the Military Munitions Response Program (MMRP) Site Inspections (SIs) of MMRP eligible sites at various Formerly Used Defense Sites (FUDS) across the United States (U.S.).

This PSAP provides general information and standard operating procedures applicable to anticipated sampling and analytical activities to be performed at all properties where MMRP SIs are being conducted by any contractor on behalf of any Military Munitions Design Center (MM DC). The information includes definitions and generic goals for data quality and minimum requirements for quality assurance/ quality control (QA/QC) samples. The procedures address sampling and decontamination protocols; geophysical investigation; field documentation; sample handling, custody, and shipping; instrument calibration and maintenance; field and laboratory auditing; data reduction, validation, and reporting; corrective action requirements; and quality assurance reporting. It should be noted that the PSAP may include discussions on procedures or methods that are not applicable to a specific site since it is intended to encompass all sites.

A PSAP addendum for inclusion in the Programmatic Work Plan for each region is being prepared to provide each Contractor's specific procedures, as well as their subcontractor laboratory's specific procedures, detection and quantitation limits, and precision and accuracy criteria. Note that if the laboratory's criteria are wider than those prescribed in this PSAP, the PSAP criteria have precedent.

A Site Specific SAP (SS-SAP) consisting of a Site-Specific FSP (SS-FSP) and a Site-Specific QAPP (SS-QAPP) will be prepared for each individual property where a Site Inspection is being conducted by a contractor. The SS-SAPs will serve as addendums to this PSAP. It is intended that once the PSAP is finalized, it will not be modified (except for programmatic changes) and will serve as a programmatic document. Site-specific sampling information and any exceptions or proposed changes to the PSAP will be addressed and included in the SS-SAP. If there are sampling and analytical activities that were not anticipated in the PSAP, they must be addressed in the SS-SAP. The majority of information contained in this PSAP should not be repeated in the SS-SAP. The appropriate EPA Region and State Regulatory Agency chemical-specific data quality objectives will be included in each SS-SAP to ensure that the analytical methods selected can achieve State reporting requirements. The methods specific to each site should specify the appropriate detection limit and reporting limit information. Any deviations from this PSAP (e.g., analytical methods, holding times, detection limits, sampling methods, etc.) should be brought to the attention of the USACE Project Manager.

USACE, CESPD Range Support Center	FUDS MMRP SI Regional Program Manager	Monique Ostermann CESPA-EC-EG (Ostermann) 4101 Jeff Plaza NE Albuquerque, NM 87109	(505) 342-3475
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2.1 USACE.

USACE is the executing organization for the MMRP Site Inspections and is responsible for ensuring each inspection is completed in accordance with ER 200-3-1 and other USACE guidance documents. .

2.1.1 Headquarters, USACE.

Headquarters, USACE (HQUSACE) oversees the management and direction of all FUDS activities, including MMRP SIs. The Chief of the DoD Environmental Support (FUDS) Team at HQ (CEMP-DE) is Mr. Robert Lubbert, and the Team Leader for FUDS MMRP activities is Mr. James Coppola. HQ is providing an SI Program Liaison (Ms. Julie Kaiser) to conduct oversight and participate in overall management of the SI program, in close coordination with the MM CX.

As FUDS program manager, HQUSACE is responsible for the following specific MMRP SI activities:

- 1) Review and approve the Program Management Plan (PgMP) and all subsequent programmatic documents
- 2) Track the PgMP and execution milestones
- 3) Report program and project information to Department of the Army (DA) and the Office of the Secretary of Defense (OSD)
- 4) Take action to correct substantial underachievement, including reporting to the Chief of the DoD Environmental Support Team immediately
- 5) Using the most recent Annual Report to Congress (ARC) dataset, develop the baseline list of MMRP projects requiring an SI, including official parametric cost estimate (using the Remedial Action Cost Engineering & Requirements (RACER) 2005 system)
- 6) Develop an executive summary of actions required for each project with significantly different scopes of work; ensure scopes correspond with those developed for 2005 SI estimates using RACER 2005
- 7) With SI Cost-to-Completes (CTCs) as a baseline, generate proposed funding for the MMRP SIs to present to DA and OSD in FY06-10 to complete all SIs
- 8) Ensure funding is distributed to appropriate organizations
- 9) Ensure FUDS Management Information System (FUDSMIS) accurately reflects completion of SIs

2.1.2 Military Munitions Center of Expertise.

HQUSACE has delegated responsibility for centralized management of the MMRP SI program to the MM CX in Huntsville, Alabama. The Program Manager (Mr. Bradford McCowan) will work with the HQ Program Liaison to provide overall oversight and guidance for all work performed. The Program Manager will coordinate SI execution activities with the FUDS Geographic Districts and MM Design Centers.

The Program Manager is responsible for the following specific activities:

- 1) Finalize the PgMP and develop the PSAP
- 2) Coordinate closely with HQUSACE, MM Design Centers, FUDS geographic Divisions and Districts, and the Contractors, as needed, to ensure high-quality project-specific documents and field work, consistent with program objectives and the generic Statement of Work (SOW) and project plans
- 3) Work with the FUDS Geographic District Project Managers to schedule and assign projects to the appropriate MM Design Center for execution
- 4) Using the baseline established by HQ under 2.1.1. 5) and 6) above, develop an SI execution plan for FY06 through FY10 that includes a prioritized execution list of projects based on program objectives, safety, health, or ecological risk, and available funding; include estimated costs for each SI
- 5) Annually, for the current year FUDS work plan, coordinate with Divisions and Districts to develop a list of projects to undergo SIs
- 6) Notify Divisions and Districts of the annual list of SI projects with an estimate for the contract effort to perform each SI; provide list to the MM Design Centers and request estimated in-house costs for each project
- 7) Provide instructions to the Divisions when transfer of (or authorization to use) funds is required
- 8) Provide upward reporting to HQUSACE of all SI activities
- 9) Within 90 days of end of current year, provide report of funds programmed vs. funds obligated and reconcile against total annual program budget amounts

2.1.3 Military Munitions Design Centers.

The MM Design Centers will provide the Regional Program Managers, Project Managers (PMs), and other members of their Product Delivery Teams (PDTs) as documented in their Project Management Plans (PMPs) for execution of specific SIs. Each MM Design Center will utilize USACE assets (i.e., local districts and the appropriate contractors) to perform the research and fieldwork required. The PM for the Design Center is responsible for the following SI activities, which will be closely coordinated with the SI Program Manager, Geographic District PMs, Geographic Divisions, and Contractors, as needed:

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- 1) Successful completion of all specific elements in order
- 2) Timely submission of the completed SI schedule and allocated budget
- 3) Ensure that appropriate coordination is maintained with the FUDS geographic district
- 4) Conduct technical reviews of work plans and reports
- 5) Perform other QA/QC functions, as required
- 6) Conduct oversight of contractor work efforts
- 7) Provide monthly status reports to the Program Manager (be a consolidated report from the contractor for all activities)
- 8) Annually and as-needed, MM Design Centers will submit costs for executing the SIs to both the District Manager

The Design Centers will manage the contracts and execute the SIs for conventional munitions will be allocated to the four IMA Management Agencies (IMA). Each MM Design Center will

2.1.3.1 USACE, Baltimore MM Design Center

The U.S. Army Engineer District, Baltimore (CENAB) will conduct inspections located in the northeastern U.S. (following the IMA region.). The following states fall under Baltimore conducting the SIs: Connecticut, Maine, Vermont, Delaware, North Carolina, Kentucky, New Jersey, New Hampshire, Rhode Island, Virginia, Washington D.C., West Virginia. The DC is Mr. Leland Reeser.

2.1.3.2 USACE, Omaha MM Design Center

The U.S. Army Engineer District, Omaha (CENWO) will conduct inspections in the northwest and central U.S. (following the northwest IMA region.). DC's MMRP SI region includes the following states: Montana, Wyoming, Colorado, North Dakota, South Dakota, Minnesota, Indiana, Wisconsin, Illinois, Iowa, Missouri. Omaha MM DC is Mr. Robert Zaruba.

2.1.3.3 USACE, South Pacific Division Range Support Center

The U.S. Army Engineer Division (CESPD) Range Support Center (RSC) is responsible for the inspections located in the southwestern U.S. (following the southwestern IMA region boundaries). This includes the states of Arizona, California, New Mexico, Nevada, Utah, New Mexico, Texas, Oklahoma, Arkansas, and Louisiana. The SPD Range Support Center PM, located at the U.S. Army Engineer District, Albuquerque (CESPA), is Ms. Monique Ostermann.

2.1.3.4 USACE, Huntsville MM Design Center

The U.S. Army Engineering Support Center-Huntsville (USAESCH) MM DC is responsible for the southeastern U.S. and USACE Pacific Ocean Division (following the southeast and Pacific IMA region boundaries). This includes the states of South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi, Alaska, Hawaii, Pacific Island Territories, and Puerto Rico. The Huntsville MM DC PM is Ms. Chris Cochrane.

2.1.3.5 USACE, Chemical Warfare Materiel Design Center

The USACE Chemical Warfare Materiel (CWM) DC, located in Huntsville, Alabama, is responsible for all SIs suspected of having Chemical Warfare Materiel. This PSAP does not address requirements related specifically to CWM. The CWM DC PM is Ms. Betina Johnson.

2.1.4 FUDS Geographic Districts.

The FUDS Geographic Districts are responsible for providing overall project management of the SIs, as the ultimate responsibility for the execution of DERP-related FUDS work lies with the districts. As such, the Geographic District PMs are responsible for the following activities, which will be closely coordinated with the Program Manager, FUDS Geographic Divisions, and Contractors, as needed.

- 1) Annually, work with the Program Manager to identify projects on which to conduct SIs for the current and budget years
- 2) Program funds for approved MM SIs in FUDSMIS; ensure that total costs, including contract and in-house costs for both the geographic district and MM Design Centers, are included in the FUDS annual work plan
- 3) Obtain rights of entry with property owners to conduct field work
- 4) Coordinate and communicate project planning activities with regulators and other key stakeholders in accordance with the TPP process
- 5) Coordinate with regulators and other stakeholders for their reviews and comments on SI work plans and reports

2.2 Contractors.

Each USACE MM Design Center will utilize contracts to execute the majority of its projects and tasks. For Fiscal Year 2005 (FY05), Huntsville's MMRP Indefinite Delivery/Indefinite Quantity (IDIQ) contracts will be used. After award, the Task Orders will be transferred to the appropriate MM DC for execution. For FY06, the FY05 task orders will be modified to address additional sites for execution. For succeeding FYs, other MMRP contractors may be used, provided the contracts contain the appropriate requirements to ensure work is done in accordance with USACE policy for ordnance work. The Contractors' team shall consist of members who have extensive experience in conducting site inspections for MC and MEC.

2.2.1 Project Manager.

The Contractor's Project Manager shall coordinate all efforts on this project including contact with the USACE PM, travel for the project team, and submission of all deliverables.

2.2.2 Ordnance Expert Team.

The Contractor's ordnance expert team will provide a technical expert to review ordnance data and military use of the property. The team will also serve in a QC role, and will consult with the project staff on specific ordnance issues.

2.2.3 Chemical Quality Control Officer

The Chemical Quality Control Officer shall ensure that all chemistry related objectives including responsibilities for DQO definitions, sampling and analysis, project requirements for data documentation and validation, and final project reports are attained.

2.2.4 Database/Technical Support Team.

The Contractor's technical support team will report directly to its Project Manager. The team will establish procedures to ensure all electronic deliverables are submitted in accordance with approved protocols. As such, the technical team will perform quality control reviews of data collection and prepared documents.

2.3 Subcontractor Laboratories.

The laboratories selected to perform analyses for samples collected at MMRP eligible sites must be capable of providing complete environmental analytical services consistent with US Environmental Protection Agency (USEPA) protocols, certified under the National Environmental Laboratory Accreditation Program (NELAP), and verified by the MM CX or the executing MM DC as compliant with the most current version of the

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3.0 PROGRAM SCOPE AND OBJECTIVES

The primary objective of the MMRP SI is to determine whether the FUDS project warrants further response action pursuant to CERCLA and the National Contingency Plan (NCP) or no Department of Defense action indicated (NDAI). The SI will collect the minimum amount of information necessary to (i) eliminate from further consideration those releases that pose no significant threat to public health or the environment; (ii) determine the potential need for a time critical removal action; (iii) collect or develop additional data, appropriate for Hazard Ranking System (HRS) scoring by USEPA; and (iv) collect data, as appropriate, to characterize the release for effective and rapid initiation of the remedial investigation and feasibility study (RI/FS). A secondary objective of the MMRP SI is to collect the appropriate data to complete the Munitions Response Site Prioritization Protocol (MRSPP).

The SI is conducted on individual projects on a FUDS property that are identified via the Archive Search Report (ASR) or PA and documented in project summaries in the property-level inventory project report (INPR). The SI is designed to confirm the presence of MEC or MC contamination identified in the PA phase on ranges or other Military Munitions Response (MMR) areas identified in the ASR or range inventory efforts. SIs will be conducted only on FUDS eligible projects and will address both potential MEC and MC hazards. If separate hazardous, toxic, or radioactive waste (HTRW) concerns are observed during the SI, the project team will notify the FUDS Geographic District for potential addition of an HTRW project.

3.1 Task Description

The MM DCs and their Contractors will execute site inspections in accordance with CERCLA and NCP requirements for all MMRP properties. These site inspections will include MEC and MC concurrently.

3.1.1 *Munitions and Explosives of Concern*

The goal of the SI for MEC is to find sufficient evidence that UXO or DMM is present or not on the site. The conduct of this portion of the SI should be such that exclusion zone impacts, engineering control requirements, clearing and grubbing efforts, and MEC disposal activities are minimized. In most cases, encountering just one MEC item will be sufficient to determine that an RI/FS is necessary for a particular MMRP site. There is no need during the SI work to determine all types of MEC present, MEC density, or the exact limits of the problem. The level of effort for the MEC site inspection will be determined for each MMRP site based on the following order preference:

1. No Site Visit required: There is already sufficient historical evidence that MEC is present.

Neither the Contractor's PSAP Addendum nor the SS-SAP should be a stand-alone document from this PSAP. The PSAP provides the majority of the QA/QC information; the Addendum should supplement this information with Contractor and Laboratory specific information and the SS-SAP should supplement this information with any changes due to site-specific condition requirements.

FINAL

FIELD SAMPLING PLAN

MILITARY MUNITIONS RESPONSE PROGRAM

SITE INSPECTIONS

SEPTEMBER 2005

1.0 PROGRAM BACKGROUND

The US Army Corps of Engineers (USACE) has inventoried all of the known Formerly Used Defense Sites (FUDS) with Munitions Constituents (MC) and Munitions and Explosives of Concern (MEC), which include Unexploded Ordnance (UXO), Discarded Military Munitions (DMM), and MC at explosive concentrations, (referred to as sites hence forth) to meet new reporting requirements and to support its management and estimating activities. The inventory effort has identified FUDS properties that have a potential for MEC and MC. The Preliminary Assessment (PA) phase for the FUDS properties is almost complete, and the Site Inspection (SI) is the next phase in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. This will complete the PA/SI requirement for Military Munitions Response Program (MMRP) on FUDS properties. It is intended that the identified MMRP sites be addressed via the CERCLA process. USACE executes the Defense Environmental Restoration Program (DERP) at FUDS and thus, oversees the management of the MMRP at FUDS.

2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

Roles and responsibilities for the FUDS MMRP SI Program are as defined below. Program and project team members with corresponding addresses and telephone numbers are provided below. Figure 1 displays the structure of the MMRP-SI team. General organization and responsibilities of the executing Contractor and Subcontractor Laboratories are also described below. Project-specific responsibilities (to include any additional subcontractors) will be identified and discussed in detail in the PSAP Addendum and/or the SS-SAP.

Organization	Position	Name & Address	Phone
HQUSACE DoD- Environmental Support Team	HQ-FUDS MMRP SI Program Liaison	Julie Kaiser CEMP-DE 441 G St. NW Washington, D.C. 20314	(202) 761-5538
USACE, MM CX	MMRP SI Program Manager	Bradford McCowan CEHNC-MM-CX 4280 University Square Huntsville, AL 35807	(256) 895-1174
USACE, MM CX	FUDS MMRP SI MC Advisor	Deborah Walker CEHNC-MM-CX 4280 University Square Huntsville, AL 35807	(256) 895-1796
USACE, HTRW CX	FUDS MMRP SI MC Advisor	Michael Crain CENWO-HX-G 12565 W. Center Road Omaha, NE 68144	(402) 697-2657
USACE, CENAB MM Design Center	FUDS MMRP SI Regional Program Manager	Leland Reeser CENAB-EN-HN (Reeser) 10 South Howard Street Room 10040D Baltimore, MD 21201	(410) 962-2186
USACE, USAESCH MM Design Center	FUDS MMRP SI Regional Program Manager	Chris Cochrane CEHNC-OE-DC (Cochrane) 4820 University Square Huntsville, AL 35807	(256) 895-1696
Chemical Warfare Materiel (CWM) Design Center	FUDS MMRP SI CWM Program Manager	Betina Johnson CEHNC-OE-CW 4820 University Square Huntsville, AL 35807	(256) 895-1238
USACE, CENWO MM Design Center	FUDS MMRP SI Regional Program Manager	Robert K. Zaruba CENWO-PM-HB (ZARUBA) 106 South 15 th Street Omaha, NE 68102-1618	(402) 221-7659

USACE, CESPD Range Support Center	FUDS MMRP SI Regional Program Manager	Monique Ostermann CESPA-EC-EG (Ostermann) 4101 Jeff Plaza NE Albuquerque, NM 87109	(505) 342-3475
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2.1 USACE.

USACE is the executing organization for the MMRP Site Inspections and is responsible for ensuring each inspection is completed in accordance with ER 200-3-1 and other USACE guidance documents. .

2.1.1 Headquarters, USACE.

Headquarters, USACE (HQUSACE) oversees the management and direction of all FUDS activities, including MMRP SIs. The Chief of the DoD Environmental Support (FUDS) Team at HQ (CEMP-DE) is Mr. Robert Lubbert, and the Team Leader for FUDS MMRP activities is Mr. James Coppola. HQ is providing an SI Program Liaison (Ms. Julie Kaiser) to conduct oversight and participate in overall management of the SI program, in close coordination with the MM CX.

As FUDS program manager, HQUSACE is responsible for the following specific MMRP SI activities:

- 1) Review and approve the Program Management Plan (PgMP) and all subsequent programmatic documents
- 2) Track the PgMP and execution milestones
- 3) Report program and project information to Department of the Army (DA) and the Office of the Secretary of Defense (OSD)
- 4) Take action to correct substantial underachievement, including reporting to the Chief of the DoD Environmental Support Team immediately
- 5) Using the most recent Annual Report to Congress (ARC) dataset, develop the baseline list of MMRP projects requiring an SI, including official parametric cost estimate (using the Remedial Action Cost Engineering & Requirements (RACER) 2005 system)
- 6) Develop an executive summary of actions required for each project with significantly different scopes of work; ensure scopes correspond with those developed for 2005 SI estimates using RACER 2005
- 7) With SI Cost-to-Completes (CTCs) as a baseline, generate proposed funding for the MMRP SIs to present to DA and OSD in FY06-10 to complete all SIs
- 8) Ensure funding is distributed to appropriate organizations
- 9) Ensure FUDS Management Information System (FUDSMIS) accurately reflects completion of SIs

2.1.2 Military Munitions Center of Expertise.

HQUSACE has delegated responsibility for centralized management of the MMRP SI program to the MM CX in Huntsville, Alabama. The Program Manager (Mr. Bradford McCowan) will work with the HQ Program Liaison to provide overall oversight and guidance for all work performed. The Program Manager will coordinate SI execution activities with the FUDS Geographic Districts and MM Design Centers.

The Program Manager is responsible for the following specific activities:

- 1) Finalize the PgMP and develop the PSAP
- 2) Coordinate closely with HQUSACE, MM Design Centers, FUDS geographic Divisions and Districts, and the Contractors, as needed, to ensure high-quality project-specific documents and field work, consistent with program objectives and the generic Statement of Work (SOW) and project plans
- 3) Work with the FUDS Geographic District Project Managers to schedule and assign projects to the appropriate MM Design Center for execution
- 4) Using the baseline established by HQ under 2.1.1. 5) and 6) above, develop an SI execution plan for FY06 through FY10 that includes a prioritized execution list of projects based on program objectives, safety, health, or ecological risk, and available funding; include estimated costs for each SI
- 5) Annually, for the current year FUDS work plan, coordinate with Divisions and Districts to develop a list of projects to undergo SIs
- 6) Notify Divisions and Districts of the annual list of SI projects with an estimate for the contract effort to perform each SI; provide list to the MM Design Centers and request estimated in-house costs for each project
- 7) Provide instructions to the Divisions when transfer of (or authorization to use) funds is required
- 8) Provide upward reporting to HQUSACE of all SI activities
- 9) Within 90 days of end of current year, provide report of funds programmed vs. funds obligated and reconcile against total annual program budget amounts

2.1.3 Military Munitions Design Centers.

The MM Design Centers will provide the Regional Program Managers, Project Managers (PMs), and other members of their Product Delivery Teams (PDTs) as documented in their Project Management Plans (PMPs) for execution of specific SIs. Each MM Design Center will utilize USACE assets (i.e., local districts and the appropriate contractors) to perform the research and fieldwork required. The PM for the Design Center is responsible for the following SI activities, which will be closely coordinated with the SI Program Manager, Geographic District PMs, Geographic Divisions, and Contractors, as needed:

- 1) Successful completion of all specific elements of the project-specific task order
- 2) Timely submission of the completed SI deliverables within the agreed schedule and allocated budget
- 3) Ensure that appropriate coordination is maintained between the contractor and the FUDS geographic district
- 4) Conduct technical reviews of work plans and reports
- 5) Perform other QA/QC functions, as required
- 6) Conduct oversight of contractor work efforts
- 7) Provide monthly status reports to the Program Manager on each SI (this can be a consolidated report from the contractor that includes the design center activities)
- 8) Annually and as-needed, MM Design Centers will provide estimated in-house costs for executing the SIs to both the District PM and the SI Program Manager

The Design Centers will manage the contracts and execute the SI in accordance with ER 200-3-1 and other applicable USACE guidance. SIs for projects suspected of containing only conventional munitions will be allocated to the four MM Design Centers according to location, following the boundaries associated with the Army's Installation Management Agencies (IMA). Each MM Design Center will be allocated SIs as follows.

2.1.3.1 USACE, Baltimore MM Design Center

The U.S. Army Engineer District, Baltimore (CENAB) MM DC is responsible for inspections located in the northeastern U.S. (following the boundaries of the northeast IMA region.). The following states fall under Baltimore's area of responsibility for conducting the SIs: Connecticut, Maine, Vermont, Delaware, Massachusetts, Maryland, North Carolina, Kentucky, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island, Virginia, Washington D.C., West Virginia. The PM for the Baltimore MM DC is Mr. Leland Reeser.

2.1.3.2 USACE, Omaha MM Design Center

The U.S. Army Engineer District, Omaha (CENWO) MM DC is responsible for the northwest and central U.S. (following the northwest IMA region boundaries). This MM DC's MMRP SI region includes the following states: Washington, Oregon, Idaho, Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Indiana, Wisconsin, Illinois, Iowa, Missouri, and Ohio. The PM for the Omaha MM DC is Mr. Robert Zaruba.

2.1.3.3 USACE, South Pacific Division Range Support Center

The U.S. Army Engineer Division (CESPD) Range Support Center (RSC) is responsible for the inspections located in the southwestern U.S. (following the southwestern IMA region boundaries). This includes the states of Arizona, California, New Mexico, Nevada, Utah, New Mexico, Texas, Oklahoma, Arkansas, and Louisiana. The SPD Range Support Center PM, located at the U.S. Army Engineer District, Albuquerque (CESPA), is Ms. Monique Ostermann.

2.1.3.4 USACE, Huntsville MM Design Center

The U.S. Army Engineering Support Center-Huntsville (USAESCH) MM DC is responsible for the southeastern U.S. and USACE Pacific Ocean Division (following the southeast and Pacific IMA region boundaries). This includes the states of South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi, Alaska, Hawaii, Pacific Island Territories, and Puerto Rico. The Huntsville MM DC PM is Ms. Chris Cochrane.

2.1.3.5 USACE, Chemical Warfare Materiel Design Center

The USACE Chemical Warfare Materiel (CWM) DC, located in Huntsville, Alabama, is responsible for all SIs suspected of having Chemical Warfare Materiel. This PSAP does not address requirements related specifically to CWM. The CWM DC PM is Ms. Betina Johnson.

2.1.4 FUDS Geographic Districts.

The FUDS Geographic Districts are responsible for providing overall project management of the SIs, as the ultimate responsibility for the execution of DERP-related FUDS work lies with the districts. As such, the Geographic District PMs are responsible for the following activities, which will be closely coordinated with the Program Manager, FUDS Geographic Divisions, and Contractors, as needed.

- 1) Annually, work with the Program Manager to identify projects on which to conduct SIs for the current and budget years
- 2) Program funds for approved MM SIs in FUDSMIS; ensure that total costs, including contract and in-house costs for both the geographic district and MM Design Centers, are included in the FUDS annual work plan
- 3) Obtain rights of entry with property owners to conduct field work
- 4) Coordinate and communicate project planning activities with regulators and other key stakeholders in accordance with the TPP process
- 5) Coordinate with regulators and other stakeholders for their reviews and comments on SI work plans and reports

- 6) Hold public meetings and conduct other community involvement activities, as needed
- 7) Establish and maintain a permanent project record and information repository, as needed
- 8) Review and comment on the project-specific SI work plans and SI reports
- 9) Work closely with the MM Design Center to monitor planning and execution of the SI field work

2.1.5 Geographic Divisions.

The Geographic Division FUDS Program Manager will be available to assist in coordination among Corps Districts within the Division, MM Design Centers, and the MM CX. The Division will assist the Districts in coordinating with the Program Manager to annually identify and scope specific SI projects and ensuring the correct funds are programmed for the project SI phase in FUDSMIS.

2.1.6 MC Advisors.

Both the HTRW and MM CXs have provided one individual to act as MC Advisors on the FUDS MMRP SI PDT (Michael Crain, Hazardous, Toxic, and Radioactive Waste Center of Expertise (HTRW CX) and Deborah Walker, MM CX). These advisors developed the PSAP and will ensure that project-specific objectives for evaluating MC in accordance with Data Quality Objectives (DQOs) are accounted for during Technical Project Planning (TPP) and work plan development. These PDT members also will ensure that adequate QA/QC reviews of the sample analytical results are conducted.

2.1.7 Independent Technical Review Team.

The Independent Technical Review (ITR) team is responsible for reviewing the contractor's work to ensure performance of the Performance Work Statement (PWS). This team will develop the necessary procedures, control checks, and process correction/improvement actions needed to ensure that the SI data is collected, processed, and prepared in the most accurate and timely process possible. The MM CX will designate an ITR team point of contact (POC) who will coordinate QA/QC activities between the design centers and the ITR team, in accordance with ER 200-3-1. The ITR team will consist of a pool of individuals from a variety of disciplines (e.g., geologists, chemists, etc.), and individual teams will be formed from this pool. ITR reviews do not relieve the Districts, Design Centers, and Divisions from performing their normal and required QA/QC roles.

2.2 Contractors.

Each USACE MM Design Center will utilize contracts to execute the majority of its projects and tasks. For Fiscal Year 2005 (FY05), Huntsville's MMRP Indefinite Delivery/Indefinite Quantity (IDIQ) contracts will be used. After award, the Task Orders will be transferred to the appropriate MM DC for execution. For FY06, the FY05 task orders will be modified to address additional sites for execution. For succeeding FYs, other MMRP contractors may be used, provided the contracts contain the appropriate requirements to ensure work is done in accordance with USACE policy for ordnance work. The Contractors' team shall consist of members who have extensive experience in conducting site inspections for MC and MEC.

2.2.1 Project Manager.

The Contractor's Project Manager shall coordinate all efforts on this project including contact with the USACE PM, travel for the project team, and submission of all deliverables.

2.2.2 Ordnance Expert Team.

The Contractor's ordnance expert team will provide a technical expert to review ordnance data and military use of the property. The team will also serve in a QC role, and will consult with the project staff on specific ordnance issues.

2.2.3 Chemical Quality Control Officer

The Chemical Quality Control Officer shall ensure that all chemistry related objectives including responsibilities for DQO definitions, sampling and analysis, project requirements for data documentation and validation, and final project reports are attained.

2.2.4 Database/Technical Support Team.

The Contractor's technical support team will report directly to its Project Manager. The team will establish procedures to ensure all electronic deliverables are submitted in accordance with approved protocols. As such, the technical team will perform quality control reviews of data collection and prepared documents.

2.3 Subcontractor Laboratories.

The laboratories selected to perform analyses for samples collected at MMRP eligible sites must be capable of providing complete environmental analytical services consistent with US Environmental Protection Agency (USEPA) protocols, certified under the National Environmental Laboratory Accreditation Program (NELAP), and verified by the MM CX or the executing MM DC as compliant with the most current version of the

Department of Defense Quality Systems Manual (DoD QSM). Prior to execution, each contractor must submit detailed information regarding the laboratory personnel, facilities and procedures for any laboratory they plan to use for this program.

3.0 PROGRAM SCOPE AND OBJECTIVES

The primary objective of the MMRP SI is to determine whether the FUDS project warrants further response action pursuant to CERCLA and the National Contingency Plan (NCP) or no Department of Defense action indicated (NDAI). The SI will collect the minimum amount of information necessary to (i) eliminate from further consideration those releases that pose no significant threat to public health or the environment; (ii) determine the potential need for a time critical removal action; (iii) collect or develop additional data, appropriate for Hazard Ranking System (HRS) scoring by USEPA; and (iv) collect data, as appropriate, to characterize the release for effective and rapid initiation of the remedial investigation and feasibility study (RI/FS). A secondary objective of the MMRP SI is to collect the appropriate data to complete the Munitions Response Site Prioritization Protocol (MRSPP).

The SI is conducted on individual projects on a FUDS property that are identified via the Archive Search Report (ASR) or PA and documented in project summaries in the property-level inventory project report (INPR). The SI is designed to confirm the presence of MEC or MC contamination identified in the PA phase on ranges or other Military Munitions Response (MMR) areas identified in the ASR or range inventory efforts. SIs will be conducted only on FUDS eligible projects and will address both potential MEC and MC hazards. If separate hazardous, toxic, or radioactive waste (HTRW) concerns are observed during the SI, the project team will notify the FUDS Geographic District for potential addition of an HTRW project.

3.1 Task Description

The MM DCs and their Contractors will execute site inspections in accordance with CERCLA and NCP requirements for all MMRP properties. These site inspections will include MEC and MC concurrently.

3.1.1 Munitions and Explosives of Concern

The goal of the SI for MEC is to find sufficient evidence that UXO or DMM is present or not on the site. The conduct of this portion of the SI should be such that exclusion zone impacts, engineering control requirements, clearing and grubbing efforts, and MEC disposal activities are minimized. In most cases, encountering just one MEC item will be sufficient to determine that an RI/FS is necessary for a particular MMRP site. There is no need during the SI work to determine all types of MEC present, MEC density, or the exact limits of the problem. The level of effort for the MEC site inspection will be determined for each MMRP site based on the following order preference:

1. No Site Visit required: There is already sufficient historical evidence that MEC is present.

2. Surface Inspection only: MEC items are clearly visible on the ground surface.
3. Magnetometer assisted Surface Sweep: MEC items are located on the surface or under vegetative cover.
4. Digital Geophysical Mapping (DGM) with no prove-out and only limited grid, transect, or path survey.
5. DGM with prove-out and only limited grid, transect, or path survey.

3.1.2 Munitions Constituents

The goal of the SI for MC is to find sufficient evidence that contamination is present or absent on the site. The conduct of this portion of the SI should utilize anomaly avoidance techniques. Sampling and analysis should primarily be for explosives and Target Analyte List (TAL) metals. For some sites, white phosphorus, perchlorate, chemical agents, or other MC may be potential contaminants of concern, as well. Testing for other contaminants is generally not recommended, but may be necessary. The total number of samples should be kept to a minimum and approved field screening/testing methods should be used to the maximum extent practical. In most cases, contamination findings that exceed federal or state Maximum Contaminant Levels (MCLs), Preliminary Remediation Goals (PRGs), or Risk Based Concentrations (RBCs) (based on current land use), or background levels (based on previous studies) will be sufficient to determine that an RI/FS is necessary for a particular MMRP site. There is no need during the SI work to determine the nature and extent of all contaminants or to develop sufficient information for a baseline risk assessment. The level of effort for the MC SI will be determined for each MMRP site based on the following order of preference:

1. Surface soil samples: composite samples at firing points, impact areas, low order detonations, or OB/OD areas, or where contamination is most expected.
2. Sediment samples: composite samples in accumulation or high runoff areas.
3. Surface water samples: only in surface water bodies in close proximity to area where contamination is most expected.
4. Groundwater samples: use existing monitoring or water supply wells to maximum extent practical.
5. Surface soil or sediment samples: discrete samples in areas of very high concern.
6. Groundwater samples: install only the minimum number of new wells (1 upgradient, 2 downgradient)

7. Subsurface soil samples: discrete samples only from new well borings or areas of very high concern.
8. Surface water samples: only in impoundment areas where high levels of explosives could accumulate.
9. Background samples: for TAL metals in any matrix sampled, only if no previous studies exist for the installation.

3.2 Screening Criteria

Screening criteria will vary by property. For SI purposes, MC results will be compared to applicable screening standards (such as federal or state MCLs, EPA Region PRGs or RBCs (based on current land use), etc.) and to background (if applicable). Potentially applicable MC screening levels are provided in Table 1.

3.3 Project Schedule

All MMRP SIs must be completed by 2010. The current programmatic schedule is available in the MMRP SI Program Management Plan. Schedules for individual SIs will be provided in the site-specific documentation.

4.0 NONMEASUREMENT DATA ACQUISITION

Nonmeasurement data acquisition will be required for each project. The data anticipated to be required includes:

- Climate,
- Geology and soils,
- Hydrogeology,
- Local relevant habitats, and
- Threatened and endangered species.

This data may be available in a property PA. Each contractor must address how their firm intends to collect this data in their Programmatic Work Plan or PSAP Addendum.

5.0 FIELD ACTIVITIES

The purpose for field activities is to discern the presence or absence of MEC and MC. MC sampling activities should be focused on firing points, suspect/confirmed bomb impact areas (including craters), locations of low-order detonations, and open burn/open detonation (OB/OD) locations. Field activities are described below for each major activity. Information about field QA/QC sample requirements and decontamination follows the activities descriptions. Prior to conducting any field activities, anomaly avoidance measures will be taken. Procedures for these measures should be described in the Contractor's Programmatic Work Plan and site-specific plans in compliance with EP 75-1-2.

5.1 Surface Soil and Sediment

This section provides general procedures for surface soil and sediment sampling. Sampling representativeness should be maximized by collection of composite samples unless regulatory agencies refuse to accept composite sample data. PSAP Addenda and/or SS-SAPs must specify compositing scheme.

5.1.1 Scope and Purpose

The objective is to ensure a representative soil or sediment sample is collected at each designated sampling location to accurately determine presence or absence of MC.

5.1.2 Sampling Surface Soil and Dry Sediments

Surface soil and dry sediment samples will be collected from 0 to 2 inches unless an alternate depth is determined during TPP. If an alternate depth is required, it must be documented in the SS-SAP. Surface soil and dry sediment samples will be collected using either a spoon (0-2") or a hand auger (for depths greater than 2") unless otherwise specified in the SS-SAP. Listed below is the process for collecting soil samples:

1. A new pair of clean disposable latex or nitrile gloves will be donned at each sampling location.
2. Prepare the sampling location by removing all vegetation, roots, etc., from the sampling point.
3. Depending upon desired sampling interval, either spoon off the sample or advance a decontaminated hand auger to the desired sampling depth below ground surface.
4. For surface samples at greater than 2" depths, remove the hand auger from the boring and use a decontaminated stainless steel spoon to remove the sample from the auger boring.

5. Place the sample into a decontaminated bowl (stainless steel or Pyrex®).
6. Once enough sample has been collected, homogenize the sample thoroughly, using at a minimum the quartering method below. When the sample has been completely mixed, fill the sample containers in reverse order according to volatility.
7. After the sample bottles are filled, the caps will be placed on the bottles and the bottles will be packaged for shipment as specified in Section 6.0.
8. QA/QC samples will be collected as specified in Section 5.6.
9. Backfill the boring with the soil removed from the hole and return the site to its original condition to the extent possible.

The cut and quartering technique is as follows:

The sample will be thoroughly mixed in a bowl, and divided into quarters. A portion of the soil will be gathered from two of the quartered sections. This process will be repeated until the amount of soil needed to completely fill the sample containers has been obtained. It is very important that the soil samples be mixed as thoroughly as possible to ensure that the sample is representative of the interval sampled.

If a more stringent mixing technique is planned, contractors should document it in their PSAP Addendum.

5.1.3 Sampling Wet Sediments

The sediment samples should be collected from background or furthest from the source locations first, to minimize the possibility of cross-contamination. Thereafter, the most downstream sediment samples will be collected followed by the next upstream samples. If surface water samples are to be taken at the same location, they should be collected before the sediment samples. The addition of organic matter into the sediment samples should be avoided. The process for collecting sediment samples is as follows:

1. A new pair of clean disposable latex or nitrile gloves will be donned at each sampling location.
2. In shallow streams and ditches that allow wading, sediment samples will be collected by using a decontaminated stainless steel spoon or scoop. In areas where wading is not possible, a hand auger or scoop attached to a pole may be needed to collect sediment samples.

3. While facing upstream, collect the sample by scooping along the bottom of the surface water body. Remove excess water and place the sediment sample into a decontaminated stainless steel bowl.
4. After a sufficient sample volume has been collected into the stainless steel bowl, the sample will be homogenized using the quartering method and then placed into the appropriate sample bottle.
5. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 6.0.
6. QA/QC samples will be collected as specified in Section 5.6.

5.1.4 Records

Soil and sediment sampling records will be kept in the field logbook. The information to be recorded will include the general requirements presented in Section 6. The following records will also be reported:

1. Name and location (including sample interval) of the soil sample and boring.
2. Depth to top of sample and soil description when applicable.
3. Type of equipment used during the soil sampling/boring.
4. Sample location.
5. Sample location conditions (distressed vegetation, presence of MEC or visible MC, water flow, suspended matter, accessibility, presence of organic matter, etc.)
6. For wet sediment samples, a description of how to get to sample point location.

5.2 Subsurface Soil

This section provides procedures for subsurface soil sampling with standard hollow-stem auger drilling rig or similar device.

5.2.1 Scope and Purpose

The objective is to ensure a representative subsurface soil sample is collected at each designated sampling location to accurately determine presence or absence of MC.

5.2.2 Subsurface Soil Sampling With Standard Hollow-Stem Auger Drilling Rig

A stainless steel split spoon sampler will be used to collect subsurface soil samples in borings using a drilling rig, using the following procedure:

1. Determine and clear (for utilities) the boring location through the depot and the local underground facilities locating service. Surface materials such as vegetation may be removed from the boring location.
2. A minimum 2.5" inside diameter hollow stem auger will be used to advance the borehole to the desired subsurface depth.
3. Once the desired sampling depth has been reached, a decontaminated split spoon sampler will be used to retrieve the subsurface soil sample.
4. A new pair of clean disposable latex or nitrile gloves will be donned at each sampling location.
5. The split spoon sampler will be brought to the surface, and opened for sample collection and lithological description.
6. Place the sample aliquot in a decontaminated stainless steel bowl, homogenized using at a minimum the quartering method (see Section 5.1.2), and then fill the remaining sample containers in order of reverse volatility.
7. Once the samples have been collected, they will be packaged as specified in Section 6.0.
8. QA/QC samples will be collected as specified in Section 5.6.
9. Backfill the boring with the soil removed from the hole, place bentonite on the top of the backfilled hole, and restore the boring location to its original condition.

5.2.3 Records

Standard drilling rig records and soil sampling records will be kept in the field logbook. Boring log and well construction forms are provided in Appendix B. The information recorded will include the general requirements presented in Section 6.0, and the following:

1. Name and location of the boring.
2. Date and time that the boring/sampling was conducted.
3. Depth to top of sample and sample collection interval.

4. Names of the persons on-site and of the company conducting the borings.
5. Lithological description of subsurface soils for each boring location.
6. Length of split spoon sampler and amount of recovered sample.

5.3 Groundwater

This section provides procedures for groundwater sampling with a Geoprobe™ or similar device, from monitoring wells, and from water supply wells.

5.3.1 Scope and Purpose

The objective is to ensure a representative groundwater sample is collected at each designated sampling location to accurately determine presence or absence of MC.

5.3.2 Sampling Groundwater using a Geoprobe™

The procedure to be used when advancing Geoprobe™ borings and extracting groundwater samples is as follows:

1. Prior to advancing the Geoprobe™, underground utilities in the area will be identified.
2. A new pair of clean disposable latex or nitrile gloves will be donned at each sampling location.
3. The Geoprobe™ borings will be advanced to just below the water table.
4. The outer sleeve will be retracted exposing the inner stainless steel screen.
5. Sample will be obtained using a peristaltic pump, tubing and check ball system, or a mini bailer.
6. In areas with low groundwater yield, a temporary piezometer constructed from pre-cleaned schedule 40 polyvinyl chloride (PVC) (1" diameter) will be placed in the Geoprobe borehole after the downhole tools have been removed.
7. If the boring yields sufficient water to allow for sample collection completion within one hour, a peristaltic pump, tubing and check ball system, or a mini bailer will be used for sample collection per Section 5.3.3.

8. Groundwater will be removed under low-flow conditions to minimize turbidity when filling pre-cleaned, pre-preserved, pre-labeled sample bottles, in order of reverse volatility.
9. If samples for metals analysis contain excessive silt, the samples may be allowed to settle. The less turbid sample will be decanted and sent to the laboratory for analysis.
10. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 6.0.
11. QA/QC samples will be collected as specified in Section 5.6.
12. Conductivity, pH, turbidity, and temperature will be measured after sample collection. The measurements will be recorded in the field logbook.
13. Once the sample collection process has been completed, the temporary casing will be removed and the borehole will be backfilled with soil removed from the hole. If the hole is not completely backfilled to ground surface with the soil removed from the hole, bentonite chips may be used to backfill the remaining space.

5.3.3 Sampling Groundwater from Monitoring Wells

Prior to the collection of groundwater samples, the monitoring wells will be purged to remove the stagnant water which is not representative of aquifer conditions. Purge water disposal will be addressed in the SS-SAP. A new pair of clean disposable latex or nitrile gloves will be donned at each sample location.

The procedures for monitoring well purging and sampling are as follows:

1. Place plastic around wellhead.
2. Unlock protective casing and remove well cap.
3. Immediately (after well cap removal) take an organic vapor reading down the well casing using a photoionization detector and record reading in the field logbook.
4. Measure water level distance from top of casing and sound the total depth. Record in logbook. Check tip of water level indicator for silt or product residue (if either are observed, note in logbook). If free product is suspected, check well first with an appropriate interface probe.
 - a. Lower decontaminated water level indicator into monitoring well until indicator sounds and light is illuminated.

- b. Confirm that the water surface has been contacted by repeatedly raising and lowering the indicator at least three times to ensure a consistent sounding level has been reached.
 - c. Measure and record depth (nearest 0.01 feet) to the water surface from the top of casing in field logbook.
 - d. Lower the indicator to the well bottom and record the total depth.
 - e. Retrieve and decontaminate water level indicator.
5. Calculate volume to remove for purging.
 6. Lower decontaminated purging device into well.
 7. Begin to remove water from the well near the bottom.
 8. Observe and record: odor, color, clarity, turbidity and general water condition in logbook. Also record changes in the physical condition of the monitoring wells that could affect the well integrity.
 9. Temperature, pH, turbidity, and specific conductivity of the groundwater will be measured and recorded periodically during well purging. To ensure that equilibrium has been established, three consecutive readings will be recorded where one casing volume is pumped between each reading. The sample may be collected after the water has cleared sufficiently and the temperature, turbidity, pH, and conductivity have stabilized. Stabilization is defined as follows: temperature ± 1 degree Celsius ($^{\circ}\text{C}$), turbidity $\pm 10\%$, pH ± 0.1 S.U., and conductivity ± 10 micromhos/square centimeter ($\mu\text{mhos}/\text{cm}^2$). The goal for turbidity measurements is 50 Nephelometric Turbidity Units (NTU) or less. If this cannot be achieved, and the turbidity has stabilized, the Contractor's project manager and MM DC will be contacted to discuss selection of appropriate actions.
 10. At least 3 to 5 well volumes should be removed for purging to be considered complete. Wells with little or no recharge will be purged to near dryness. If a pump is used for well purging, it will be brought to the water surface prior to completion of purging activities to ensure complete removal of stagnant water.

Groundwater sample collection from a monitoring well will continue as follows:

1. Establish that the well has properly recharged (80% of static water level has recovered). Typically, no more than 16 hours should lapse between purge

completion and sample collection, unless the method specified in Item 8 (below) is used.

2. Carefully lower a decontaminated Teflon™ bailer (with a fresh nylon line attached for each well) down the monitoring well. Disposable Teflon™ bailers may also be used.
3. Continue to lower the sample collection device to the desired sampling depth.
4. Raise the bailer and carefully fill pre-cleaned, pre-preserved, and pre-labeled sample bottles in order of reverse volatility.
5. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 6.0.
6. QA/QC samples will be collected as specified in Section 5.6.
7. Conductivity, pH, turbidity, and temperature, will be measured after sample collection. The measurements will be recorded in the field logbook.
8. If the 50 NTU goal for turbidity is not met, and the turbidity has stabilized as defined above, a quiescent sampling procedure may be employed (assuming concurrence by USACE and the regulatory agency). In this method, the well is purged as described, and then allowed to sit overnight. The next day, the bailer will be slowly lowered into the top of the water column, and extracted without causing undo agitation of the water column in the well. The metals aliquot will be collected in this manner first, followed by the remaining parameters.

5.3.4 Sampling Groundwater from Water Supply Wells

Water supply wells that need to be sampled for constituents of concern, and are equipped with an operable pump, will also be purged of stagnant water. To do so, the total depth and diameter of the well should be known or accurately estimated, and it must be determined whether or not a storage tank exists. If a storage tank is present and is located before the sample port location, it must also be purged of stagnant water.

The procedures used for water supply well purging are as follows:

1. Locate a sample port or discharge location.
2. Determine volume to be removed based on total depth and diameter of the well and the storage capacity of the storage tank if it exists.
3. Activate the submersible pump in the well.

4. Begin to remove water from the well, and continue until it has been determined that the stagnant water has been removed based on discharge rate and well construction.
5. Observe and record: odor, color, clarity, turbidity and general water condition in logbook. Also record observed construction of the water supply well.
6. Temperature, pH, turbidity, and specific conductivity of the groundwater will be measured and recorded periodically during water supply purging. To ensure that equilibrium has been established, three consecutive readings will be recorded at five-minute intervals. The sample may be collected after the water has cleared sufficiently and the temperature, turbidity, pH, and conductivity have stabilized. Stabilization is defined as follows: temperature $\pm 1^{\circ}\text{C}$, turbidity $\pm 10\%$, pH ± 0.1 S.U., and conductivity $\pm 10 \mu\text{mhos}/\text{cm}^2$. If well construction information is not available, then the recommended purge time is 15 minutes for a high volume pump.

Groundwater sample collection from a water supply well will be as follows:

1. Purge the well as described previously.
2. At the sampling port carefully fill pre-cleaned, pre-preserved, and pre-labeled sample bottles in order of reverse volatility.
3. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 6.0.
4. QA/QC samples will be collected as specified in Section 5.6.
5. Conductivity, pH, turbidity, and temperature will be measured after sample collection. The measurements will be recorded in the field logbook.

5.3.5 Monitoring Wells Using Low-Flow Method (and for Field-Filtered Samples)

Monitoring wells which contain excess silt and have a low yield will be purged using the low-flow method. This method of purging and well sampling will be used to minimize the volume of purge water removed from the well and to reduce the turbidity in the groundwater samples collected. The pumping device selected should operate at variable speeds to reduce aquifer stress and agitation.

The procedures used for purging a well using the low-flow method are as follows:

1. Place plastic around wellhead.

2. Unlock protective casing and remove well cap.
3. Immediately after well cap removal, take an organic vapor reading down the well casing using a photoionization detector and record reading in the field logbook.
4. Measure water level distance from top of casing and sound the total depth as detailed below. Record in logbook. Check tip of water level indicator for silt or product residue (if either are observed note in logbook).
 - a. Lower decontaminated water level indicator into monitoring well until indicator sounds and light is illuminated.
 - b. Confirm that the water surface has been contacted by repeatedly raising and lowering the indicator at least three times to ensure a consistent sounding level has been reached.
 - c. Measure and record depth (nearest 0.01 feet) to the water surface from the top of casing in field logbook.
 - d. Lower the indicator to the well bottom and record the total depth.
 - e. Retrieve and decontaminate water level indicator.
5. Calculate volume to remove for purging.
6. Lower decontaminated low-flow purging device into well within the screened area of the well producing the highest flow rate. Begin pumping and measure the groundwater elevation to ensure that the aquifer is not being stressed. If significant draw down occurs, reduce the pumping rate. Flow rates should be 100 milliliters per minute or less.
7. Observe and record: odor, color, clarity, turbidity and general water condition in logbook. Also record changes in the physical condition of the monitoring wells that could affect the well integrity.
8. Temperature, pH, turbidity, and specific conductivity of the groundwater quality will be measured and recorded periodically during well purging. The sample may be collected after the water has cleared sufficiently, water quality indicators have stabilized after 3 successive measurements, and at least one well volume has been removed. Stabilization is defined as follows: temperature $\pm 1^{\circ}\text{C}$, turbidity $\pm 10\%$, pH ± 0.1 S.U., and conductivity ± 10 $\mu\text{mhos}/\text{cm}^2$. The goal for turbidity is 50 NTUs.

After the monitoring well is purged, do not turn off the pump or remove it from the well. Groundwater sample collection using the low-flow method is as follows:

1. Purge the monitoring well as described previously.
2. Use the pumping device already in place to collect the samples where turbidity can influence the analytical results (such as metals). Flow rate will be 100 milliliters per minute or less. If field filtering is required, an in-line 45-micron filter will be inserted into the sample intake line.
3. If a peristaltic pump/ vacuum jug assembly or stainless steel and bladder pump were used for purging, continue to collect the remaining samples using these devices. Flow rate will be 100 ml/minute or less.
4. If neither of the devices listed above were used, carefully remove the pump from the well and use a bailer to collect the remaining groundwater samples.
5. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 6.0.
6. QA/QC samples will be collected as specified in Section 5.6.
7. Conductivity, pH, turbidity, and temperature will be measured after sample collection.
8. The measurements will be recorded in the field logbook.

5.3.6 Records

Groundwater sampling records will be recorded in the field logbook. The information recorded will include the general requirements presented in Section 6.0

The following records will be reported for all groundwater sampling:

1. Observations of groundwater condition (see above).
2. Field measurements.

The following records will also be reported for Geoprobe™ sampling:

1. Name and location of the Geoprobe™ sample and boring.
2. Date and time that the Geoprobe™ boring/sampling was conducted.

3. Depth of sample.
4. Name of the persons overseeing and company conducting the Geoprobe™ borings.
5. Type of equipment used during the Geoprobe™ boring and during construction of the temporary piezometers, as well as soil description when applicable.
6. Type of equipment used during sampling, number and type of containers used for sampling purposes, and analyses to be conducted.

5.4 Surface Water

This section provides the procedures for collecting surface water samples.

5.4.1 Purpose

The objective is to ensure a representative surface water sample that is collected in such a manner as to minimize the introduction of sediments into the sample is collected at each designated sampling location to accurately determine presence or absence of MC.

5.4.2 Sampling Surface Water

The surface water sample collection location should be deep enough so the sample bottles can be completely submerged (if possible), in an area with minimal flow or surface disturbance, and free of suspended material. Downstream samples will be collected first and disturbances during wading should be avoided. At locations where both surface water and sediments will be collected, the surface water samples should be collected before sediment samples. The process for collecting surface water samples is as follows:

1. A new pair of clean disposable latex or nitrile gloves will be donned at each sampling location.
2. Facing upstream, submerge pre-labeled sample bottles in the upright position to prevent the loss of preservative into the water. Sediment should not be disturbed during the collection of surface water samples.
3. Allow sample bottle to fill and use bottle cap if necessary to fill the bottle completely. If samples cannot be collected directly into the sample bottle, a decontaminated sample collection device made of glass, stainless steel, or Teflon® may be used.
4. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 6.0.

5. Conductivity, pH, turbidity, and temperature, will be measured after sample collection. The measurements will be recorded in the field logbook.
6. QA/QC samples will be collected as specified in Section 5.6.
7. If filtered samples are required, a Grundfos or equivalent pump will be used to pull the sample through an in-line 45-micron filter. The sample will be drawn directly from the surface water body, or from a sample aliquot collected into a laboratory-supplied, preservative-free sample bottle. The sample will be discharged from the filter line outlet directly into laboratory-supplied pre-preserved sample bottles. Alternate methods, if used, will be described in the SS-SAP.

5.4.3 Records

Surface water sampling records will be kept in the field logbook. The information to be recorded will include the general requirements presented in Section 6.0. The following records will also be reported:

1. Sample location conditions (water flow, suspended matter, accessibility, presence of organic matter, etc.)
2. Description of how to get to sample point location.
3. Field measurements.

5.5 Sample Containers and Preservation Techniques

Sample containers and preservation techniques are provided in Table 2.

5.6 Field QA/QC Sample Requirements

Field QA/QC samples are used to assess the representativeness of the sampling activities. They are designed to determine what effects activities such as sample container cleaning, sample collection, field decontamination, bottling and shipping have on sample integrity and to ensure that samples sent to the laboratory are representative of site conditions. Field QC samples collected in support of this program will include field duplicates, matrix spike/matrix spike duplicate (MS/MSD) samples, and equipment blanks; field QA sample includes field split samples. Unless an alternate basis is agreed upon and documented in the SS-SAP, field QA/QC samples must be collected as follows:

Field Duplicates	1:10 (10%, minimum 1 per Munitions Response Area (MRA))
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QA Splits	1:10 (10%, minimum 1 per MRA)
MS/MSD	1:20 (5%, minimum 1 pair per MRA)
Equipment blanks	1 per day
Temperature blanks	1 per cooler

5.6.1 Field Duplicates

Field duplicates will be collected during the field effort. Duplicate samples are samples collected simultaneously from the same media source under identical conditions, homogenized and split into separate containers. All samples will be homogenized prior to division of split samples to ensure all sub-samples have the same properties. Field duplicates sent to the laboratories will be labeled so that analysts performing laboratory analyses cannot distinguish duplicates from other samples in accordance with the sample numbering requirements in Section 6.4.1.

5.6.2 Matrix Spikes / Matrix Spike Duplicates

For the laboratory analyses, MS/MSDs are used to assess interferences in analytical results caused by the sampled matrix. The analytical laboratory spikes the MS/MSDs with known concentrations of representative target compounds, and then analyzes the MS/MSDs. The percent recovery is calculated and is used to evaluate interference effects. The samples for MS/MSD may be shared with the parent sample container or have its' own containers. The sample volume required in Table 2 will be tripled (for aqueous samples) to ensure enough sample is collected for all MS/MSD analyses. The MS/MSD samples will be labeled in accordance with the sample numbering requirements in Section 6.4.1. Samples collected for metal and explosive analyses only require MS according to NELAP requirements. Instead of an MSD, a matrix duplicate may be analyzed in lieu of the MSD. The lab may decide whether to run MS/MSD or MS/MD according to DoD QSM. For this program, an MSD for explosives is preferred. Lab's process should be specified in the SS-SAP.

5.6.3 QA Split

The QA split is defined as a field duplicate/triplicate that is collected from the same location as the parent sample under identical conditions. QA splits may be collected for the MMRP SI program. The PWS requires QA splits; however, the MM DC may opt to use alternate methods of addressing QA in accordance with (IAW) EM 200-1-6. If collected, the QA samples are sent to ECB Laboratory or another laboratory designated by the applicable MM DC for independent analysis. The QA split sample will provide a measure of the representativeness of the sampling procedure and precision between primary and secondary laboratories. The QA split sample containers will be filled

immediately after the field duplicate samples. The sample ID will be identical to the parent sample with the addition of "QA" to the name.

5.6.4 Equipment Blank

Rinsate (equipment) blanks are samples of analyte-free (deionized) water that are rinsed over decontaminated sampling equipment, collected, and submitted for analysis. These samples are used to assess cross-contamination from the sampling equipment, in addition to incidental contamination, the sample container, and/or preservatives. Equipment blanks will be collected in sample containers, sealed and handled in the same manner as the associated field samples, and shipped to the laboratory for analysis. One equipment blank per FUDS will be collected if non-disposal sample collection tools are used.

5.6.5 Temperature Blank

A temperature blank is a container (e.g., 40 milliliter vial) of water packaged along with field samples in the shipping cooler that will represent the temperature of the incoming cooler upon receipt at the laboratory. Use of these samples within a shipping container enables the receiving laboratory to assess the temperature of the shipment without disturbing any project field samples. Each cooler must contain a minimum of one temperature blank.

5.7 Decontamination Procedures

Sample collection devices will be decontaminated prior to each use unless disposable equipment is used. All potentially hazardous rinse liquids and materials will be containerized and properly disposed, in accordance with the SS-SAP, if necessary. Decontamination methods will be modified if necessary, based on the SS-SAP. Decontamination procedures for sample collection equipment, submersible pump and water level indicator, and drill rigs are provided below. Equipment decontamination will be conducted in a clean area free of dust.

For any samples to be analyzed for perchlorate, disposable sampling equipment is recommended. If decontamination is performed on sampling equipment used for perchlorate, documentation that any detergents used are perchlorate-free must be provided along with the report.

5.7.1 Decontamination of Sample Collection Equipment

Sample collection equipment (bailers, stainless steel scoops/spoons, and hand auger bucket) used to collect groundwater, surface soil, subsurface soils, surface water, or sediment will be decontaminated by the following process:

1. Wash equipment with tap/potable water and laboratory-grade detergent (Alconox™ or Liquinox™). A scrub brush will be used to remove dirt and surface film.
2. Rinse thoroughly with tap water.
3. Rinse with deionized, organic-free, reagent grade water.
4. Remove excess water and allow equipment to dry.
5. Wrap equipment in aluminum foil, shiny side out.

5.7.2 Decontamination of Submersible Pump and Water Level Indicator

Submersible pumps and water level indicators will be decontaminated with the following procedure:

1. Wash outside of pump/water level indicator and hoses/lines with laboratory-grade detergent (Alconox™ or Liquinox™) and water.
2. Rinse outside of pump/water level indicator and hoses/lines with potable water.
3. Rinse outside of pump/water level indicator and hoses/lines with deionized, organic-free, reagent grade water.
4. Remove excess water.
5. Wrap pump hose in plastic, pump in aluminum foil, and wrap water level indicator in plastic.

5.7.3 Decontamination of the Drilling Rig

The drilling rig will be decontaminated with the following procedure:

1. Any portion of the drilling rig that will be over the borehole, including hollow stem augers, will be cleaned with pressurized hot water.
2. Down-hole tools such as augers will be brushed cleaned using soap and tap water if pressure cleaning does not remove particulate matter.
3. Split spoons, used to collect soil samples, will be cleaned as described in Section 5.7.1.

4. Cleaned down-hole equipment, such as augers, will be placed on clean tarps, racks, or sawhorses to dry.
5. After drilling equipment has been allowed to dry, it will be covered with clean, unused plastic.

6.0 FIELD OPERATIONS DOCUMENTATION

Field operations documentation consists of Daily Quality Control Reports (DQCRs), field logbooks, photographic records, sample documentation, and field analytical records. This section also addresses documentation procedures/data management and retention.

6.1 Daily Quality Control Reports

During the sampling activities, DQCRs will be prepared daily, dated, and signed by the project Site Manager. The DQCR may be included with the Site Manager's Daily Report or submitted separately. These will be sent to MM DC PM, FUDS Geographic District PM, MM DC Project Chemist, and MC Advisors daily. The DQCR will include weather information at the time of sampling, field instrument measurements, calibrations, identification of all field and control samples taken, the status of each sample, departures from the PSAP, PSAP Addendum, or SS-SAP necessary, any problems encountered, and instructions from Government personnel. Any deviations that may affect data quality objectives will be conveyed to the MM DC PM immediately. The following should be attached to the DQCRs: QA sample tables that match up primary, replicate (QC/QA), and other field control samples (e.g., blanks), copies of chain-of-custody forms, field-generated analytical results, and any other project forms that are generated. An example form is provided in Appendix B.

6.1.1 DCQR Corrective Action

If a significant problem occurs during sampling, the DQCR will be provided to the project chemist within 48 hours accompanied by a corrective action report. The DQCR will be written by the sampling technician and will be cross checked against the field logbook for completeness at the end of each day.

6.2 Field Logbook

A logbook will be maintained during each sampling event. Its primary purpose is to provide documentation of activities, which have occurred in the field on any given day including the conditions or activities that affected the fieldwork. The logbook will be bound with numbered pages. All pertinent information regarding the site activities will be documented as near to real-time as possible. Entries in the logbook will be signed and dated. The following is a partial list of the types of information that may be recorded in the logbook:

- Name and title of author; date and time of entry; and physical/environmental (weather included) conditions during the daily field activities.
- Names of field personnel.

- Names and titles of all site visitors.
- Sampling activity purpose and plan.
- Type of sampled media (i.e., surface soil).
- Sample collection method (i.e., grab-into sample container).
- Number, type, and volume of samples taken.
- Sample ID number of each sampling points.
- Description, location, and elevation of the sampling point.
- Sample description
- Analysis, number of containers and preservation required.
- Date and time sample was collected.
- Instrument operational check records.
- Description of sample collection activities.
- Overnight shipper airbill number for each shipment.

All entries will be made in permanent, waterproof ink. Any corrections made in the logbook will be marked through with a single line and then dated and initialed.

6.3 Photographic Records

Photographs will be collected at all locations to document field activities. Typical photographs may include, but are not limited to, sample locations, field equipment, onsite structures, and various sample media (i.e. soil, sediment, groundwater, and surface water). Photographic logs will be kept in the field book and transferred to electronic files following the completion of fieldwork activities. All photologs will be included as an appendix to the Site Inspection report at each site.

6.4 Sample Documentation

The following sections describe the sample numbering scheme, sample labeling requirements, and chains of custody (COCs). It is recommended that sample documentation be handled electronically (i.e., via Forms II Lite or alternate software

program) where possible. Forms II Lite software is available to all USACE contractors upon request.

6.4.1 Sample Numbering

A sample numbering system will be used to identify each sample collected during the field investigation and for all QA/QC samples. The numbering system will provide a tracking procedure to allow retrieval of information about a particular location and to monitor that each sample is uniquely labeled. The samples will be identified by the following designation scheme. Each sample collected will be preceded by a site name abbreviation to identify the sample's general location. The sample ID will be designated as follows:

Site Name - Sampling Location - Sample Type - Sample Depth - Sample Number

Sample location abbreviations that will be used during each sampling event will be identified in the SS-SAP. The potential environmental sample types collected include groundwater (GW), subsurface soil (SB), surface soil (SS), sediment (SD), and surface water (SW). QA/QC samples that will be collected are field duplicate, MS/MSD, QA splits (optional, see applicable MM DC for direction), and equipment blanks. Sample identification for the QA/QC samples will be as follows:

- FD# Field duplicate (replaces sample number)
- MS Added to any sample ID indicates a Matrix Spike
- MSD Added to any sample ID indicates a Matrix Spike Duplicate
- QA Added to any sample ID indicates a QA split sample.
- EB Equipment blank (replaces sample type and depth),

6.4.2 Sample Labels

Each bottle shipped to the laboratory for analysis will have a sample label containing, at a minimum, the following information:

- Site Name,
- Site Location,
- Sample number designation,
- Date and time of sample collection,

- Analysis required,
- Preservation, and
- Sampler.

Prior to sample collection, the sample label information will be completed except time of collection; the label will be placed on the appropriate bottle. After sample is collected, collection time will be entered and sample label will be covered with clear tape.

6.4.3 Chain-Of-Custody (COC) Records

COC procedures provide documentation of the handling of each sample from the time it is collected until it is delivered to the lab. COC procedures will be implemented so that a record of sample collection, transfer of samples between personnel, sample shipping, and receipt by the laboratory that will analyze the sample is maintained. The COC record will serve as a legal record of possession of the sample. The COC record will be initiated with the acquisition of the sample. The COC record will remain with the sample at all times and bears the name of the person assuming responsibility for the samples. A sample is considered to be under custody if one or more of the following criteria are met:

- The sample is in the sampler's possession.
- The sample is in the sampler's view after being in possession.
- The sample was in the sampler's possession and then was locked up to prevent tampering.
- The sample is in a designated secure area.

All samples collected will be documented on a COC. This COC will be used in the field to document the transfer of samples from the Contractor to the Subcontractor laboratory. All sample shipments will be accompanied by a COC record. Each cooler must have its own COC record, rather than one COC record per shipment. To document the transfer of possession of the samples, the person relinquishing the samples, as well as the person receiving the samples, will sign and date the respective COC.

6.5 Documentation Procedures / Data Management and Retention

All analytical and field data collected as part of any investigation will be stored in hard copy and electronic form at the Contractor office conducting the investigation. Microsoft Access, Excel, Word and PowerPoint will be utilized to store analytical data and generate documents. All data and information relating to each specific project will be kept on file at the respective Contractor office for 10 years following the completion of the project.

7.0 SAMPLE HANDLING

Upon collection, all samples will be placed on ice and will be kept cool ($4 \pm 2^{\circ}\text{C}$) until analysis has been performed or packaged to ship to a laboratory facility. Once the samples have been collected, the following guidelines will be used to initially prepare the sample bottles for shipment to the laboratory:

1. Seal the container by wrapping tape around the lid of the container.
2. Place containers in bubble pack/sleeve.
3. Place all glass containers in Ziploc®-type bag and seal.
4. Use a permanent marker to write the sample ID on the outside of the Ziploc®-type bag.
5. Line insulated shipping cooler with a large trash bag and place samples into the lined, insulated cooler then cool (to $4 \pm 2^{\circ}\text{C}$) using wet ice.
6. Place all samples in designated cooler. Make sure all samples in the cooler are listed on the COC. Samples shall be placed on ice as soon as possible following collection.

7.1 Sample Packaging

The following procedure will be used to complete the sample packaging for shipment to the laboratory:

1. Seal completed COC form and blank cooler receipt form (see Appendix B for example Cooler Receipt Form) in a Ziploc®-type plastic bag and tape to the inside of the cooler lid.
2. Pour out water from melted ice and replace with double bagged fresh ice.
3. Place sample bottles in upright position in a way they do not touch.
4. Place temperature blank in cooler.
5. Close trash bag and seal with tape.
6. Fill empty spaces in cooler with ice or packaging material.

7. Tape shut cooler drain plug.
8. Securely seal shipping container/cooler with packing tape and custody seals (provided by laboratory).
9. Place "This side up" labels on all four sides of the cooler and "Fragile" labels on two sides of the cooler.
10. Ship container/cooler to the appropriate laboratory via overnight express.

7.2 Sample Shipping

Samples collected will be sent to Contractor laboratory specified in SS-SAP.

If collected, QA Split samples will be sent to the Government or Government-contracted laboratory specified in SS-SAP.

8.0 INVESTIGATION DERIVED WASTE

This section provides general procedures for containing, sampling and disposing of investigation derived waste (IDW). Specific plans regarding containerization, sampling, and disposal must be provided in SS-SAP.

8.1 Objective

The objective is to ensure that any waste generated as a result of field activities is disposed of in accordance with applicable local, state, and federal laws and regulations.

8.2 Containerization

If warranted, all IDW generated during fieldwork activities will be segregated by type and location and placed in sealed 55-gallon drums. IDW may include, but is not limited to, soil, sediment, purge water, drilling water, decontamination water, sampling and decontamination equipment, and personal protective equipment (PPE). At the completion of the project, any drums will be relocated

8.3 Sampling

Each type of IDW will be sampled (if necessary) by the Contractor in accordance with the SS-SAP. Analytical results will be used to determine the final disposition of the waste.

8.4 Disposal

Unless otherwise specified in the SS-SAP or SS-WP, all containerized IDW will be disposed at an appropriate disposal facility. Waste disposal companies and disposal facilities will be identified in the SS-WP. Following receipt of analytical results from the subcontractor laboratory and review by the Contractor, the material will be disposed at an appropriate disposal facility. All waste manifests will be reviewed by the applicable MM DC and then signed by a representative of the FUDS Geographic District as documentation of the disposal activities.

9.0 FIELD ASSESSMENT/THREE-PHASE INSPECTION PROCEDURES

Each Contractor should have a QC program to ensure that sampling and analytical activities comply with the requirements of this PSAP, their PSAP Addendum, and the SS-SAP and will produce data that complies with the DQOs. This QC program encompasses a review of the project sampling activities at three distinct phases (preparatory, initial, and follow up). The Chemical Quality Control Officer (CQCO) should oversee the QC program. Specifics about each Contractor's QC program as relates to sampling and analytical activities should be provided in their Programmatic Work Plan or PSAP Addendum.

9.1 Preparatory Phase

The CQCO, in conjunction with the sampling technician, will conduct the preparatory phase inspection prior to the initiation of sampling.

9.2 Initial Phase

The initial phase inspection will be performed when sampling is first initiated and at individual points during the sampling event.

9.3 Follow-Up Phase

The CQCO will perform follow-up inspections on an as-needed basis to ensure continued compliance with the contract requirements until completion of that particular feature of work. Inspections will include a review of all field activities to ensure that all actions and documentation of those actions are complete, accurate, and consistent with the procedures outlined in this PSAP.

10.0 NONCONFORMANCE/CORRECTIVE ACTION

Corrective action is initiated whenever there is a nonconformance to procedures and requirements in the applicable planning documents. A description of the problem, corrective action recommended or required, and corrective action implemented must be documented on a corrective action report (CAR) form (See Appendix B for example CAR). CARs must be retained in the project file. Each Contractor should address their Corrective Action process in their Programmatic Work Plan or PSAP Addendum.

10.1 Field Activities

The CQCO and sampling team members are responsible for verifying that all procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. During the preparatory phase inspection by the CQCO, any nonconformances will be documented and corrected prior to the initiation of sampling. Any nonconformances identified during the initial phase inspection will be immediately reported to the CQCO who will consult with MM DC and issue a corrective action report.

FINAL

QUALITY ASSURANCE PROJECT PLAN

MILITARY MUNITIONS RESPONSE PROGRAM

SITE INSPECTIONS

SEPTEMBER 2005

1.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

To conduct the MMRP SIs many essential personnel and/or organizations are necessary to perform the site activities in a correct and cost effective manner. General information on organization and responsibilities is described in Section 2.0 of the FSP. It is essential to identify in this section all key individuals as well as their responsibilities and experience. A chart or table listing the lines of authority specific to the project for the following should be included in the SS-SAP:

- Overall project coordination
- Overall QA
- Systems auditing (on-site)
- Performance auditing
- Sampling operations/QC
- Laboratory analyses/QC
- Data processing activities
- Data quality review

This table should identify how key individuals performing integral tasks relate to the overall organization of the project and points of contact. QA managers shall be organizational independent of project managers so that conflict of interest is minimized. Requirements for laboratory personnel are provided in Appendix I of EM 200-1-3, Section 4.3.

2.0 DATA ASSESSMENT ORGANIZATION AND RESPONSIBILITIES

This element of the QAPP identifies laboratory personnel, QA personnel at the lab and individuals at each of the four design centers that will be performing assessment of the data that is produced. A table should be produced that identifies these individuals and their project-specific responsibilities. General responsibilities are described below.

2.1 Laboratory

All analytical data will be verified prior to being released by the Laboratory. Verification will include both editorial and technical reviews. The electronic format of the data will be reviewed along with the hardcopy data package. A final review of the data package will be performed and the approved data package signed by the PM, or designee, when complete.

2.2 Contractor

The Contractor Project Chemist will validate all analytical data generated during the sampling effort. The validation will include requirements in the specific USEPA methods as well as contractual procedures. The PM will receive reports on the data quality at the completion of the data validation process from the Project Chemist.

2.3 USACE

Various USACE team members will have roles and responsibilities related to data assessment.

2.3.1 MM DC Project Chemist

The MM DC Project Chemist will review DQCRs, data quality reports, and any other MC-related documentation prepared by the Contractor. If the MM DC specifies QA splits, the MM DC Project Chemist will be responsible for coordinating with the QA Laboratory and will receive and evaluate all data reports from the QA Laboratory.

2.3.2 MC Advisors.

Both the HTRW and MM CXs have provided one individual to act as MC Advisors for the MMRP SI Program (Michael Crain, HTRW CX and Deborah Walker, MM CX). These advisors developed the PSAP and will ensure that project-specific objectives for evaluating MC in accordance with DQOs are accounted for during TPP and work plan development. These PDT members also will ensure that adequate QA/QC reviews of the sample analytical results are conducted.

2.3.3 *ITR Team.*

The ITR team is responsible for reviewing the contractor's work to ensure performance of the PWS. This team will develop the necessary procedures, control checks, and process correction/improvement actions needed to ensure that the SI data is collected, processed, and prepared in the most accurate and timely process possible. The ITR team will consist of a pool of individuals from a variety of disciplines (e.g., geologists, chemists, etc.), and individual teams will be formed from this pool. ITR reviews do not relieve the Districts, Design Centers, and Divisions from performing their normal and required QA/QC roles.

3.0 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements which specify the quality of the data required to support decisions, and are developed to achieve the level of data quality required to meet project goals. DQOs are implemented so the data is legally and scientifically defensible. The development of DQOs for a specific site and measurement takes into account project needs, data uses and types and needs, and data collection. These factors determine whether the quality and quantity of data are adequate for its end use.

3.1 Introduction

This section discusses DQOs for the MMRP SI. Program objectives of the SI are provided in Section 3.0 of the FSP.

3.2 TPP Process

Technical Project Planning (TPP) is used to identify project objectives and design data collection programs to help ensure that the requisite type, quality, and quantity of data are obtained so that informed decisions can be made for site closeout. The TPP process is a critical component of the USACE quality management system and meets the American National Standard for planning the collection and evaluation of environmental data.

The TPP Process is a comprehensive and systematic process that involves four phases of planning activities. Use of the TPP Process is consistent with the philosophy of taking a graded approach to planning that will produce the type and quality of data needed for site-specific decision making.

The TPP sessions conducted for each SI are intended to establish the site-specific DQOs. The results of the initial TPP will be incorporated into the SS-FSP, SS-QAPP, and the SS-WP. The DQOs discussed below will be developed for the SI, either as an element of the TPP or during completion of the SS-WP.

3.2.1 Identify Decision Types

Stage 1 of the DQO process should identify and involve the data users, evaluate all available information, and specify investigation goals and decisions.

3.2.1.1 Data Users

Due to the interdisciplinary nature of environmental investigations and/or sampling, it becomes important that all personnel involved with the investigation be identified, including individuals associated with collecting and analyzing environmental samples,

and individuals at the regulatory agencies that will review investigative results. The SS-QAPP will identify the individuals responsible for data collection and data quality.

3.2.1.1.1 Data Quality for Sample Analysis

A number of factors relate to the quality of data and its adequacy for use in the corrective action process, including the following considerations:

- Age of the data;
- Analytical methods used;
- Detection limits of method; and
- QA/QC procedures and documentation.

3.2.1.1.2 Data Quality for Sample Collection

Methods used for sample collection are as important to consider as the methods used for sample analysis. These considerations fall into two broad categories: statistical and standard operating procedures (SOPs). The statistical considerations relate to the representativeness of the data and the level of confidence that may be placed in conclusions drawn from the data.

Following SOPs ensure sample integrity and data comparability and reduces sampling and analytical error. Typical issues to consider include the following:

- Sampling objective and approach;
- Sample collection methods;
- Chain-of-Custody documentation;
- Sample preservation techniques;
- Sample shipment methods; and
- Holding times.

If limited or no information exists on sample collection, preservation techniques, or holding times, the data should be interpreted with caution, if they can be accepted at all.

3.2.1.1.3 Data Adequacy

The uncertainty associated with each data measurement activity should be considered when data are evaluated. Although data may be validated analytically, the level of precision of a particular data point may not provide sufficient certainty for use in a decision. The uncertainty associated with a decision is a function of the statistical distribution of the factors that were used in reaching the decision. Assessment of data adequacy has two steps. The first step is data validation. The second step is determining if the data is sufficient to reduce the uncertainty surrounding a decision to an acceptable level.

Data validation identifies invalid data and qualifies the usability of the remaining data. The output of data validation is qualitative or quantitative statements of data quality. Once the quality of individual measurements is known, a compilation of all data points into a cohesive statement can be made. The confidence associated with a statement incorporates both the confidence in individual measurements as well as in the decision.

3.2.1.1.4 Conceptual Site Model

Conceptual site models (CSMs) describe a site and its environs and present hypotheses regarding the contaminants present, their route of migration, and their potential impact on sensitive receptors. A CSM must be developed during the TPP for the SI. The hypotheses are tested, refined and modified throughout the investigation.

3.2.2 *Identify Data Uses and Needs*

Stage 2 of the DQO process defines data uses and specifies the types of data needed to meet the project objectives. This process begins when the project objectives are established. The CSM and TPP become the basis for determining data uses and data needs. Stage 1 determines if existing data meet the project objectives. If the existing data are sufficient, there is no need to collect additional data. If the data are insufficient, the types, quality, and quantity of data that must be collected are determined in Stage 2.

3.2.2.1 *Identifying Data Quality Needs*

The identification of data uses and data types must be defined during the initial phases of the investigation. As the project proceeds and more data becomes available, data types may change.

3.2.2.2 *Appropriate Analytical Types*

The following analytical types can also be used as a guidance to help achieve data types, and are defined by the USACE as follows:

- a. **Screening Data with Definitive Confirmation** – Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data provide analytical identification and quantification, although the quantification may be relatively imprecise. At least 10% of the screening data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality. The QA/QC elements of screening data include the following: sample documentation; chain-of-custody; sampling design approach; initial and continuing calibration; determination and documentation of detection limits; analyte identification; analyte quantification; analytical error determination; and definitive confirmation of at least 10% of the samples.

- b. **Definitive Confirmation** – Definitive data are generated using rigorous analytical methods, such as EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produced are tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined. The QA/QC elements of definitive data include the following: chain-of-custody; sampling design approach; initial and continuing calibration; determination and documentation of detection limits; analyte identification; analyte quantification; QC blanks; matrix spike recoveries; performance evaluation sample results (when specified); analytical error determination (precision of analytical method); and total measurement error determination (over all precision of measurement system).

For each generic data use, several of the analytical levels may be appropriate, and the decision maker needs further criteria to select the most appropriate level. Important criteria driving the decision are the contaminants of concern and the level of concern for each contaminant.

Engineering design typically requires information beyond analytical levels for chemical analyses. Physical property data (viscosity, soil organic carbon, etc.) may be necessary for engineering design, and in all likelihood would require more than one analytical level.

3.2.2.3 Action and Target Levels

The action level specifies a concentration above which some form of corrective action may need to be taken. The action level is defined by the regulatory agency to be a health and environmental standard or criteria value. The action level is intimately linked with a target level that defines the level of cleanup for corrective action. Project-specific action levels for activities conducted under the MMRP investigations are to be specified in the SS-QAPP.

A rough estimate of a target level is necessary to ensure that the chosen analytical methods are accurate at the target level. The potential DQOs identified in Table 1 were determined for that purpose. In addition, knowledge of the target level can influence the number of samples required.

3.2.2.4 Detection Limit Requirements

The action level can directly affect data quality requirements. The sampling and analysis methods used must be accurate at the detection limit. Since sampling accuracy is hard to evaluate or control, it is extremely important that the analytical technique chosen has a detection limit well below the action level. This must be considered when evaluating analytical options.

3.2.2.5 Critical Samples

Critical samples are those for which valid data must be obtained to satisfy the objective of the sampling and analysis program. Critical samples may be taken in duplicate, or as appropriate.

3.2.2.6 Identify Data Quantity Needs

In the absence of available data, the data users and decision makers will be required to develop a rationale for selecting sampling locations. Questions to guide the data users in selecting appropriate locations could include the following:

- a. Do source materials still exist on the soil surface?
- b. Is there evidence of soil disturbance or vegetative stress based upon review of aerial photographs?
- c. Do geologic features in the area control ground water and surface water flow patterns?
- d. Do site conditions favor surficial soil erosion or wind erosion?

- e. Are sensitive receptors located in the vicinity of the site?

In situations where data are available, or as new data are added to a database, statistical techniques may be utilized in determining the number of data required.

3.2.3 Design Data Collection Program

Stage 3 of the DQO process entails design of the detailed data collection program for the investigation. The process of addressing elements in Stages 1 and 2, all of the components required for the completion of Stage 3, are available.

3.2.3.1 Assemble Data Collection Components

During Stage 2, specific DQOs were developed by media or sampling activity. The intent of Stage 3 is to compile the information and DQOs developed for specific tasks into a comprehensive data collection program. A detailed list of all samples to be obtained should be assembled in a format which includes phase, media, and sample type, number of samples, sample location, analytical methods, and QA/QC samples (type and number). In addition, a schedule for all sampling activities should be developed in bar chart or critical path method format. Analyte lists for methods anticipated for use in the SIs are provided in Table 3.

3.2.3.2 Develop Data Collection Documentation

The output of the DQO process will be documented in the TPP Memorandum, as well as the SS-QAPP. The DQO process provides a framework to ensure that all the pertinent issues related to the collection of data with known quality are addressed. The DQO levels for sampling will be outlined in SS-QAPP documents.

4.0 SAMPLE RECEIPT, HANDLING, CUSTODY, AND HOLDING TIME REQUIREMENTS

4.1 Verification / Documentation Of Cooler Receipt Condition

A COC record accompanies the sample container from the laboratory to the field where the sample is contained, preserved, and then returned to the laboratory. The laboratory's sample custody program must meet the criteria listed below.

- The laboratory has designated a sample custodian who is responsible for maintaining sample custody and for maintaining all associated records documenting sample custody.
- Upon receipt of the samples, the custodian measures and records sample temperature (using the temperature blank) on a cooler receipt form, checks for proper preservation, and checks the original COC documents and compares them with the labeled contents of each sample container for correctness and traceability. The custodian signs the COC record and records the date and time the samples are received. In the event of discrepant documentation or temperature of temp blank outside $4\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, the laboratory immediately contacts the Contractor PM as part of the corrective action process. The Contractor PM will notify the MM DC if samples are received outside the above listed temperature range.
- A qualitative assessment of each sample container is performed to note any anomalies, such as broken or leaking containers. This assessment will be recorded as part of incoming COC procedures.
- The samples are stored in a secured refrigerator until analyses begin. Refrigerators will be maintained at $4\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, and the temperatures recorded daily.
- A copy of the COC and cooler receipt forms accompanies the laboratory report and becomes a permanent part of the project records.

4.2 Holding Times

To maximize representativeness of sample results, all samples will be extracted and/or analyzed within the holding times specified in each method. Table 2 presents the maximum holding times allowed for each method. Extraction or analysis performed after the expiration of the holding time will result in the qualification of the results during the data validation procedures.

Any samples that exceed laboratory holding time for extraction or analysis may be resampled and resubmitted for analysis.

5.0 ANALYTICAL PROCEDURES

This section lists the procedures and methods that will be used to analyze the environmental samples collected during the sampling effort. All laboratory analytical methods will be performed in accordance with the most current version of USEPA SW-846 protocols and methods and the most current version of the DoD QSM. Table 2 lists the anticipated analytical parameters and methods to be employed. Note that laboratory's procedure for subsampling and processing solid matrices must meet or exceed the requirements of SW8330 and that SW3535A is required in lieu of salting out procedure for aqueous samples.

5.1 Preventative Maintenance

A preventative maintenance program is necessary to help prevent delays in project schedules, poor output performance or erroneous results in investigative operations. Preventative maintenance on laboratory analytical equipment used in this program will be performed contractually by qualified personnel. Maintenance of field equipment will be performed routinely for sampling events. More extensive maintenance will be performed based on hours of use, by a qualified servicing organization. Repairs, adjustments and calibrations will be recorded.

5.1.1 *Field Equipment*

The three elements of the field equipment maintenance program include normal upkeep of equipment, service and repair (when required), and formalized record-keeping of all work performed on each piece of equipment. This section addresses the normal equipment upkeep element of the maintenance program. For most of the equipment, normal maintenance will consist of cleaning outside surfaces, lubrication of all moving parts, and, if applicable, a battery level check and recharge or replacement as necessary. This program will include the maintenance of all monitoring, measuring, and test equipment returning from use or any equipment used on a daily basis. The frequency of maintenance checks will be dependent on the individual needs and use of each piece of equipment. Maintenance procedures will be only those necessary for keeping an instrument in service or in preparation for everyday use. It is beyond the scope of this document to cover repair procedures for each piece of equipment. Repair problems will be referred to the manufacturer or other qualified servicing organization.

The Project QA/QC Coordinator, or the designated task leader, will be responsible for keeping all maintenance records, making sure all equipment used is maintained properly, informing field team members of any specific maintenance requirements for equipment used at the site and shipping any instrument in need of repair to the correct source.

The field personnel responsibilities include maintaining each piece of equipment located at the site and the maintenance of equipment after use. A record of equipment maintenance and repair will be kept in the field logbook.

5.1.2 Rental Equipment

Rental equipment used on the project should be obtained only from a certified rental supplier. The equipment will require a pre-receipt to verify accuracy, maintenance and up-keep of the equipment. A receipt indicating that the equipment has been checked upon return will be required as well.

5.1.3 Laboratory Equipment

An important factor in maintaining accuracy and precision, achieving required holding times, and addressing contract schedule is preventive maintenance. As part of the laboratory's maintenance program, service contracts are held on critical analytical instruments. SOPs for routine maintenance of laboratory equipment shall be submitted for each laboratory performing analytical services as part of this SI.

5.2 Calibration Procedures and Frequency

Measuring and test equipment shall have an initial calibration and shall be recalibrated at scheduled intervals against certified standards that have known and valid traceability to recognized national standards. Calibration intervals for each item shall be, at a minimum, in accordance with manufacturer's recommendations as defined in the equipment manual.

Calibration standards shall be maintained and used in an environment with temperature, humidity, and cleanliness controls that are compatible with the accuracy and operating characteristics of the standards. An inspection will be made during the equipment calibration to evaluate the physical condition of the equipment. The purpose of the inspection is to detect any abnormal wear or damage that may affect the operation of the equipment before the next calibration. Equipment found to be out of calibration or in need of maintenance or repair will be identified and removed from service.

The Project QA/QC Coordinator shall be notified if the test equipment is found to be out of tolerance during inspection and calibration. The corrective actions to be taken include evaluating the validity of previous inspection or test results; evaluating the acceptability of the items inspected or tested since the last calibration check; and repeating the original inspections or tests using calibrated equipment when it is necessary to establish the acceptability of previous inspections or tests. Specifics regarding QC checks and verification of equipment stability are located in Table 4.

Each item of measuring and test equipment in the calibration program shall be identified in such a way as to show its calibration status and calibration expiration date. Equipment history records for measurement and test equipment shall be used to indicate calibration status and conditions, corrections to be applied, results of in-service checks, and repair history. This will provide a basis for establishing calibration frequencies and for remedial action if the instrument is found out of calibration.

Laboratory instrumentation calibration procedures, frequency, and standards will be consistent with the requirements of the applicable analytical method and Table 4.

5.3 Laboratory QC Procedures

Type and frequencies of specific QC samples performed by the laboratory are dependent upon analytical requirements specific to the method analyzed. Internal QC methods require performance on a sample batch basis and include analyses of method blanks, laboratory control samples, and actual environmental samples as duplicates, matrix spikes, and matrix spike duplicates. Additional QC is incorporated into the analytical sequence. Laboratory QC procedures will be consistent with the requirements of the applicable analytical method and Table 4.

5.4 Performance and System Audits

Audits will include a careful evaluation of both field and laboratory quality control procedures and will be performed before or shortly after systems area operational. The audits will be conducted by an individual who is technically knowledgeable about the operation(s) under review. Systems audits provide a quantitative measure of the quality of the data produced by one section or the entire measurement process. Performance audits are conducted by introducing control samples into the data production process. These control samples may include performance evaluation samples, field samples spiked with known amounts of analyte, and split field samples that are analyzed by two or more analysts within or without the organization. Systems audits are onsite qualitative inspections and reviews of the quality assurance system used by some part of or the entire measurement system. The audits are performed against a set of requirements, which may be a quality assurance project plan or work plan, a standard method, or a project statement of work. The primary objective of the systems audits is to ensure that the QA/QC procedures are being followed.

5.4.1 Field Audit Procedures

Field performance audits will be conducted on an ongoing basis during the project as field data are generated, reduced, and analyzed. All numerical manipulations, including manual calculations, will be documented. All records of numerical analyses will be legible, of reproduction-quality, and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator.

Indicators of the level of field performance include the analytical results of the blank and replicate samples. Each blank analysis will be considered an indirect audit of the effectiveness of measures taken in the field to ensure sample integrity (e.g., field decontamination procedures). The results of the field replicate analyses are an indirect audit of the ability of each field team to collect representative sample portions of each matrix type. System audits of site activities will be accomplished by an inspection of all field site activities. During this audit, the auditor(s) will compare current field practices

with standard procedures. The following elements will be evaluated during a field system audit:

- All activities conducted in accordance with the Work Plan;
- All procedures and analyses conducted according to procedures outlined in the QAPP;
- Sample documentation;
- Working order of instruments and equipment;
- Level of QA conducted per each field team;
- Contingency plans in case of equipment failure or other event preventing the planned activity from proceeding;
- Decontamination procedures;
- Level of efficiency with which each team conducts planned activities at one site and proceeds to the next; and
- Sample packaging and shipment.

After completion of the audit, any deficiencies will be discussed with the field staff and corrections implemented. If any of these deficiencies could affect the integrity of the samples being collected, the auditor(s) will inform the field staff immediately, so that corrections will be implemented immediately. The audit will be performed by the Project QA/QC Coordinator or the Site Field Manager.

5.4.2 Laboratory Audit Procedures

Laboratory audit procedures consist of systems/internal audits and performance and external audits. Prior to initiation of field sampling, the MM CX and HTRW CX, in coordination with the MM DCs and Contractors, will perform a programmatic laboratory audit of the subcontractor laboratories selected by the prime Contractors for compliance with the current version of the DoD QSM.

5.4.2.1 Systems/Internal Audits

As part of its Quality Assurance Program, the Laboratory Quality Assurance Manager shall conduct periodic checks and audits of the analytical systems. The purpose of these is to ensure that the analytical systems are working properly and that personnel are adhering to established procedures and documenting the required information. These checks and audits will also assist in determining or detecting where problems are occurring.

The Quality Assurance Manager will periodically review laboratory control samples. These samples will check the entire analytical method, the efficiency of the preparation method and the analytical instrument performance. When a problem is detected, the Quality Assurance Manager will report and assist the analyst and laboratory management in determining the reason and in developing a solution. Rechecking of systems will be conducted by the Quality Assurance Manager as required.

5.4.2.2 Performance and External Audits

In addition to conducting internal reviews and audits, as part of its established Quality Assurance program, the laboratory is required to take part in regularly scheduled Performance Evaluations and laboratory audits from State and Federal agencies. These are conducted as part of certification processes and to monitor the laboratory performance. The laboratory shall use the information provided from these audits to monitor and assess the quality of its performance. Problems detected in these audits shall be reviewed by the Quality Assurance Manager and laboratory management and corrective action shall be instituted as necessary.

5.5 Nonconformance/Corrective Actions

A nonconformance is defined as an identified or suspected deficiency in an approved document, such as a technical report, calculation, or computer program); an item where the quality of the end item itself or subsequent activities using the document or item would be affected by the deficiency; or an activity that is not conducted in accordance with the established plans or procedures. Any staff member engaged in project work that discovers or suspects a nonconformance is responsible for initiating a nonconformance report. The Project QA/QC Coordinator shall evaluate each nonconformance report and determine what actions are to be taken. The Project Manager shall ensure that no further work dependent on the nonconforming item or activity is performed until the nonconformance is corrected.

Samples that are analyzed prior to the resolution of a nonconforming event will be re-sampled, and/or reanalyzed once the corrective action has been initiated and is proven effective.

A copy of each closed nonconformance report shall be included in the quality assurance file and shall be maintained by the Project QA/QC Coordinator.

5.5.1 Field Corrective Action

A corrective action shall be initiated during the field work when precision, accuracy, completeness, representativeness or comparability are not met or changes are made in the field that do not meet the scope of work requirements or other conditions are identified that are not acceptable. To document, a report shall be filed which lists the problems encountered and the corrective action implemented. A stop-work order may be issued by the Project QA/QC Coordinator, if no resolution can be reached.

5.5.2 Laboratory Corrective Action

If a particular analysis is deemed "out-of control," corrective action will be taken to ensure continued data quality. Actions which may be taken include, but are not limited to:

- Rechecking calculations;
- Checking QC data on other samples;
- Auditing laboratory procedures;
- Reanalyzing the sample if the holding time requirements have not been exceeded;
- Accepting data with the acknowledged level of uncertainty; and
- Qualifying the data as unusable.

The laboratory QA Manager will be responsible for initiating laboratory corrective action within 48 hours of the time it was noted.

6.0 DATA REDUCTION/CALCULATION OF DATA QUALITY INDICATORS

6.1 Field and Technical Data Reduction

Field personnel will record all field data in bound field notebooks and on standard forms. After checking the validity of the data in the field notes, the Site Field Manager or his designee will reduce the data to tabular form, when possible, by entering the data into data files. Where appropriate, the data files will be set up for direct input into the project database. Subjective data will be filed as hard copies for later review by the Project Manager and incorporation into technical reports, as appropriate.

6.2 Laboratory Data Reduction

Data reduction is the process by which raw analytical data generated from laboratory instrument systems is converted into usable concentrations. The raw data, which may take the form of area counts, instrument responses or observations, is processed by the lab and converted into concentrations expressed in the parts-per-million (ppm) or parts-per-billion (ppb) range. Raw data from these systems include compound identifications, concentrations, retention times, and data system print-outs. Raw data is usually reported in graphic form, bar-graph form, or tabular form. The laboratories will follow the applicable data reduction SOPs for data reduction requirements. Data will be reported in the units listed in Table 1. Concentration units are to be listed on reports and any special conditions, such as dry weight conversions will be noted. "Non-detects" will be reported as less than the Practical Quantitation Limit (PQL). Results reported greater than the Method Detection Limit (MDL) but less than the PQL will be reported as estimated and flagged by the laboratory.

6.3 Calculation of Data Quality Indicators

6.3.1 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed conditions. Assessing precision measures the random error component of the data collection process. Precision is determined by measuring the agreement among individual measurements of the same property, under similar conditions, and is calculated as an absolute value. The degree of agreement, expressed as the relative percent difference (RPD), is calculated using the formula below.

$$RPD = \frac{(V_1 - V_2)}{\frac{(V_1 + V_2)}{2}} \times 100$$

where: V1 = value 1; V2 = value 2

Analytical precision is assessed by analyzing matrix spike/matrix spike duplicate pairs and laboratory duplicate samples. Field precision is assessed by measurement of field duplicate samples. The objective for precision is to equal or exceed the precision demonstrated for similar samples and should be within the established control limits for the methods.

6.3.2 Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Accuracy measures the bias or systematic error of the entire data collection process. Sources of these errors include the sampling process, field and laboratory contamination, sample preservation and handling, sample matrix interferences, sample preparation methods, and calibration and analytical procedures. To determine accuracy, a reference material of known concentration is analyzed or a sample which has been spiked with a known concentration is reanalyzed. Accuracy is expressed as a percent recovery and is calculated using the following formula:

$$\% \text{ Recovery} = 100 \times \frac{\text{measured value}}{\text{true value}}$$

Recoveries are assessed to determine method efficiency and matrix interference effects. Analytical accuracy is measured by the analysis of calibration checks, system blanks, quality control samples, surrogate spikes, matrix spikes, and other checks required by the selected analytical methods. Sampling accuracy is assessed by evaluating the results of field and trip blanks. Sampling accuracy is also maintained by frequent and thorough review of field procedures. The objective is to meet or exceed the demonstrated accuracy for the analytical methods on similar samples and should be within established control limits for the methods.

6.3.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is achieved through proper development of the field sampling program. The sampling program must be designed so that the samples collected are as representative as possible of the medium being sampled and that a sufficient number of samples will be collected.

6.3.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data is complete and valid if it meets all acceptance criteria including

accuracy, precision, and any other criteria specified by the particular analytical method being used.

Field completeness will be estimated as the percentage of all planned samples that were actually collected and analyzed. The calculation is as follows:

$$\% FC = (A/P) \times 100$$

where,

%FC = Field Percent Completeness;
A = Actual number of samples collected; and
P = Number of planned samples to collect.

Laboratory completeness will be estimated as the percentage of all usable measurements and calculated as follows:

$$\%C = (U/T) \times 100$$

where:

%C = Percent completeness;
U = Number of measurements judged usable; and
T = Total number of measurements.

The objective is to generate a sufficient database with which to make informed decisions. To help meet the completeness objective, every effort must be made to avoid sample loss through accidents or inadvertence.

6.3.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability cannot be described in quantitative terms, but must be considered in designing the sampling program. Thus, this objective will be met by using standard methods for sampling and analyses and by following techniques and methods set forth in the project specific work plan.

6.3.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between small differences in analyte concentration. The sensitivity and detection limits for methods applicable to MMRP investigations shall be provided in the Contractors' PSAP addenda and/or the SS-SAPs, as appropriate.

7.0 LABORATORY OPERATIONS DOCUMENTATION

7.1 Data Reporting Procedures

7.1.1 Laboratory Report Requirements

For all analyses, at a minimum, the laboratory report will show traceability to the sample analyzed and will contain the following information required for data validation:

- Case narrative (identifies problems and corrective actions);
- Copy of signed COC;
- Cooler receipt forms documenting the date, time of receipt, condition of samples (including preservation) and labels, temperature of the shipping container, and verification of integrity of the custody seals;
- Laboratory name;
- Client name;
- Date of sample collection;
- Date of sample receipt;
- Date of sample extraction or preparation;
- Date of issue;
- Project name and unique identification number;
- Field sample name/number;
- Laboratory sample number;
- Sample matrix description;
- Analytical method description and reference citation for all analyses, preparation, cleanup procedures;
- Preparation, analysis and other batch numbers;
- Individual parameter;
- Analytical results with correct number of significant figures;
- All confirmation data, when performed;
- Date of analysis (first run and subsequent runs);
- Analysis time;
- Method reporting limits adjusted for sample-specific factors (i.e., aliquot size, dilution/concentration factors, moisture content);
- Method detection limits;
- Concentration units;
- Any data qualifiers assigned;
- Percent moisture or percent solids (all soils reported on dry weight basis);
- Any special conditions;
- Chromatograms, as needed;
- Sample aliquot analyzed;
- Final extract volume;

- Dilution or concentration factors (if dilutions result in non-detect values for all other analytes which showed detected concentrations in previous analyses, the results of both runs will be reported with the appropriate notations in the narrative);
- A cross-reference to identify applicable laboratory QC samples with field samples; and
- Corresponding QC summary report.

QC data will be recorded on Contract Laboratory Program (CLP) or CLP-equivalent QC summary forms for the appropriate tests and correlated to the analysis results by the laboratory lot control numbers. The QC results are used to prepare control charts for each test and matrix type. QC reports will contain the following items as appropriate:

- Narratives describing any non-compliant samples,
- Initial and continuing calibration results,
- Method blank,
- Surrogate results,
- Laboratory Control Sample (LCS) results,
- MS/MSD or MS/MD results, and
- Tuning results.

The laboratory will, as a part of the data reduction and validation process, confirm that its documentation is complete, paginated, and legible; qualitative identifications are accurate; calculations are accurate; and results are expressed in the appropriate units. The laboratory will also confirm that data documentation has been approved by the laboratory manager or designee.

7.1.2 Electronic Data Deliverables

The laboratories also must submit the analytical data for environmental, field and laboratory QC samples via email, on diskettes, or on CD- or DVD-ROM IAW Section 3.0 of the PWS. The electronic data deliverable (EDD) shall contain the same information as described for the hard copy deliverable in the Staged Electronic Data Deliverable (SEDD) software format and the Automated Data Review (ADR) format, which shall be accomplished by parsing the SEDD version. In general, the Stage 2a SEDD submittal will include:

- the laboratory's identification of each field sample,
- field sample identifications,
- analytes,
- results,
- data qualifiers and validation flags,
- concentration units, and
- applicable QC data.

Additionally, the calibration information should be included in the SEDD if the laboratory has that capability (Stage 2b). The analytical laboratory is required to run the ADR compliance checker software on the ADR file obtained by parsing the SEDD file prior to submitting the files to the Contractor.

8.0 DATA ASSESSMENT PROCEDURES

This element of the QAPP identifies personnel or organizations that will be performing data assessment activities.

8.1 Field and Technical Data Verification/Validation

Validation of objective field and technical data will be performed at two different levels. The first level of data validation will be performed at the time of collection by following standard procedures and quality control checks. The Site Field Manager who will review the data to ensure that the correct codes and units have been included will complete the second level of data validation. After data reduction has been completed, the Field Manager will review data sets for anomalous values. The Project Manager, who will review field reports for reasonableness and completeness, will validate subjective field and technical data. In addition, the Field Manager and/or Site QA/QC Coordinator will make random checks of sampling and field conditions.

8.2 Analytical Data Validation

Data validation for laboratory data will be performed for all sample results in accordance with the requirements contained in the QAPP, DoD QSM, applicable USEPA Region SOPs, and the USEPA *National Functional Guidelines for Data Review* (USEPA, 1999, 2004) by the Contractor Project Chemist. ADR software should be used to assist in the data validation process to the fullest extent possible. Additionally, manual validation may be used to evaluate the laboratory data where necessary. Laboratory results will be assessed for compliance with required precision, accuracy, completeness and sensitivity. Field QC results will be evaluated for compliance with required precision, accuracy, and representativeness. At a minimum, the review of laboratory data will focus on the following subjects:

- COC forms,
- Holding times,
- Method calibration limits,
- Method blanks,
- Laboratory-established detection limits,
- Analytical batch control records including spike recoveries and spike duplicate results,
- Surrogate standard recoveries, if applicable,
- Internal standard areas and retention times (RTs), if applicable,
- Confirmation results for explosives
- Corrective actions,
- Formulas used for analyte quantitation,
- Calculations supporting analyte quantitation, and
- Completeness of data.

Data outliers that fall outside of the QC criteria outlined in Table 4 will be flagged with an appropriate qualifier that is descriptive of the outlying condition (i.e., precision limits exceeded, etc.). Data will be flagged both in laboratory reports as well as during the data validation process. All data validation flags applied will be added to the EDD with explanation prior to submittal. Data validation flags are provided in Table 9.

8.3 Analytical Data QA/QC Report

Appendix G of each SI report is to contain the Analytical Data QA/QC Report, which should include all requirements from DID MR005-10 for Chemical Data Final Report (see Section 2.8 <http://www.hnd.usace.army.mil/oew/policy/dids/FY04DIDs/MR/mr005-10.pdf>) that are not addressed elsewhere in the site-specific SI Report.

Per DID MR005-10, this includes the following:

- a. Summary of project scope and description.
- b. Summary of any deviations from the design chemical parameter measurement specifications.
- c. Summary of chemical parameter measurements performed as contingent measurements.
- d. Summary discussion of resulting data including achieving data reporting requirements.
- e. Summary of achieving project-specific DQOs.
- f. Presentation and evaluation of the data to include an overall assessment on the quality of the data for each method and matrix. This should include, at a minimum, two types of data tables. The first shall include all analytical results for all samples collected. The second shall include all analytical results greater than MDL for all samples collected. Tables should be sorted by method and include appropriate data flags resulting from laboratory review and from Contractor's data validation.
- g. Internal QC data generated during the project, including tabular summaries correlating sample identifiers with all blank, matrix spikes, surrogates, duplicates, laboratory control samples, and batch identifiers.
- h. A list of the affected sample results for each analyte (indexed by method and matrix) including the appropriate data qualifier flag (J, B, R, etc.), where sample results are negatively impacted by adverse quality control criteria.
- i. Summary of field and laboratory oversight activities, providing a discussion of the reliability of the data, QC problems encountered, and a summary of the evaluation of data quality for each analysis and matrix as indicated by the laboratory QC data and any other relevant findings.
- j. Comparison of results to any applicable project-specific numeric criteria.
- k. Conclusions and recommendations.
- l. Appendices containing: (1) Chemistry data package (Appendix F of the SI Report), (2) DQCRs, and (3) Results of the Chemical Quality Assurance Report (CQAR). The CQAR is a Government produced document achieved through the

inspection and analysis of QA samples and corresponding project sample data. The CQAR will include review of all QC parameters such as holding times, detection limits, method blanks, surrogate recoveries, matrix spikes and duplicates, and inter-laboratory and intra-laboratory data comparisons.

Appendix A: References

- 1) DoD, 2005. Quality Systems Manual for Environmental Laboratories (Final Version 3), 2005.
- 2) Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846) – Third Edition, September 1986; Final Update I, July 1992; Final Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.
- 3) DOD's Interim Policy on Perchlorate Sampling, 29 September 2003, http://www.epa.gov/swerffrr/pdf/perchlorate_sampling_interim_policy_9-23-03.pdf.
- 4) DoD Interim Guidance on Sampling and Testing for Perchlorate, 5 February 2004, <http://www.navylabs.navy.mil/Archive/PerchlorateInterim.pdf>.
- 5) DAIM, Army Environmental Cleanup Strategy, Apr 2003, <https://www.denix.osd.mil/denix/Public/Library/Cleanup/AECS/start.html>.
- 6) DAIM, Department of Army Guidance for Addressing Potential Perchlorate Contamination, 11 June 2004, <http://www.itrcweb.org/armyguidance.pdf>.
- 7) Handbook on the Management of OE at Closed, Transferring, and Transferred Ranges and Other Sites, Review Draft 2, August 2003, http://www.epa.gov/swerffrr/pdf/review_draft_oe_handbook_august_2003.pdf.
- 8) Draft EPA Guidelines for Munitions Response, 24 October 2003, http://www.epa.gov/fedfac/pdf/oe_guidelines_draft_10-24-03.pdf.
- 9) DOD Memorandum on Definitions Related to Munitions Response Actions, 18 December 2003, http://www.epa.gov/fedfac/pdf/MRP_Definitions_12-18-03.pdf.
- 10) ER 200-3-1. FUDS Program Policy, 10 May 2004, <http://www.usace.army.mil/publications/eng-regs/er200-3-1/toc.htm>.
- 11) ER 385-1-92, Safety and Occupational Health Requirements for HTRW Activities, 1 July 2003, <http://www.usace.army.mil/publications/eng-regs/er385-1-92/toc.htm>.
- 12) ER 385-1-95, Safety and Health Requirements for OE Operations, 16 June 2003 (including 30 September 2003 errata) <http://www.usace.army.mil/publications/eng-regs/er385-1-95/toc.htm>.
- 13) ER 1110-1-263, Chemical Data Quality Management for HTRW Remedial Activities, 30 April 1998 <http://www.usace.army.mil/publications/eng-regs/er1110-1-263/toc.htm>.
- 14) ER 1110-1-8153, OE Response, 14 May 1999, <http://www.usace.army.mil/publications/eng-regs/er1110-1-8153/toc.htm>.
- 15) EM 200-1-2, TPP Process, 31 Aug 98, <http://www.usace.army.mil/publications/eng-manuals/em200-1-2/toc.htm>.
- 16) EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans, 1 Feb 01, <http://www.usace.army.mil/publications/eng-manuals/em200-1-3/toc.htm>.
- 17) EM 1110-1-1200, Conceptual Site Models for OE and HTRW Projects, 3 Feb 03, <http://www.usace.army.mil/publications/eng-manuals/em1110-1-1200/toc.htm>.
- 18) EM 1110-1-4009, OE Response, 23 Jun 00, <http://www.usace.army.mil/publications/eng-manuals/em1110-1-4009/toc.htm>.

- 19) EP 75-1-2, MEC Support during HTRW and Construction Activities, 01 Aug 2004, <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep75-1-2/toc.htm>.
- 20) EP 75-1-3, Recovered Chemical Warfare Materiel Response, 4 January 2002, <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep75-1-3/toc.htm>.
- 21) EP 385-1-95a, Basic Safety Concepts and Considerations for OE Operations, 29 Jun 2001, <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep385-1-95a/toc.htm>.
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- 23) EP 1110-3-8, Public Participation in DERP for FUDS, 09 Apr 04, <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep1110-3-8/toc.htm>.
- 24) USACE Memorandum: HTRW Chemical Data Quality Management Policy for Environmental Laboratory Testing, 30 September 2004, http://www.environmental.usace.army.mil/info/technical/chem/chemval/HTRW_CDQM_Policy_for_Lab_Testing.pdf
- 25) CEHNC Interim Guidance Document 01-01, Implementation of TPP at OE FUDS Projects, [http://www.hnd.usace.army.mil/oew/policy/IntGuidRegs/TPP%20and%20the%20OE%20Process%20\(Final\).pdf](http://www.hnd.usace.army.mil/oew/policy/IntGuidRegs/TPP%20and%20the%20OE%20Process%20(Final).pdf).
- 26) CEHNC Data Item Descriptions (DIDs), <http://www.hnd.usace.army.mil/oew/didsindex.asp>.
- 27) ERDC TR-02-1, Guide for Characterization of Sites Contaminated with Energetic Materials, Feb 2002, [http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR02-1\(ERDC-CRL\).pdf](http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR02-1(ERDC-CRL).pdf)
- 28) USEPA, 1992 - Guidance for Performing Site Inspections under CERCLA; Interim Final, September 1992, PB92-963375, EPA 9345.1-05
- 29) DA, 2005a. Munitions Response Terminology, April 21, 2005
- 30) DA, 2005b. Working with Environmental Regulators and Safety Officials, May 5, 2005

Appendix B: Standard Forms

HTRW DRILLING LOG			DISTRICT			HOLE NUMBER	
1. COMPANY NAME			2. DRILLING SUBCONTRACTOR			SHEET OF SHEETS	
3. PROJECT				4. LOCATION			
5. NAME OF DRILLER				6. MANUFACTURER'S DESIGNATION OF DRILL			
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT			8. HOLE LOCATION				
9. SURFACE ELEVATION							
10. DATE STARTED					11. DATE COMPLETED		
12. OVERBURDEN THICKNESS				15. DEPTH GROUNDWATER ENCOUNTERED			
13. DEPTH DRILLED INTO ROCK				16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED			
14. TOTAL DEPTH OF HOLE				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)			
18. GEOTECHNICAL SAMPLES		DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DISPOSITION OF HOLE		BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
LOCATION SKETCH/COMMENTS						SCALE:	
PROJECT						HOLE NO.	

Facility/Project Name	Local Grid Location of Well N. _____ m. E. _____ m. W. _____ m. S. _____ m.	Well Number
Facility License, Permit or Monitoring Number	Grid Origin Location Lat. _____ Long. _____ or St. Plane _____ m. N. _____ m. E. _____ m.	Date Well Installed (Start)
Type of Protective Cover: Above-Ground <input type="checkbox"/> Flush-To-Ground <input type="checkbox"/>	Section Location of Waste/Source _____ % of _____ % of Sec. _____ T. _____ N.R. _____ E. _____ W. _____	Date Well Installed (Completed)
Well Distance From Waste/Source Boundary	Location of Well Relative to Waste/Source <input type="checkbox"/> Upgradient <input type="checkbox"/> Sidegradient <input type="checkbox"/> Downgradient <input type="checkbox"/> Not Known	Well Installed By: (Person's Name & Firm)
Maximum Depth of Frost Penetration (estimated)		

Note: Use top of casing (TOC) for all depth measurements.

A. Protective casing, top elevation _____ m. MSL

B. Well casing, top elevation _____ m. MSL

C. Land surface elevation _____ m. MSL

D. Surface seal, bottom _____ m. TOC or _____ m. MSL

16. USCS classification of soil near screen:

GP GM GC GW SW SP
 SM SC ML MH CL CH
 Bedrock

17. Sieve analysis attached? Yes No

18. Drilling method used: Rotary
 Hollow Stem Auger
 Other

19. Drilling fluid used: Water Air
 Drilling Mud None

20. Drilling additives used? Yes No
 Describe _____

21. Source of water (attach analysis):

E. Secondary filter, top _____ m. TOC or _____ m. MSL

F. Bentonite seal, top _____ m. TOC or _____ m. MSL

G. Secondary filter, top _____ m. TOC or _____ m. MSL

H. Primary filter, top _____ m. TOC or _____ m. MSL

I. Screen joint, top _____ m. TOC or _____ m. MSL

J. Well bottom _____ m. TOC or _____ m. MSL

K. Filter pack, bottom _____ m. TOC or _____ m. MSL

L. Borehole, bottom _____ m. TOC or _____ m. MSL

M. Borehole, diameter _____ mm.

N. O.D. well casing _____ mm.

O. I.D. well casing _____ mm.

P. 24-hr water level after completion _____ m. TOC or _____ m. MSL



1. Cap and lock? Yes No

2. Protective posts? Yes No

3. Protective casing:
 a. Inside diameter: _____ mm.
 b. Length: _____ m.

4. Drainage port(s) Yes No

5. Surface seal:
 a. Cap _____
 Gravel blanket
 Bentonite
 Concrete
 Other
 b. Annular space seal: Bentonite
 Cement
 Other

6. Material between well casing and protective casing:
 Bentonite
 Cement
 Other

7. Annular space seal:
 a. Granular Bentonite
 b. _____ lbs/gal mud weight Bentonite-sand slurry
 c. _____ lbs/gal mud weight Bentonite slurry
 d. _____ Bentonite Bentonite-cement grout
 e. _____ m³ volume added for any of the above
 f. How installed: Tremie
 Teemie pumped
 Gravity

8. Centralizers Yes No

9. Secondary Filter Yes No
 a. Volume added _____ m³ Bags/Size

10. Bentonite seal:
 a. Bentonite granules
 b. 1/2 in. 3/4 in. 1 in. Bentonite pellets
 c. _____ Other

11. Secondary Filter Yes No
 a. Volume added _____ m³ Bags/Size

12. Filter pack material: Manufacturer, product name & mesh size

 b. Volume added _____ m³ Bags/Size

13. Well casing: Flush threaded PVC schedule 40
 Flush threaded PVC schedule 80
 Other

14. Screen material:
 A. Screen type: Factory cut
 Continuous slot
 Other
 b. Manufacturer: _____
 c. Slot size: _____ in.
 d. Slotted length: _____ m.

15. Backfill material (below filter pack): None
 Other

MMRP: (Installation name) _____
DAILY QUALITY CONTROL REPORT

DATE _____

DAY:

S	M	T	W	TH	F	S
---	---	---	---	----	---	---

USACE PROJECT MGR. _____

PROJECT _____

JOB NO. _____

CONTRACT NO. _____

WEATHER	BRIGHT SUN	CLEAR	OVERCAST	RAIN	SNOW
TEMPERATURE	< 32	32 - 50	50 - 70	70-85	> 85
WIND	STILL	MODERATE	HIGH	REPORT NO.	
HUMIDITY	DRY	MODERATE	HUMID		

SUBCONTRACTORS ON-SITE:
EQUIPMENT ON SITE:
WORK PERFORMED (INCLUDING SAMPLING):
QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):
HEALTH AND SAFETY LEVELS AND ACTIVITIES:
PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:
SPECIAL NOTES:
TOMORROW'S EXPECTATIONS:

BY _____ TITLE _____

Attachments: QA/QC tables, COCs, field analytical results, other project forms generated

SHIPPING CONTAINER CHECKLIST SUMMARY

ATTN.: Corps of Engineers Contractors

Failure to properly handle or document the Project samples could jeopardize the useability of the sample results and ultimately the project. Prior to sending this cooler to the Analytical Laboratory at the address shown below, please check the following items:

- Is the project clearly identified on the Chain-of-Custody (official project name, project location, project phase)? Is the United States Army Corps of Engineers project number from the Sampling and Analysis Plan clearly indicated on the Chain-of-Custody?
- Are all enclosed sample containers clearly labeled with waterproof (permanent) ink and enclosed in a plastic bag?
- Are the desired analyses indicated on the bottle labels and chain-of-custody? Are the metals defined on the Chain-of-Custody (e.g., metals = lead, cadmium, etc.)?
- Are the sample labels complete, including the identification of appropriate method numbers for both the preparatory and analysis procedures?
- Does the information on the Chain-of-Custody match the information on the sample container labels?
- Have you placed the Chain-of-Custody in a plastic bag and attached it to the inside of the cooler lid?
- Have the samples been properly preserved (acid or base and cooling to $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$)?
- Is there a Contractor point of contact including name and phone number clearly shown on the Chain-of-Custody?
- Is there sufficient ice (double bagged in zip-locks) or "blue ice" in the cooler? It is recommended that the samples be placed on ice as soon as possible after sampling and repacked on new ice in shipping cooler.

This is a partial list of the requirements for proper documentation and shipping of the environmental samples. Please refer to the Sampling and Analysis Plan for further details.

COOLER RECEIPT FORM		Contractor Cooler _____
LIMS# _____		QA Lab Cooler # _____
		Number of Coolers _____
PROJECT: _____		Date received: _____
USE BOTTOM OF PAGE 2 OF THIS FORM TO NOTE DETAILS CONCERNING CHECK-IN PROBLEMS.		
A. PRELIMINARY EXAMINATION PHASE: Date cooler was opened: _____		
by (print) _____ (sign) _____		
1.	Did cooler come with a shipping slip (air bill, etc.)?	YES NO
	If YES, enter carrier name & air bill number here: _____	
2.	Were custody seals on outside of cooler?	YES NO
	How many & where _____, seal date: _____ seal name: _____	
3.	Were custody seals unbroken and intact at the date and time of arrival?	YES NO
4.	Did you screen samples for radioactivity using the Geiger counter?	YES NO
5.	Were custody papers in a plastic bag & taped inside to the lid?	YES NO
6.	Were custody papers filled out properly (ink, signed, etc.)?	YES NO
7.	Did you sign custody papers in the appropriate place?	YES NO
8.	Was the project identifiable from custody papers? If YES, enter project name at the top of this form	YES NO
9.	Were temperature blanks used?	YES NO
	Cooler Temperature _____ (°C) Thermometer ID No. _____	
10.	Have designated person initial here to acknowledge receipt of cooler: _____ (date) _____	
(Continued)		

B. LOG-IN PHASE: Date samples were logged in: _____
by (print) _____ (sign) _____

11. Describe type of packing in cooler: _____

12. Were all bottles sealed in separate plastic bags? YES NO

13. Did all bottles arrive unbroken with labels in good condition? YES NO

14. Were all bottle labels complete (ID, date, time, signature, preservative, etc.)? YES NO

15. Did all bottle labels agree with custody papers? YES NO

16. Were correct containers used for the tests indicated? YES NO

17. Were samples preserved to correct pH, if applicable? YES NO

18. Was a sufficient amount of sample sent for tests indicated? YES NO

19. Were bubbles absent in volatile organic analysis (VOA) samples? If NO, list
VOA samples below YES NO

20. Was the project manager called and status discussed? If YES, give details
on the bottom of this form YES NO

20. Who was called? _____ By whom? _____ (date) _____

NONCONFORMANCE AND CORRECTIVE ACTION REPORT

Date _____

NCR No. _____

Description of Nonconformance and Cause _____

Proposed Disposition _____

Submitted by: _____ Date: _____

Approved by: _____

DISPOSITION (by Project Manager or Designee)

Implementation of Disposition Assigned to: _____

Actual Disposition _____

Disposition completed on: _____

Date

Signature

VERIFICATION

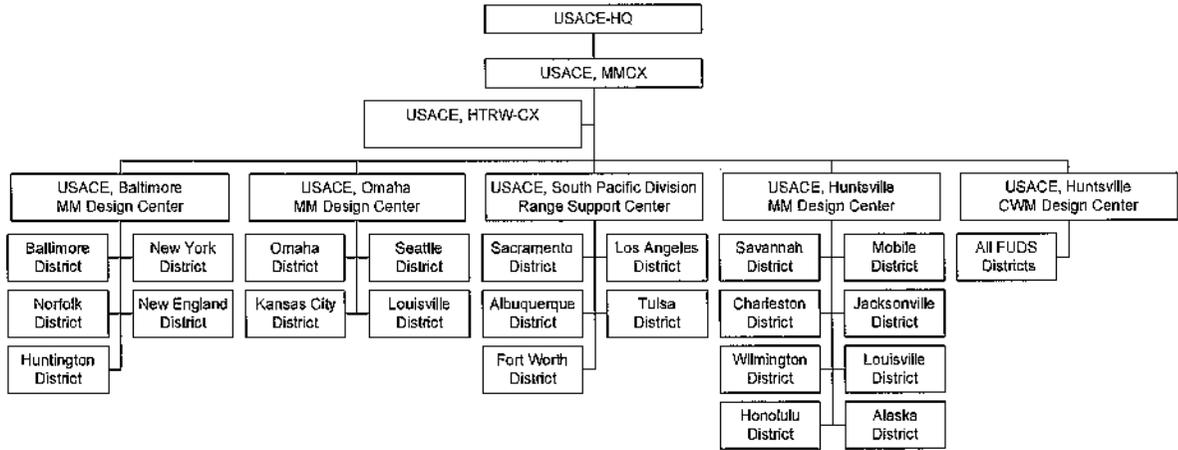
Disposition reviewed and work inspected by: _____ on _____

Disposition verified by: _____ on _____

(Use additional sheet or memo if necessary)

Appendix C: Figures

Figure 1. MMRP SI Organizational Chart



Appendix D: Tables

Table 1-A. Potential Chemical-Specific Data Quality Objectives and Preferred Maximum Method Quantitation Limits for Soil/Sediment

Analyte	Abbreviation	CAS #	Human Health Screening Values						Most Stringent Human Health Criteria	Ecological Screening Values (Terrestrial) (mg/kg)	Eco SV Source	Preferred Maximum Method Quantitation Limit Soil (mg/kg)*
			Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Soil - Direct Contact (mg/kg)					
			Region IX PRG	Region III RBC	Region VI SSL	Region IX PRG		Region III RBC				
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	4.4	5.8	4.4	16	26	17	4.4	5.8	A	2.2
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	3100	3900	3100	3100	51000	34000	3100	43	H	22
2,4,6-Trinitrotoluene (4)	2,4,6-TNT	118-96-7	16	3.9	16	57	51	64	16	8	B	2.0
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	1800	2300	1800	18000	31000	21000	1800	0.38	F	0.19
1,3-Dinitrobenzene	1,3-DNB	99-65-0	6.1	7.8	6.1	62	100	68	6.1	0.66	F	0.33
2,4-Dinitrotoluene (1)	2,4-DNT	121-14-2	0.72	0.94	0.72	2.5	4.2	2.8	0.72	1.28	F	0.36
2,6-Dinitrotoluene (1)	2,6-DNT	606-20-2	0.72	0.94	0.72	2.5	4.2	2.8	0.72	0.033	F	0.017
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	12	160		120	2000		12	5.3	H	2.7
2-Nitrotoluene	2-NT	88-72-2	0.88	2.8	2.9	2.2	12	14	2.8	4.1	H	0.44
3-Nitrotoluene	3-NT	99-08-1	730	1600	1600	1000	20000	23000	370	5.3	H	2.7
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	12	160		120	2000		12			6.0
4-Nitrotoluene	4-NT	99-99-0	12	38	38	30	170	190	38	9.4	H	4.7
Nitrobenzene	NB	98-95-3	20	39	20	100	510	110	20	40	C	10
Nitroglycerin	NG	55-63-0	35	46		120	200		35	150	H	18
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	610	310	240	6200	4100	2700	240	2	H	1.0
Pentaerythritol Tetranitrate	PETN	78-11-5								21000	H	10500
Aluminum	Al	7429-90-5	76000	78000	76000	100000	100000	100000	76000	50	C	25

Table I-A. Potential Chemical-Specific Data Quality Objectives and Preferred Maximum Method Quantitation Limits for Soil/Sediment

Analyte	Abbreviation	CAS #	Human Health Screening Values						Most Stringent Human Health Criteria	Ecological Screening Values (Terrestrial) (mg/kg)	Eco SV Source	Preferred Maximum Method Quantitation Limit Soil (mg/kg)*	
			Residential Soil (mg/kg)			Industrial Soil (mg/kg)							
			Region IX PRG	Region III RBC	Region VI SSL	Region IX PRG	Region III RBC	Region VI SSL (3)					Soil - Direct Contact (mg/kg)
Antimony	Sb	7440-36-0	31	31	31	410	410	410	450	31	0.30	A	0.15
Arsenic	As	7440-38-2	0.39	0.43	0.39	1.6	1.9	1.8	1.8	0.39	10	C	0.20
Barium	Ba	7440-38-2	5400	5500	5500	67000	72000	79000	79000	5400	330	A	165
Beryllium	Be	7440-41-7	150	160	150	1900	2000	2200	2200	150	1.1	C	0.55
Cadmium	Cd	7440-43-9	37	39	39	450	510	560	560	37	1.6	C	0.80
Calcium	Ca	7440-70-2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A
Chromium (2)	Cr	7440-47-3	210	230	210	450	3100	450	450	210	7.9	A	4.0
Cobalt	Co	7440-48-4	900	1600	900	1900	20000	1900	1900	900	13	A	6.5
Copper	Cu	7440-50-8	3100	3100	2900	41000	41000	42000	42000	2900	40	C	20
Iron	Fe	7439-89-6	23000	23000	23000	100000	310000	100000	100000	23000	N/A	--	11500
Lead	Pb	7439-92-1	400		400	800		800	800	400	16	A	8.0
Magnesium	Mg	7439-95-4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A
Manganese	Mn	7439-96-5	1800	1600	3200	19000	20000	35000	35000	1600	152	A	76
Molybdenum	Mo	7439-98-7	390	390	390	5100	5100	5700	5700	390			195
Nickel	Ni	7440-02-0	1600	1600	1600	20000	20000	23000	23000	1600	38	A	19
Potassium	K	7440-09-7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A
Selenium	Se	7782-49-2	390	390	390	5100	5100	5700	5700	390	0.50	A	0.25
Silver	Ag	7440-22-4	390	390	390	5100	5100	5700	5700	390	2.0	C	1.0
Sodium	Na	7440-23-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A

Table 1-A. Potential Chemical-Specific Data Quality Objectives and Preferred Maximum Method Quantitation Limits for Soil/Sediment

Analyte	Abbreviation	CAS #	Human Health Screening Values						Most Stringent Human Health Criteria	Ecological Screening Values (Terrestrial) (mg/kg)	Eco SV Source	Preferred Maximum Method Quantitation Limit Soil (mg/kg)*
			Residential Soil (mg/kg)			Industrial Soil (mg/kg)						
			Region IX PRG	Region III RBC	Region VI SSL	Region IX PRG	Region III RBC	Region VI SSL (3)				
Strontium	Sr	7440-24-6	47000	47000	47000	100000	610000	100000	47000		23500	
Thallium	Tl	7440-28-0	5.2	5.5		67	72		5.2	C	0.50	
Titanium	Ti	7440-32-6	100000	310000		100000	4100000		100000		50000	
Vanadium	V	7440-62-2	78	78	78	1000	1000	1100	78	C	1.0	
Zinc	Zn	7440-66-6	23000	23000	23000	100000	310000	100000	23000	C	25	
Zirconium	Zr	7440-67-7										
Mercury	Hg	7439-97-6	23		23	310		340	23	C	0.05	
Phosphorus (White)	WP or P ₄	7723-14-0	1.6	1.6	1.6	20	20	23	1.6		0.80	
Perchlorate	ClO ₄	14797-73-0	7.8	55	7.8	100	720	110	7.8		3.9	

* If laboratory cannot meet any of the preferred QLs with routine SW846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in Laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL. In those cases, the QL achievable with a routine SW846 methodology would be accepted.

- (1) Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values
- (2) Total chromium values used if available. All Region III values are based on hexavalent chromium.
- (3) Lower of the industrial values provided (industrial w/o dermal vs. industrial/outdoor)
- (4) Noncancer RBCs at an HI of 0.1 provided because screening at an HI of 0.1, in accordance with Region III guidance, will result in noncancer RBCs being lower than the cancer RBCs

Region IX PRGs, dtd 28 December 2004

Region III RBCs, dtd April 2005

Region VI SSLs, dtd 21 December 2004

Eco Screening Value Sources:

- A USEPA EcoSSLs
- D San Francisco Regional Water Quality Control Board Surface Water Screening Values
- F USEPA Region V Ecological Data Quality Levels
- H Los Alamos National Laboratory (LANL), ECORISK Database, 2004

- B Los Alamos Nuclear Lab Screening Level
- E USEPA Region III Freshwater Screening Benchmarks
- G Talmage, et. al. 1999

C USEPA Region IV Eco Screening Values

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Table 1-B. Potential Chemical-Specific Data Quality Objectives and Preferred Maximum Method Quantitation Limit for Surface Water/ Groundwater												
Analyte	Abbreviation	CAS #	Human Health Screening Values				Federal Ambient Water Quality (µg/L)		Ecological Screening Values (µg/L)	Eco SV Source	Most Stringent Criteria (µg/L)	Preferred Maximum Method Quantitation Limit Aqueous (µg/L)*
			Tap Water (µg/L)	Region III RBC	Region VI SSL	Region III RBC	Region VI SSL	CMC				
			IX PRG	III RBC	VI SSL	HA	MCLs	HA				
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.61	0.61	0.61	2	4000	190	E	0.61	0.31	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	1800	1800	1800	400		330	E	150	75	
2,4,6-Trinitrotoluene (4)	2,4,6-TNT	118-96-7	2.2	1.8	2.2	2	560	<40	E	1.8	0.90	
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	1100	1100	1100		30	14	G	11	5.5	
1,3-Dinitrobenzene	1,3-DNB	99-65-0	3.6	3.7	3.7	1	110	30	G	1.0	0.50	
2,4-Dinitrotoluene (1)	2,4-DNT	121-14-2	0.099	0.098	0.099	5 (6)	0.11		C	0.098	0.049	
2,6-Dinitrotoluene (1)	2,6-DNT	606-20-2	0.099	0.098	0.099	5 (6)	18,500		E	0.098	0.049	
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	7.3	73					G	7.3	3.7	
2-Nitrotoluene	2-NT	88-72-2	0.049	0.046	0.29					0.046	0.023	
3-Nitrotoluene	3-NT	99-08-1	120	120	120				E	120	60	
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	7.3	73						7.3	3.7	
4-Nitrotoluene	4-NT	99-99-0	0.66	0.62	4.0				E	0.62	0.31	
Nitrobenzene	NB	98-95-3	3.4	3.5	3.4			27,000	C	3.4	1.7	
Nitroglycerin	NG	55-63-0	4.8	4.8		5	1,700	200	E	4.8	2.4	
Methyl 2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	360	150	150				H	150	75	
Pentaerythritol Tetranitrate	PETN	78-11-5							E	85000	42500	
Aluminum	Al	7429-90-5	36000	37000	37000	50 (5)				50	25	

Table 1-B. Potential Chemical-Specific Data Quality Objectives and Preferred Maximum Method Quantitation Limit for Surface Water/ Groundwater														
Analyte	Abbreviation	CAS #	Human Health Screening Values						Federal Ambient Water Quality (µg/L)		Ecological Screening Values (µg/L)	Eco SV Source	Most Stringent Criteria (µg/L)	Preferred Maximum Method Quantitation Limit Aqueous (µg/L) ^s
			Tap Water (µg/L)			Federal Drinking Water Criteria (µg/L)			CMC	CCC				
			Region IX PRG	Region III RBC	Region VI SSL	Region I RBC	MCLs	HA						
Antimony	Sb	7440-36-0	15	15	15	6				6.0	D	6.0	3.0	
Arsenic	As	7440-38-2	0.045	0.045	0.045	10				0.14	D	0.045	0.023	
Barium	Ba	7440-38-2	2600	2600	2600	2000				1000	D	1000	500	
Beryllium	Be	7440-41-7	73	73	73	4				2.7	D	2.7	1.4	
Cadmium	Cd	7440-43-9	18	18	18	5				2.2	D	2.2	1.1	
Calcium	Ca	7440-70-2								--		NE		
Chromium (2)	Cr	7440-47-3	110	110	110	100				50	D	50	2.5	
Cobalt	Co	7440-48-4	730	730	730	1300/1000 (S)				3.0	D	3.0	1.5	
Copper	Cu	7440-50-8	1500	1500	1400	300 (S)				9.0	D	9.0	4.5	
Iron	Fe	7439-89-6	11000	11000	11000	300 (S)				--		300	150	
Lead	Pb	7439-92-1			15	15				2.5	D	2.5	1.3	
Magnesium	Mg	7439-95-4								--		NE		
Manganese	Mn	7439-96-5	880	730	1700	50 (S)	300			--		50	2.5	
Mercury	Hg	7439-97-6	11		11	2				0.77	D	0.77	0.39	
Molybdenum	Mo	7439-98-7	180	180	180	40				--		40	20	
Nickel	Ni	7440-02-0	730	730	730	100				52	D	52	26	
Potassium	K	7440-09-7								--		NE		
Selenium	Se	7782-49-2	180	180	180	50				5.0	D	5.0	2.5	
Silver	Ag	7440-22-4	180	180	180	100 (S)	100			0.34	D	0.34	0.17	
Sodium	Na	7440-23-5				20000 (8)				--		20000	10000	
Strontium	Sr	7440-24-6	22000	22000	22000	4000				--		4000	2000	
Thallium	Tl	7440-28-0	2.4	2.6		2				2.0	D	2.0	1.0	
Titanium	Ti	7440-32-6	150000	150000						--		150000	75000	
Vanadium	V	7440-62-2	36	37	37					19	D	19	9.5	

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Table 1-B. Potential Chemical-Specific Data Quality Objectives and Preferred Maximum Method Quantitation Limit for Surface Water/ Groundwater										
Analyte	Abbreviation	CAS #	Human Health Screening Values				Federal Ambient Water Quality (µg/L)		Ecological Screening Values (µg/L)	Preferred Maximum Method Quantitation Limit (µg/L)*
			Tap Water (µg/L)		Federal Drinking Water Criteria (µg/L)		CMC	CCC		
			Region IX PRG	Region III RBC	Region VI SSL	MCLs				
Zinc	Zn	7440-66-6	11000	11000	11000	5000 (5)	2000	120	D	60
Zirconium	Zr	7440-67-7								NE
Phosphorus (White)	WP or P ₄	7723-14-0	0.73	0.73	0.73		0.1			0.050
Perchlorate	ClO ₄	14797-73-0	3.6	26	3.7		(7)			3.6

* If laboratory cannot meet any of these QLs with routine SW846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in Laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL.

- (1) Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values
- (2) Total chromium values used if available. All Region III values are based on hexavalent chromium.
- (3) Lower of the industrial values provided (industrial w/o dermal vs. industrial/outdoor)
- (4) Noncancer RBCs at an HI of 0.1 provided because screening at an HI of 0.1, in accordance with Region III guidance, will result in noncancer RBCs being lower than the cancer RBCs
- (5) All MCLs are primary except those with this footnote.
- (6) All HAs are lifetime except those footnoted, which are based on 10-4 cancer risk
- (7) Drinking Water Equivalent Level
- (8) Drinking Water Advisory

Sources:

- A USEPA EcoSSLs
- B Los Alamos Nuclear Lab Screening Level
- C USEPA Region IV Eco Screening Values
- D San Francisco Regional Water Quality Control Board Surface Water Screening Values
- E USEPA Region III Freshwater Screening Benchmarks
- F USEPA Region V Ecological Data Quality Levels
- G Talmage, et al. 1999

- Region IX PRGs, dtd 28 December 2004
- Region III RBCs, dtd April 2005
- Region VI SSLs, dtd 21 December 2004

Table 2-A. Sample Containers, Preservatives, and Holding Times for Soils and Sediments

Parameter	Sample Container	Preservative	Holding Time
Metals	1 4 oz wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	28 days (Hg); 180 days (others)
Explosives	1 4 oz wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	14/40 days ^a
Perchlorate	1 4 oz wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	28 days
pH	1 4 oz wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	ASAP
SVOCs	1 4 oz wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	14/40 days ^a
Pesticides/PCBs	1 4 oz wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	14/40 days ^a
VOCs	State dependent, specify in SS-SAP	Cool to 4°C	State dependent, specify in SS-SAP

Table 2-B. Sample Containers, Preservatives, and Holding Times for Aqueous Samples

Parameter	Sample Container	Preservative	Holding Time
Metals	1 500-ml plastic bottle	pH<2, HNO ₃ , Cool to 4°C	28 days (Hg); 180 days
Explosives	2 1-L amber bottles	Cool to 4°C	7/40 days ^a
Perchlorate	1 250-ml plastic or glass bottle	Cool to 4°C	28 days
Hardness	1 100-ml plastic bottle	pH<2, HNO ₃ , Cool to 4°C	ASAP
SVOCs	1 1-L amber bottle	Cool to 4°C	7/40 days ^a
Pesticides	1 1-L amber bottle	Cool to 4°C	7/40 days ^a
PCBs	1 1-L amber bottle	Cool to 4°C	7/40 days ^a
VOCs	3 40 mL vials	pH<2, HCl, Cool to 4°C	14 days ^a

^a number of days between sample collection and extraction / number of days between extraction and analysis

Table 3A. Target Analyte List for Volatile Organic Compounds by GC/MS
 (based on SW-846 Method 8260B)

Volatile Organic Compound	CAS #	Comments
Acetone	67-64-1	
Benzene	71-43-2	
Bromobenzene	108-86-1	
Bromochloromethane	74-97-5	
Bromodichloromethane	75-27-4	
Bromoform	75-25-2	
Bromomethane (Methyl bromide)	74-83-9	
2-Butanone (MEK)	78-93-3	
n-Butylbenzene	104-51-8	
sec-Butylbenzene	135-98-9	
tert-Butylbenzene	98-06-6	
Carbon disulfide	75-15-0	
Carbon tetrachloride	56-23-5	
Chlorobenzene	108-90-7	
Chlorodibromomethane	124-48-1	
Chloroethane	75-00-3	
Chloroform	67-66-3	
Chloromethane	74-87-3	
2-Chlorotoluene	95-49-8	
4-Chlorotoluene	106-43-4	
1,2-Dibromo-3-chloropropane	96-12-8	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	
Dibromomethane	74-95-3	
Dichlorodifluoromethane	75-71-8	
1,1-Dichloroethane	75-34-3	
1,2-Dichloroethane	107-06-2	
1,1-Dichloroethene	75-35-4	
Cis-1,2-Dichloroethene	156-59-2	
trans-1,2-Dichloroethene	156-60-5	
1,2-Dichloropropane	78-87-5	
1,3-Dichloropropane	142-28-9	
2,2-Dichloropropane	594-20-7	
1,1-Dichloropropene	563-58-6	
cis-1,3-Dichloropropene	10061-01-5	
Trans-1,3-Dichloropropene	10061-02-6	
Ethylbenzene	100-41-4	
2-Hexanone	591-78-6	

Table 3A. Target Analyte List for Volatile Organic Compounds by GC/MS
 (based on SW-846 Method 8260B)

Volatile Organic Compound	CAS #	Comments
Hexachlorobutadiene	87-68-3	
Isopropylbenzene	98-82-8	
p-Isopropyltoluene	99-87-6	
Methylene chloride	75-09-2	
4-Methyl-2-pentanone (MIBK)	108-10-1	
Methyl Tert-butyl Ether (MTBE)	1634-04-4	
n-Propylbenzene	106-65-1	
Styrene	100-42-5	
1,1,1,2-Tetrachloroethane	630-20-6	
1,1,2,2-Tetrachloroethane	79-34-5	
Tetrachloroethene	127-18-4	
Toluene	108-88-3	
1,2,3-Trichlorobenzene	87-61-6	
1,2,4-Trichlorobenzene	120-82-1	
1,1,1-Trichloroethane	71-55-6	
1,1,2-Trichloroethane	79-00-5	
Trichloroethene	79-01-6	
Trichlorofluoromethane	75-69-4	
1,2,3-Trichloropropane	96-18-4	
1,2,4-Trimethylbenzene	95-63-6	
1,3,5-Trimethylbenzene	108-67-8	
Vinyl chloride	75-01-4	
o-Xylene	95-47-6	
m,p-Xylene	108-38-3/ 106-42-3	
Xylenes (Total)	1330-20-7	
4-Bromofluorobenzene	460-00-4	Surrogate
Dibromofluoromethane	1868-53-7	Surrogate
1,2-Dichlorobenzene-d4	2199-69-1	Surrogate
1,2-Dichloroethane-d4	17060-07-0	Surrogate
Fluorobenzene	462-06-6	Surrogate
Toluene-d8	2037-26-5	Surrogate
Pentafluorobenzene	363-72-4	Surrogate

Table 3-B. Target Analyte List for Semivolatile Organic Compounds by GC/MS
 (based on SW-846 Method 8270C)

Semivolatile Compound	CAS #	Comments
Acenaphthene	83-32-9	
Acenaphthylene	208-96-8	
Anthracene	120-12-7	
Benzidine	92-87-5	
Benzoic acid	65-85-0	
Benz(a)anthracene	56-55-3	
Benzo(b)fluoranthene	205-99-2	
Benzo(k)fluoranthene	207-08-9	
Benzo(g,h,i)perylene	191-24-2	
Benzo(a)pyrene	50-32-8	
Benzyl alcohol	100-51-6	
Bis(2-chlorethoxy)methane	111-91-1	
Bis(2-chloroethyl) ether	111-44-4	
Bis(2-chloroisopropyl) ether	108-60-1	
Bis(2-ethylhexyl) phthalate	117-81-7	
4-Bromophenyl phenyl ether	101-55-3	
Butyl benzyl phthalate	85-68-7	
Carbazole	86-74-8	
4-Chloroaniline	106-47-8	
4-Chloro-3-methylphenol	59-50-7	
2-Chloronaphthalene	91-58-7	
2-Chlorophenol	95-57-8	
4-Chlorophenyl phenyl ether	7005-72-3	
Chrysene	218-01-9	
Dibenz(a,h)anthracene	53-70-3	
Dibenzofuran	132-64-9	
Di-n-butyl phthalate	84-74-2	
1,2-Dichlorobenzene	95-50-1	
1,3-Dichlorobenzene	541-73-1	
1,4-Dichlorobenzene	106-46-7	
3,3'-Dichlorobenzidine	91-94-1	
2,4-Dichlorophenol	120-83-2	
2,6-Dichlorophenol	87-65-0	
Diethyl phthalate	84-66-2	
2,4-Dimethylphenol	105-67-9	
Dimethyl phthalate	131-11-3	
4,6-Dintro-2-methylphenol	534-52-1	

Table 3-B. Target Analyte List for Semivolatile Organic Compounds by GC/MS
 (based on SW-846 Method 8270C)

Semivolatile Compound	CAS #	Comments
2,4-Dinitrophenol	51-28-5	
2,4-Dinitrotoluene	121-14-2	
2,6-Dinitrotoluene	606-20-2	
1,2-Diphenylhydrazine	122-66-7	
Di-n-octyl phthalate	117-84-0	
Fluoranthene	206-44-0	
Fluorene	86-73-7	
Hexachlorobenzene	118-74-1	
Hexachlorobutadiene	87-68-3	
Hexachloroethane	67-72-1	
Indeno(1,2,3-cd)pyrene	193-39-5	
Isophorone	78-59-1	
2-Methylnaphthalene	91-57-6	
2-Methylphenol	95-48-7	
3-Methylphenol/4-Methylphenol	108-39-4 / 106-44-5	
Naphthalene	91-20-3	
2-Nitroaniline	88-74-4	
3-Nitroaniline	99-09-2	
4-Nitroaniline	100-01-6	
Nitrobenzene	98-95-3	
2-Nitrophenol	88-75-5	
4-Nitrophenol	100-02-7	
N-Nitrosodimethylamine	62-75-9	
N-Nitrosodiphenylamine	86-30-6	
N-Nitrosodi-n-propylamine	621-64-7	
N-Nitrosopyrrolidine	930-55-2	
Pentachlorophenol	87-86-5	
Phenanthrene	85-01-8	
Phenol	108-95-2	
Pyrene	129-00-0	
1,2,4-Trichlorobenzene	120-82-1	
2,4,5-Trichlorophenol	95-95-4	
2,4,6-Trichlorophenol	88-06-2	
2-Fluorophenol	367-12-4	Surrogate
Phenol-d5/d6		Surrogate
Nitrobenzene-d5		Surrogate
2-Fluorobiphenyl	321-60-8	Surrogate
2,4,6-Tribromophenol	118-79-6	Surrogate
Terphenyl-d14	1718-51-0	Surrogate

Table 3-C. Target Analyte List for Explosives by HPLC or HPLC/MS
 (based on SW-846 Method 8330)

Explosive Compound	CAS #	Comments
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	99-35-4	
1,3-Dinitrobenzene	99-65-0	
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	
Nitrobenzene	98-95-3	
2,4,6-Trinitrotoluene (TNT)	118-96-7	
4-Amino-2,6-dinitrotoluene	19406-51-0	
2-Amino-4,6-dinitrotoluene	35572-78-2	
2,4-Dinitrotoluene	121-14-2	
2,6-Dinitrotoluene	606-20-2	
2-Nitrotoluene	88-72-2	
3-Nitrotoluene	99-08-1	
4-Nitrotoluene	99-99-0	
Nitroglycerin	55-63-0	Requires HPLC/MS, SW8332, or modification to SW8330; must be identified in PSAP Addendum
Pentaerythritol Tetranitrate	78-11-5	Requires HPLC/MS or modification to SW8330; must be identified in PSAP Addendum

Note: PSAP Addendum must identify surrogate analyte(s) planned for use.

Table 3-D. Target Analyte List for Organochlorine Pesticides by GC/ECD
 (based on SW-846 Method 8081A)

Organochlorine Pesticide Compound	CAS #	Comments
Aldrin	309-00-2	
alpha-BHC	319-84-6	
beta-BHC	319-85-7	
delta-BHC	319-86-8	
gamma-BHC (Lindane)	58-89-9	
alpha-Chlordane	5103-71-9	
gamma-Chlordane	5103-74-2	
4,4'-DDD	72-54-8	
4,4'-DDE	72-55-9	
4,4'-DDT	50-29-3	
Dieldrin	60-57-1	
Endosulfan I	959-98-8	
Endosulfan II	33213-65-9	
Endosulfan sulfate	1031-07-8	
Endrin	72-20-8	
Endrin aldehyde	7421-93-4	
Endrin ketone	53494-70-5	
Heptachlor	76-44-8	
Heptachlor epoxide	1024-57-3	
Methoxychlor	72-43-5	
Toxaphene	8001-35-2	
4-Chloro-3-nitrobenzo-trifluoride	121-17-5	Surrogate
Tetrachloro-m-xylene (TCMX)	877-09-8	Surrogate
Decachlorobiphenyl	2051-24-3	Surrogate

Table 3-E. Target Analyte List for Polychlorinated Biphenyls by GC/ECD
 (based on SW-846 Method 8082)

PCB Compound	CAS #	Comments
Aroclor 1016	12674-11-2	
Aroclor 1221	11104-28-2	
Aroclor 1232	11141-16-5	
Aroclor 1242	53469-21-9	
Aroclor 1248	12672-29-6	
Aroclor 1254	11097-69-1	
Aroclor 1260	11096-82-5	
Aroclor 1268	11100-14-4	
Aroclor 1016/1260	12674-11-2/11096-82-5	
Decachlorobiphenyl	2051-24-3	Surrogate
Tetrachloro-m-xylene (TCMX)	877-09-8	Surrogate
2,2',4,4',5,5'-Hexabromobiphenyl	59080-40-9	Surrogate 8082A

**Table 3-F. Target Analyte List for Inorganics by ICP, ICP/MS, GFAA, CVAA,
 and GC/NPD**
 (based on SW-846 Methods 6010B, 6020, and 7000A Series ⁽¹⁾)

Metal	CAS #	Comments
Aluminum	7429-90-5	6010B/6020
Antimony	7440-36-0	6010B//6020/7041
Arsenic	7440-38-2	6010B/6020/7060A/7061A
Barium	7440-39-3	6010B/6020
Beryllium	7440-41-7	6010B//6020/7090
Cadmium	7440-43-9	6010B/6020/7131A
Calcium	7440-70-2	6010B/6020A
Chromium	7440-47-3	6010B/6020
Cobalt	7440-48-4	6010B/6020
Copper	7440-50-8	6010B/6020
Iron	7439-89-6	6010B/6020A
Lead	7439-92-1	6010B/6020/7421
Magnesium	7439-95-4	6010B/6020A
Manganese	7439-96-5	6010B/6020
Mercury	7439-97-6	7470/7471/7472/6020A
Molybdenum	7439-98-7	6010B/7481/6020A
Nickel	7440-02-0	6010B/6020
Potassium	7440-09-7	6010B/6020A
Selenium	7782-49-2	6010B/7240/6020A
Silver	7440-22-4	6010B/6020
Sodium	7440-23-5	6010B/6020A
Strontium	7440-24-6	6010B
Thallium	7440-28-0	6010B/6020/7841
Titanium	7440-32-6	6010B
Vanadium	7440-62-2	6010B/7911/6020A
White Phosphorus	7723-14-0	7580
Zinc	7440-66-6	6010B/6020
Zirconium	7440-67-7	6010B/6020

⁽¹⁾ Site-specific SAPs must specify which method is intended.

Table 4-A. Quality Control Requirements for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography
 (Methods 7580, 8081A, 8082, and 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
Method detection limit (MDL) study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a response at least 3 times greater than instrument's noise level.	Run MDL verification check at higher level and higher MDL set or reconduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Retention time window width calculated for each analyte and surrogate	At method set-up and after major maintenance (e.g., column change)	Width is ± 3 times standard deviation for each analyte retention time from 72-hour study.	NA	NA	
Breakdown check (Endrin/DDT Method 8081A only)	Daily prior to analysis of samples	Degradation < 15% for both Endrin and DDT.	Correct problem, then repeat breakdown check.	Flagging criteria are not appropriate.	No samples shall be run until degradation < 15%.

Table 4-A. Quality Control Requirements for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography (Methods 7580, 8081A, 8082, and 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte $\leq 20\%$ Option 2: linear - least squares regression: $r \geq 0.995$ Option 3: non-linear regression: coefficient of determination (COD) $r^2 \geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem, then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1268, 1262). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.
Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within $\pm 20\%$ of expected value (initial source)	Correct problem and verify second source standard. If that fails then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.
Retention time window position establishment for each analyte and surrogate	Once per ICAL	The center of the retention time window shall be set at midpoint of initial calibration curve.	NA	NA	

Table 4-A. Quality Control Requirements for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography
 (Methods 7580, 8081A, 8082, and 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Retention time window verification for each analyte and surrogate	Each calibration verification standard	Analyte within established window	Correct problem, and then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window.	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification.
Calibration verification (initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within $\pm 20\%$ of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if reanalysis isn't possible.	If %D for an individual analyte is $> 20\%$, no samples may be analyzed until the problem has been corrected.
Method blank	One per preparatory batch	No analytes detected $\geq \frac{1}{2}$ RL. For common laboratory contaminants, no analytes detected \geq RL.	Correct problem. If required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	

Table 4-A. Quality Control Requirements for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography
 (Methods 7580, 8081A, 8082, and 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory control sample (LCS) containing all analytes required to be reported by the project or contract	One LCS per preparatory batch	QC accepted criteria specified by DoD, if available; see Table 8.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated batch for failed analytes in all samples in the associated preparatory batch, if sufficient sample material is available (see full explanation in Appendix DoD-D of DoD QSM)	If corrective action fails, apply Q to specific analyte(s) in all samples in the associated preparatory batch	
Matrix spike (MS)	One MS per preparation batch per matrix	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per preparation batch per matrix	RPD \leq 30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.

**Table 4-A. Quality Control Requirements for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography
 (Methods 7580, 8081A, 8082, and 8330)**

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Surrogate spike (analytes identified in Table 7)	All field and QC samples	QC acceptance criteria for LCS specified in Table 7	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J if acceptance criteria are not met. For QC samples, apply Q to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.
Confirmation of positive results (second column or second detector)	All positive results must be confirmed (in Method 8081A exclude Toxaphene and chlordane)	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD \leq 40%.	NA	Apply J if RPD > 40% from primary column result or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non-effected result and document in the case narrative.
Results reported between MDL and PQL	NA	NA	NA	Apply J to all results between MDL and PQL.	

Table 4-B. Quality Control Requirements for Organic Analysis by Gas Chromatography/Mass Spectroscopy (Methods 8260B and 8270C)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a response at least 3 times greater than instrument's noise level.	Run MDL verification check at higher level and higher MDL, set or reconduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be accepted without a valid tune.

Table 4-B. Quality Control Requirements for Organic Analysis by Gas Chromatography/Mass Spectroscopy (Methods 8260B and 8270C)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Breakdown check (DDT Method 8270C only)	Daily prior to analysis of samples	Degradation < 20% for DDT	Correct problem then repeat breakdown check	Flagging criteria are not appropriate	No samples shall be run until degradation < 20%. Benzidine and pentachlorophenol should be present at their normal responses and no peak tailing should be visible.
Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	1. Average response factor (RF) for SPCCs: VOCs - ≥ 0.30 for Chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs - ≥ 0.050 . 2. %RSD for RFs for CCCs: VOCs and SVOCs - $\leq 30\%$ and one option below; Option 1: RSD for each analyte $\leq 15\%$ Option 2: linear - least squares regression $r \geq 0.995$ Option 3: non-linear regression - coefficient of determination (COD) $r^2 \geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.
Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within $\pm 25\%$ of expected value (Initial source)	Correct problem and verify second source standard. If that fails, then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.

Table 4-B. Quality Control Requirements for Organic Analysis by Gas Chromatography/Mass Spectroscopy (Methods 8260B and 8270C)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA	NA	
Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within +/- 0.06 RRT units.	Correct problem, then rerun ICAL.	Flagging criteria are not appropriate.	
Calibration verification (CV)	Daily, before sample analysis and every 12 hours of analysis time	1. Average RF for SPCCs: VOCs - ≥ 0.30 for Chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050 . 2. %Difference/Drift for CCCs: VOCs and SVOCs - $\leq 20\%D$ (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	Correct problem, then rerun CV. If that fails, then repeat initial calibration.	Apply Q-flag if no sample material remains and analyte exceeds criteria.	
Internal standards (IS) verification	All field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associates with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Sample results are not acceptable without a valid IS verification.

Table 4-B. Quality Control Requirements for Organic Analysis by Gas Chromatography/Mass Spectroscopy (Methods 8260B and 8270C)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method blank	One per preparatory batch	No analytes detected $\geq \frac{1}{2}$ RL. For common laboratory contaminants, no analytes detected \geq RL.	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B to all results for the specific analyte(s) in all samples in the associated preparatory batch.	
LCS containing all analytes required to be reported, including surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see Table 8.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated batch for failed analytes in all samples in the associated batch, if sufficient sample material is available. (See full explanation in Appendix DoD-D of DoD QSM.)	If corrective action fails, apply Q to specific analyte(s) in all samples in the associated preparatory batch.	
MS	One MS per preparatory batch per matrix	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.

Table 4-B. Quality Control Requirements for Organic Analysis by Gas Chromatography/Mass Spectroscopy (Methods 8260B and 8270C)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
MSD or sample duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.
Surrogate spike (analytes identified in Table 7)	All field and QC samples	QC acceptance criteria for in Table 7.	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J if acceptance criteria are not met. For QC samples, apply Q to specific analyte(s) in all samples in the associated preparatory batch.	
Results reported between MDL and PQL	NA	NA	NA	Apply J to all results between MDL and PQL.	

Table 4-C. Quality Control Requirements for Inorganic Analysis by Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AA)
 (Methods 6010B And 7000A Series)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specified criteria	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analyst ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
MDL study	At initial set-up and subsequently once per 12 months; otherwise quarterly	See 40 CFR 136B. MDL verification checks must produce a response at least 3 times greater than instrument noise level.	Run MDL verification check at higher level and higher MDL set or reconduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Instrument detection limit (IDL) study (ICP only)	Every 3 months	Detection limits established shall be \leq MDL.	NA	NA	Samples cannot be analyzed without a valid IDL.
Linear range or high-level calibration check standard (ICP only)	Every 6 months	Within \pm 10% of expected value	NA	NA	

Table 4-C. Quality Control Requirements for Inorganic Analysis by Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AA)
 (Methods 6010B And 7000A Series)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Initial calibration for all analytes (ICAL)	Daily initial calibration prior to sample analysis	ICP: No acceptance criteria unless more than one standard is used, in which case $r \geq 0.995$. GFAA: $r \geq 0.995$ CVAA: $r \geq 0.995$	Correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.
(ICP: minimum one high std and a calibration blank; GFAA: minimum three stds and a calibration blank; CVAA: minimum 6 stds and a calibration blank)	Once after each initial calibration, prior to sample analysis	All analyte(s) within $\pm 10\%$ of expected value	Correct problem and verify second source standard. Re-run ICV. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.
Second source calibration verification (ICV)	After every 10 samples and at the end of the analysis sequence	ICP: within $\pm 10\%$ of expected value GFAA: within $\pm 20\%$ of expected value CVAA: within $\pm 20\%$ of expected value	Correct problem, rerun calibration verification. If that fails, then repeat initial calibration. Reanalyze all samples since the last successful calibration.	Flagging criteria are not appropriate.	Problem must be corrected. Results may not be reported without a valid CCV.
Continuing calibration verification (CCV)					

**Table 4-C. Quality Control Requirements for Inorganic Analysis by Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AA)
 (Methods 6010B And 7000A Series)**

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Low level calibration check standard (ICP only)	Daily, after one-point initial calibration	Within $\pm 20\%$ of expected value	Correct problem, then reanalyze.	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.
Method blank	One per preparatory batch	No analytes detected \geq $\frac{1}{2}$ RL For common laboratory contaminants, no analytes detected \geq RL	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B to all results for the specific analyte(s) in all samples in the associated preparatory batch.	
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected \geq 2X MDL	Correct problem, then reprep and reanalyze calibration blank and previous 10 samples	Apply B to all results for specific analyte(s) in all samples associated with the blank.	
Interference check solutions (ICS) (ICP only)	At the beginning of an analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes $<$ 2X MDL (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within $\pm 20\%$ of expected value	Terminate analysis; locate and correct problem; reanalyze ICS.	Flagging criteria are not appropriate.	No samples may be analyzed without a valid ICS.

**Table 4-C. Quality Control Requirements for Inorganic Analysis by Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AA)
 (Methods 6010B And 7000A Series)**

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
LCS containing all analytes required to be reported	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see Table 8	Correct problem, then reprep and reanalyze the LCS and all samples in the associated batch for failed analytes in all samples in the associated preparatory batch (see full explanation in Appendix DoD-D of DoD QSM).	If corrective action fails, apply Q to specific analyte(s) in all samples in the associated preparatory batch.	
Dilution test	Each preparatory batch or when a new or unusual matrix is encountered	Five-fold dilution must agree within $\pm 10\%$ of the original determination	ICP: Perform post-digestion spike (PDS) addition GFAA: Perform recovery test CVAA: Perform matrix spike	Flagging criteria are not appropriate.	Only applicable for samples with concentrations $> 50 \times$ MDL (ICP) or $> 25 \times$ MDL (GFAA and CVAA).
Post-digestion spike (PDS) addition (ICP only)	When dilution test fails or analyte concentration in all samples $< 50 \times$ MDL	The spike addition must produce a level between 10 and 100x MDL. Recovery within 75-125% of expected result.	Run samples by method of standard addition (MSA) or see flagging criteria.	Apply J to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post-digestion spike addition.	The spike addition should produce a level between 10 and 100 x MDL.
Recovery test (GFAA only)	When dilution test fails or analyte concentration in all samples $< 25 \times$ MDL	Recovery within 85-115% of expected results.	Run samples by method of standard addition (MSA) or see flagging criteria.	Apply J to all sample results (for same matrix) in which MSA was not run when recovery is outside of 85-115% range.	

**Table 4-C. Quality Control Requirements for Inorganic Analysis by Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AA)
 (Methods 6010B And 7000A Series)**

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method of standard addition (MSA) or Internal standard calibration	When matrix interference is suspected	NA	NA	NA	Document use in the case narrative.
MS	One MS per every preparatory batch per matrix	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
MSD or sample duplicate	One per preparatory batch per matrix	RPD \leq 20% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.
Results reported between MDL and PQL	NA	NA	NA	Apply J to all results between MDL and PQL	

Table 4-D. Quality Control Requirements for Trace Metals Analysis by Inductively Coupled Plasma Mass Spectrometry (Method 6020)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel or test method	QC acceptance criteria published by DoD, if available; otherwise method-specified criteria	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analyst ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
MDL study	At initial set-up and once per 12 months; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a response at least 3 times greater than instrument noise level.	Run MDL verification check at higher level and higher MDL set or reconduct MDL study.	NA	Samples cannot be analyzed without a valid MDL.
IDL study	Every 3 months	Detection limits established shall be \leq MDL.	NA	NA	Samples cannot be analyzed without a valid IDL.
Tuning	Prior to initial calibration	Mass calibration \leq 0.1 amu from the true value; Resolution < 0.9 amu full width at 10% peak height; for stability, RSD \leq 5% for at least 4 replicate analytes	Retune instrument then reanalyze tuning solutions.	Flagging criteria are not appropriate.	No analysis shall be performed without a valid MS tune.

Table 4-D. Quality Control Requirements for Trace Metals Analysis by Inductively Coupled Plasma Mass Spectrometry (Method 6020)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Initial calibration (ICAL) (minimum one high standard and a calibration blank)	Initial calibration prior to sample analysis	If more than one calibration standard is used, $r \geq 0.995$	Correct problem, then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.
Second source calibration verification	Once after each ICAL, prior to beginning a sample run	Value of second source for all analytes within $\pm 10\%$ of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem, then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.
Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 10\%$ of expected value	Correct problem, rerun calibration verification. If that fails, then repeat initial calibration. Reanalyze all samples since the last successful calibration.	Flagging criteria are not appropriate.	Problem must be corrected. Results may not be reported without a valid CCV.
Low-level calibration check standard	Daily, after one-point initial calibration	Within $\pm 20\%$ of expected value	Correct problem, then reanalyze.	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.
Linear range or high-level check standard	Every 6 months	Within $\pm 10\%$ of expected value	NA	NA	

Table 4-D. Quality Control Requirements for Trace Metals Analysis by Inductively Coupled Plasma Mass Spectrometry (Method 6020)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method blank	One per preparatory batch	No analytes detected $\geq \frac{1}{2}$ RL. For common laboratory contaminants, no analytes detected \geq RL.	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B to all results for the specific analyte(s) in all samples in the associated preparatory batch.	
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected $\geq 2X$ MDL	Correct problem, then reprep and reanalyze calibration blank and previous 10 samples.	Apply B to all results for specific analyte(s) in all samples associated with the blank.	
Interference check solutions (ICS-A and ICS-AB)	At the beginning and end of an analytical run	<u>ICS-A:</u> Absolute value of concentration for all non-spiked analytes $< 2X$ MDL (unless they are a verified trace impurity from one of the spiked analytes) <u>ICS-AB:</u> Within $\pm 20\%$ of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all affected samples.	if corrective action fails, apply Q to all results for specific analyte(s) in all samples associated with the ICS.	
LCS containing all analytes required to be reported	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see Table 8	Correct problem, then reprep and reanalyze the LCS and all samples in the associated batch for failed analytes in all samples in the associated preparatory batch, if sufficient sample material is available (see full explanation in Appendix DoD-D of the DoD QSM).	If corrective action fails, apply Q to specific analyte(s) in all samples in the associated preparatory batch.	

Table 4-D. Quality Control Requirements for Trace Metals Analysis by Inductively Coupled Plasma Mass Spectrometry (Method 6020)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Dilution test	Each preparatory batch	Five-fold dilution must agree within $\pm 10\%$ of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations $> 100x$ MDL.
Post digestion spike addition	When dilution test fails or analyte concentration for all samples $< 100x$ MDL	Recovery within 75-125% of expected results	Run samples by method of standard addition (MSA) or see flagging criteria.	Apply J to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post-digestion spike addition.	
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use in the case narrative.
MS	One MS per preparatory batch per matrix	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
MSD or sample duplicate	One per preparatory batch per matrix	RPD $< 20\%$ (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.
Internal standards (IS)	Every sample	IS intensity within 30-120% of intensity of the IS in the initial calibration	Perform corrective action as described in Method 6020 (8.3).	Flagging criteria are not appropriate.	
Results reported between MDL and PQL	NA	NA	NA	Apply J to all results between MDL and PQL.	

Table 4-E. Quality Control Requirements for Perchlorate by Ion Chromatography (Method 314.0)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Initial Demonstration of Capability (IDC)	Prior to beginning any analysis batch.	See Table 5 of Method 314.0.	N/A	
Matrix Conductivity Threshold (MCT)	As part of the initial demonstration of capability. See section 9.2.8 of Method 314.0.	MCT, based on linear regression, is the matrix conductance for which the peak area-to-height ratio percent difference exceeds 20%. See Table 5 of Method 314.0.	N/A	
Method Detection Limit (MDL)	An MDL study is conducted at initial setup and subsequently once per 12-month period and when major changes occur in the methods operating procedures (addition of cleanup procedures, column changes, mobile phase changes). If no changes have been made to the method, quarterly MDL verification checks may be performed in lieu of the yearly MDL study.	MDL study must be performed in the matrix of interest using a standard at a concentration that is 1 to 10 times the estimated MDL value. MDL must be validated through the analysis of a low-level spike at ~ 2 times MDL taken through the entire preparation process. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or perform the MDL study again.	Samples cannot be analyzed without a valid MDL.
Limit of Quantitation (LOQ; called MRL, Method Reporting Level in 314.1)	With every initial calibration.	Documented in the specific matrix of concern, at or below the applicable regulatory limit. Equal to lowest calibration standard. At least 3 times the MDL/LOD. The LOQ must be verified in a solution prepared at the MCT.	Apply J-flag to all results between LOD and LOQ.	

Table 4-E. Quality Control Requirements for Perchlorate by Ion Chromatography (Method 314.0)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Retention-Time (window width calculated for each analyte and internal standard)	At method setup and after major maintenance (e.g., column change).	Width is + 3 times standard deviation for each analyte retention time from 72-hour study.	N/A	N/A
Holding time (HT)	Applies to all samples.	HT < 28 days (to be consistent with other EPA requirements).	None, qualify data with a Q-flag.	
Initial Calibration (ICAL)	Initial calibration prior to sample analysis.	Minimum of 5 calibration standards to establish linearity (daily), $r^2 > 0.995$.	Correct problem, then repeat initial calibration. Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.
Second Source Calibration Verification (SSCV)	Once after each multipoint calibration.	Value of second source for perchlorate within + 10% of expected value (initial source).	Correct problem and verify second source standard. Rerun SSCV. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until SSCV has passed.
Initial Calibration Verification Standard (ICV)	After initial calibration, with each analysis batch, analysis of a standard at the LOQ	Recovery must be 85-115% of true value. Note: Method 314.0 requires + 25%; however, the DoD-QSM requires the acceptance criteria for the ICV to be the same as the continuing calibration verifications. As the QSM requirements are more stringent, they supersede the method requirements.	Correct problem and rerun ICV. If that fails, correct problem and repeat initial calibration. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.	Problem must be corrected. No samples may be run until calibration has been verified.

Table 4-E. Quality Control Requirements for Perchlorate by Ion Chromatography (Method 314.0)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Instrument Performance Check (IPC)	<p>One per analytical batch</p> <p>Analysis of a standard containing mid-level perchlorate and interfering anions bracket each analytical batch to verify method performance at the matrix conductivity threshold. At least one IPC must be analyzed daily.</p>	<p>IPC conductance within + 10% of original measured value.</p> <p>Peak area-to-height ratio percent difference < 20% (compared to peak area-to-height ratio of the LCS).</p> <p>Perchlorate quantitated between 80 and 120% of fortified level.</p>	<p>Correct problem and then reanalyze all samples in that batch. If poor recovery from the cleanup filters is suspected, a different lot of filters must be used to re-extract all samples in the batch. If column degradation is suspected, a new column must be calibrated before the samples can be reanalyzed.</p>	<p>No samples may be reported as associated with a failing IPC.</p>
Continuing Calibration Verification Standard (CCV)	<p>Alternate analysis of mid-level standard and a standard at the LOQ after every 10 samples. At the end of the batch, both standards should be analyzed. All samples should be bracketed by the analysis of a standard demonstrating that the system was capable of accurately detecting and quantifying perchlorate.</p>	<p>< 5% shift in perchlorate retention time.</p> <p>Recoveries must fall between 85 and 115%.</p>	<p>Correct problem and rerun CCV and all samples analyzed since last successful CCV. If that fails, apply Q-flag to all results in all samples since the last acceptable calibration verification, if reanalysis is not possible.</p>	<p>No samples may be analyzed until the problem has been corrected.</p>
Method Blank or Pretreated Laboratory Reagent Blank	<p>One per batch (up to 20 samples). Must undergo same pretreatment process that was performed on the samples.</p>	<p>< 1/2 of the RL</p>	<p>Correct problem, re-prep, then reanalyze method blank and all samples processed with the contaminated blank. Apply B-flag to all results for the specific analytes in all samples in the associated preparatory batch if reanalysis is unsuccessful.</p>	<p>N/A</p>

Table 4-E. Quality Control Requirements for Perchlorate by Ion Chromatography (Method 314.0)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Pretreated QC	REQUIRED once per analytical batch in any analysis that includes samples that have exceeded the MCT and have been pretreated in any way to reduce the common anion levels. Pretreated method blanks, LCS, ICS, and matrix spikes should be analyzed if any samples in the batch have required pretreatment to reduce common anions.	Apply criteria as stated above for individual QC elements.	Use corrective action/flagging criteria as stated above for individual QC elements.	Pretreated samples must have associated pretreated QC samples.
Laboratory Control Sample (LCS)	Once per analytical batch following the ICV. Calculate %Recovery prior to analyzing samples.	%Recovery within 85-115%.	Correct problem, then re-prepare and reanalyze the LCS and all associated samples. If corrective action fails, apply Q-flag to all samples in the associated preparatory batch.	Sample results from batches that fail the LCS are invalid.
Matrix Spikes (MS)	Collect one per 20 samples per matrix.	%Recovery within 80-120%.	In the parent sample, apply J-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the limits, the data must be evaluated to determine the source of the difference and to determine if there is a matrix effect or analytical error.
Matrix Spike Duplicates or Laboratory Duplicates (MS and MSD)	Collect one per 20 samples per matrix.	%Recovery within MS limits, RPD < 15%.	In the parent sample, apply J-flag if acceptance criteria are not met.	Evaluate the data to determine the source of the difference.

Table 4-F. Quality Control Requirements for Perchlorate by MS Methods (Method EPA 331.0, EPA 332.0, SW6850, SW6860)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Holding Time (HT)	All samples	HT < 28 days (to be consistent with other EPA requirements)	None, quality data with a Q-flag.	No criteria exist.
Limit of Quantitation (LOQ)	With every initial calibration.	Documented in the specific matrix of concern, at or below the applicable regulatory limit. Equal to lowest calibration standard.	Apply J-flag to all results between LOD and LOQ.	
Method Detection Limit (MDL)	A full MDL study is conducted at initial setup and subsequently once per 12-month period and when major changes occur in the method's operating procedures (addition of cleanup procedures, column changes, mobile phase changes). If no changes have been made to the method, quarterly MDL verification checks may be performed in lieu of the yearly MDL study.	At least 3 times the MDL/LOD MDL study must be performed in the matrix of interest using a standard at a concentration that is 1 to 10 times the estimated MDL value. MDL must be validated through the analysis of a low-level spike at ~ 2 times MDL taken through the entire preparation process. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study.	Samples cannot be analyzed without a valid MDL.
Retention Time (window width calculated for each analyte and internal standard)	At method setup and after major maintenance (e.g., column change).	Width is + 3 times standard deviation for each analyte retention time from 72-hour study.	N/A	N/A

Table 4-F. Quality Control Requirements for Perchlorate by MS Methods (Method EPA 331.0, EPA 332.0, SW6850, SW6860)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Initial Calibration (ICAL)	Initial calibration prior to sample analysis.	Minimum of 5 calibration standards to establish linearity (daily), $r^2 > 0.995$. The calibration is linear and shall not be forced through the origin.	Correct problem, then repeat initial calibration. Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.
Initial Calibration Verification Standard (ICV)	After initial calibration, daily analysis of a second source standard at the midpoint of the calibration.	%Difference < 15% relative to initial value.	Correct problem and rerun ICV. If that fails, correct problem and repeat initial calibration. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.	Problem must be corrected. No samples may be run until calibration has been verified.
Continuing Calibration Verification Standard (CCV)	Analysis of mid-level standard after every 10 samples. All samples should be bracketed by the analysis of a standard, demonstrating that the system was capable of accurately detecting and quantifying perchlorate.	%Difference < 15% relative to initial value.	Correct problem and rerun CCV and all samples analyzed since last successful CCV. If that fails, apply Q-flag to all results in all samples since the last acceptable calibration verification, if reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.

Table 4-F. Quality Control Requirements for Perchlorate by MS Methods (Method EPA 331.0, EPA 332.0, SW6850, SW6860)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
<p>Method Detection Limit Verification Standard (MDLV)</p>	<p>Analysis of a standard containing perchlorate at 2 times the MDL concentration. This standard must be analyzed before and directly after every batch of samples is analyzed. It can be analyzed after every 10 samples in order to reduce the reanalysis rate.</p>	<p>Recovery within 30% of its true value.</p>	<p>Correct problem and rerun MDLV and all samples analyzed since last successful MDLV. If that fails, apply Q-flag to all results in all samples since the last acceptable calibration verification, if reanalysis is not possible.</p>	<p>No samples may be analyzed until the problem has been corrected.</p>
<p>Interference Check Sample (ICS)</p>	<p>Analysis of a standard containing perchlorate at the RL and interfering anions at the concentration determined by the interference threshold study. One ICS is extracted with every batch of 20 samples. It verifies the method performance at the matrix conductivity threshold (MCT). At least one ICS must be analyzed daily.</p>	<p>Monitor recovery of perchlorate and retention time. Recovery within 30%.</p>	<p>Correct problem and then reanalyze all samples in that batch. If poor recovery from the cleanup filters is suspected, a different lot of filters must be used to re-extract all samples in the batch. If column degradation is suspected, a new column must be calibrated before the samples can be reanalyzed.</p>	<p>No samples may be reported that are associated with a failing ICS.</p>

Table 4-F. Quality Control Requirements for Perchlorate by MS Methods (Method EPA 331.0, EPA 332.0, SW6850, SW6860)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Method Blanks (MB)	One per batch. Undergoes same pretreatment steps as the samples.	< 1/2 of the RL.	Correct problem, re-prep, then reanalyze method blank and all samples processed with the contaminated blank. Apply B-flag to all results for the specific analytes in all samples in the associated preparatory batch if reanalysis is unsuccessful.	
Laboratory Control sample (LCS)	Once per analytical batch spiked at the RL. Undergoes same pretreatment steps as the samples.	Recovery within method requirements or laboratory-generated limits, or 85-115% to verify calibration and to check method performance.	Correct problem, then re-prep and reanalyze the LCS and all associated samples. If corrective action fails, apply Q-flag to all samples in the associated preparatory batch.	
Matrix Spikes (MS)	Collect one per 20 samples per matrix, spiked at the RL. Undergoes same pretreatment steps as the samples.	Recovery within 75-125%.	In the parent sample, apply J-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the limits, the data must be evaluated to determine the source of the difference and to determine if there is a matrix effect or analytical error.

Table 4-F. Quality Control Requirements for Perchlorate by MS Methods (Method EPA 331.0, EPA 332.0, SW6850, SW6860)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Matrix Spike Duplicates or Laboratory Duplicates (MS and MSD)	Collect one per 20 samples per matrix, spiked at the RL. Undergoes same pretreatment steps as the samples.	Recovery within MS limits, RPD < 20%.	In the parent sample, apply J-flag if acceptance criteria are not met.	Evaluate the data to determine the source of the difference.
Laboratory Reagent Blank	Analyzed prior to calibration and after samples with over-range concentration of perchlorate and after each batch is analyzed.	Concentration < 1/2 RL.	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank. Apply B-flag to all results not preceded by an acceptable reagent blank if reanalysis is not possible.	
QC Criteria Specific to MS Confirmation				
Mass Tuning	Daily before sample analysis.	Tuning standards should contain the analytes of interest.	Retune instrument. If the tune will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone.	Sample analysis should not proceed without an acceptable tuning.
Mass Calibration	Performed prior to sample analysis and calibration curve analysis.	Mass calibration range must bracket the ion masses of interest. The most recent mass calibration must be used and the same mass calibration must be used for all data files in an analytical run. Acceptance criteria must be clearly stated in the laboratory's SOP.	If the mass calibration fails, recalibrate. If it still fails, consult manufacturer instructions on corrective maintenance.	No samples may be analyzed under a failing mass calibration.

Table 4-F. Quality Control Requirements for Perchlorate by MS Methods (Method EPA 331.0, EPA 332.0, SW6850, SW6860)

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/ Flagging Criteria	Comments
Isotope Ratio $^{35}\text{Cl}/^{37}\text{Cl}$	Every sample, spiked sample, and standard and method blank.	Monitor for both the parent ion at mass 99/101 and the product ion at mass 83/85 for MS-MS methods or just 99/101 for MS only. Theoretical ratio ~ 3.06. Must fall between 2.2 to 3.3.	If criteria are not met, the sample must be rerun. If the sample was not pretreated, the sample should be re-extracted using cleanup procedures. If, after cleanup, the ratio still fails, use alternative techniques to confirm presence of perchlorate (i.e., a post spike sample, dilution to reduce any interferences, etc.). Data should be qualified as estimated and should be noted in the case narrative.	Decision to report data failing ratio check should be thoroughly documented in case narrative.
Internal Standard (IS)	Addition of 18O-labeled perchlorate to every sample, spiked sample, standard, instrument blank, and method blank.	Measured 18O IS area within + 50% of the value from the initial calibration (retention time window of ~ 0.3% for perchlorate and IS).	Rerun the sample at increasing dilutions until the + 50% acceptance criteria are met. If criteria cannot be met with dilution, the interferences are suspected and the sample must be re-prepped using further pretreatment steps. Data should be qualified as estimated with a Q-flag and should be discussed in the case narrative.	If peak is not within retention time window, presence is not confirmed. Use for quantitation and to ensure identification. Failing internal standard should be thoroughly documented in the case narrative.
Interference Threshold Study	At initial setup and when major changes occur in the method's operating procedures (addition of cleanup procedures, column changes, mobile phase changes).	Measure the threshold of common suppressors (chloride, sulfate, carbonate, bicarbonate) that can be present in the system without affecting the quantitation of perchlorate. The threshold is the concentration of the common suppressors where perchlorate recovery falls outside of a 90-110% window.	N/A	This study and site history will determine the concentration at which the ICS suppressors

Table 5. Number of Marginal Exceedances

Number of Analytes in LCS	Allowable Number of Marginal Exceedances of LCS-CLs
> 90	5
71 – 90	4
51 – 70	3
31 – 50	2
11 – 30	1
< 11	0

Table 6. Poor Performing Analytes

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
8270C Water:				
4-Nitrophenol	0	125	0	145
Benzoic acid	0	125	0	150
Phenol	0	115	0	135
Phenol-d5/d6 (surrogate)	10	115	0	135
8270C Solid:				
3,3'Dichlorobenzidine	10	130	0	145
4-Chloroaniline	10	95	0	110
Benzoic acid	0	110	0	130
8330 Solid:				
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	10	150	0	172

Table 7. Surrogates

Analyte	Lower Control Limit	Upper Control Limit
8260B Water:		
1,2-Dichloroethane-d4	70	120
4-Bromofluorobenzene	75	120
Dibromofluoromethane	85	115
Toluene-d8	85	120
8260B Solid:		
4-Bromofluorobenzene	85	120
Toluene-d8	85	115
8270C Water:		
2-Fluorobiphenyl	50	110
Terphenyl-d14	50	135
2,4,6-Tribromophenol	40	125
2-Fluorophenol	20	110
Nitrobenzene-d5	40	110
8270C Solid:		
2-Fluorobiphenyl	45	105
Terphenyl-d14	30	125
2,4,6-Tribromophenol	35	125
2-Fluorophenol	35	105
Phenol-d5/d6	40	100
Nitrobenzene-d5	35	100
8081A Water:		
Decachlorobiphenyl	30	135
TCMX	25	140
8081A Solid:		
Decachlorobiphenyl	55	130
TCMX	70	125
8082 Water:		
Decachlorobiphenyl	40	135
8082 Solid:		
Decachlorobiphenyl	60	125
8330 Water:		
TBD ⁽¹⁾	50	150
8330 Solid:		
TBD ⁽¹⁾	50	150

⁽¹⁾ PSAP Addendum must specify which surrogate compound is intended.

**Table 8-A. LCS Control Limits for Volatile Organic Compounds
 SW846 Method 8260B
 Water Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	80	130	75	135
1,1,1-Trichloroethane	65	130	55	145
1,1,2,2-Tetrachloroethane	65	130	55	140
1,1,2-Trichloroethane	75	125	65	135
1,1-Dichloroethane	70	135	60	145
1,1-Dichloroethene	70	130	55	140
1,1-Dichloropropene	75	130	65	140
1,2,3-Trichlorobenzene	55	140	45	155
1,2,3-Trichloropropane	75	125	65	130
1,2,4-Trichlorobenzene	65	135	55	145
1,2,4-Trimethylbenzene	75	130	65	140
1,2-Dibromo-3-chloropropane	50	130	35	145
1,2-Dibromoethane	80	120	75	125
1,2-Dichlorobenzene	70	120	60	130
1,2-Dichloroethane	70	130	60	140
1,2-Dichloropropane	75	125	65	135
1,3,5-Trimethylbenzene	75	130	65	140
1,3-Dichlorobenzene	75	125	65	130
1,3-Dichloropropane	75	125	65	135
1,4-Dichlorobenzene	75	125	65	130
2,2-Dichloropropane	70	135	60	150
2-Butanone	30	150	10	170
2-Chlorotoluene	75	125	65	135
2-Hexanone	55	130	45	140
4-Chlorotoluene	75	130	65	135
4-Methyl-2-pentanone	60	135	45	145
Acetone	40	140	20	160
Benzene	80	120	75	130
Bromobenzene	75	125	70	130
Bromochloromethane	65	130	55	140
Bromodichloromethane	75	120	70	130
Bromoform	70	130	60	140
Bromomethane	30	145	10	165
Carbon disulfide	35	160	15	185
Carbon tetrachloride	65	140	55	150
Chlorobenzene	80	120	75	130
Chlorodibromomethane	60	135	45	145
Chloroethane	60	135	50	145
Chloroform	65	135	50	150
Chloromethane	40	125	25	140
cis-1,2-Dichloroethene	70	125	60	135
cis-1,3-Dichloropropene	70	130	60	140

**Table 8-A. LCS Control Limits for Volatile Organic Compounds
 SW846 Method 8260B
 Water Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Dibromomethane	75	125	65	135
Dichlorodifluoromethane	30	155	10	175
Ethylbenzene	75	125	65	135
Hexachlorobutadiene	50	140	35	160
Isopropylbenzene	75	125	65	135
m,p-Xylene	75	130	65	135
Methyl tert-butyl ether	65	125	55	135
Methylene chloride	55	140	40	155
Naphthalene	55	140	40	150
n-Butylbenzene	70	135	55	150
n-Propylbenzene	70	130	65	140
o-Xylene	80	120	75	130
p-Isopropyltoluene	75	130	65	140
sec-Butylbenzene	70	125	65	135
Styrene	65	135	55	145
tert-Butylbenzene	70	130	60	140
Tetrachloroethene	45	150	25	165
Toluene	75	120	70	130
trans-1,2-Dichloroethene	60	140	45	150
trans-1,3-Dichloropropene	55	140	40	155
Trichloroethene	70	125	60	135
Trichlorofluoromethane	60	145	45	160
Vinyl chloride	50	145	35	165

**Table 8B. LCS Control Limits for Volatile Organic Compounds
 SW-846 Method 8260B
 Solid Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	75	125	65	135
1,1,1-Trichloroethane	70	135	55	145
1,1,2,2-Tetrachloroethane	55	130	40	145
1,1,2-Trichloroethane	60	125	50	140
1,1-Dichloroethane	75	125	65	135
1,1-Dichloroethene	65	135	55	150
1,1-Dichloropropene	70	135	60	145
1,2,3-Trichlorobenzene	60	135	50	145
1,2,3-Trichloropropane	65	130	50	140
1,2,4-Trichlorobenzene	65	130	55	140
1,2,4-Trimethylbenzene	65	135	55	145
1,2-Dibromo-3-chloropropane	40	135	25	150
1,2-Dibromoethane	70	125	60	135
1,2-Dichlorobenzene	75	120	65	125
1,2-Dichloroethane	70	135	60	145
1,2-Dichloropropane	70	120	65	125
1,3,5-Trimethylbenzene	65	135	55	145
1,3-Dichlorobenzene	70	125	65	135
1,3-Dichloropropane	75	125	70	130
1,4-Dichlorobenzene	70	125	65	135
2,2-Dichloropropane	65	135	55	145
2-Butanone	30	160	10	180
2-Chlorotoluene	70	130	60	140
2-Hexanone	45	145	30	160
4-Chlorotoluene	75	125	65	135
4-Methyl-2-pentanone	45	145	30	165
Acetone	20	160	10	180
Benzene	75	125	65	135
Bromobenzene	65	120	55	130
Bromochloromethane	70	125	60	135
Bromodichloromethane	70	130	60	135
Bromoform	55	135	45	150
Bromomethane	30	160	10	180
Carbon disulfide	45	160	30	180
Carbon tetrachloride	65	135	55	145
Chlorobenzene	75	125	65	130
Chlorodibromomethane	65	130	55	140
Chloroethane	40	155	20	175
Chloroform	70	125	65	135
Chloromethane	50	130	40	140
cis-1,2-Dichloroethene	65	125	55	135
cis-1,3-Dichloropropene	70	125	65	135

**Table 8B. LCS Control Limits for Volatile Organic Compounds
 SW-846 Method 8260B
 Solid Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Dibromomethane	75	130	65	135
Dichlorodifluoromethane	35	135	15	155
Ethylbenzene	75	125	65	135
Hexachlorobutadiene	55	140	40	155
Isopropylbenzene	75	130	70	140
m,p-Xylene	80	125	70	135
Methylene chloride	55	140	40	155
Naphthalene	40	125	25	140
n-Butylbenzene	65	140	50	150
n-Propylbenzene	65	135	50	145
o-Xylene	75	125	70	135
p-Isopropyltoluene	75	135	65	140
sec-Butylbenzene	65	130	50	145
Styrene	75	125	65	135
tert-Butylbenzene	65	130	55	145
Tetrachloroethene	65	140	55	150
Toluene	70	125	60	135
trans-1,2-Dichloroethene	65	135	55	145
trans-1,3-Dichloropropene	65	125	55	140
Trichloroethene	75	125	70	130
Trichlorofluoromethane	25	185	10	215
Vinyl chloride	60	125	45	140

**Table 8-C. LCS Control Limits For Semivolatile Organic Compounds
 SW-846 Method 8270C
 Water Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Polynuclear Aromatics				
2-Methylnaphthalene	45	105	35	115
Acenaphthene	45	110	35	120
Acenaphthylene	50	105	40	115
Anthracene	55	110	45	120
Benz(a)anthracene	55	110	45	120
Benzo(a)pyrene	55	110	45	120
Benzo(b)fluoranthene	45	120	35	130
Benzo(g,h,i)perylene	40	125	25	135
Benzo(k)fluoranthene	45	125	30	135
Chrysene	55	110	45	120
Dibenz(a,h)anthracene	40	125	30	140
Fluoranthene	55	115	45	125
Fluorene	50	110	40	120
Indeno(1,2,3-cd)pyrene	45	125	30	140
Naphthalene	40	100	30	115
Phenanthrene	50	115	40	130
Pyrene	50	130	35	140
Phenolic/Acidic				
2,4,5-Trichlorophenol	50	110	40	120
2,4,6-Trichlorophenol	50	115	40	125
2,4-Dichlorophenol	50	105	40	115
2,4-Dimethylphenol	30	110	15	125
2,4-Dinitrophenol	15	140	10	160
2-Chlorophenol	35	105	25	115
2-Methylphenol	40	110	25	120
2-Nitrophenol	40	115	25	125
3-Methylphenol/4-Methylphenol	30	110	20	125
4,6-Dinitro-2-methylphenol	40	130	25	145
4-Chloro-3-methylphenol	45	110	35	120
Pentachlorophenol	40	115	25	130
Basic				
3,3'-Dichlorobenzidine	20	110	10	125
4-Chloroaniline	15	110	10	125
Phthalate Esters				
Bis(2-ethylhexyl) phthalate	40	125	30	140
Butyl benzyl phthalate	45	115	35	130
Di-n-butyl phthalate	55	115	45	125
Di-n-octyl phthalate	35	135	20	155
Diethyl phthalate	40	120	30	130
Dimethyl phthalate	25	125	10	145

Table 8-C. LCS Control Limits For Semivolatile Organic Compounds
 SW-846 Method 8270C
 Water Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Nitrosoamines				
N-Nitrosodi-n-propylamine	35	130	20	145
N-Nitrosodimethylamine	25	110	10	125
N-Nitrosodiphenylamine	50	110	35	120
Chlorinated Aliphatics				
Bis(2-chlorethoxy)methane	45	105	35	115
Bis(2-chloroethyl) ether	35	110	25	120
Bis(2-chloroisopropyl) ether	25	130	10	150
Hexachlorobutadiene	25	105	15	115
Hexachloroethane	30	95	15	105
Halogenated Aromatics				
1,2,4-Trichlorobenzene	35	105	25	120
1,2-Dichlorobenzene	35	100	20	115
1,3-Dichlorobenzene	30	100	20	110
1,4-Dichlorobenzene	30	100	20	110
2-Chloronaphthalene	50	105	40	115
4-Bromophenyl phenyl ether	50	115	40	125
4-Chlorophenyl phenyl ether	50	110	40	120
Hexachlorobenzene	50	110	40	120
Nitroaromatics				
2,4-Dinitrotoluene	50	120	40	130
2,6-Dinitrotoluene	50	115	35	130
2-Nitroaniline	50	115	35	125
3-Nitroaniline	20	125	10	145
4-Nitroaniline	35	120	20	130
Nitrobenzene	45	110	35	120
Neutral Aromatics				
Carbazole	50	115	35	130
Dibenzofuran	55	105	45	115
Others				
1,2-Diphenylhydrazine	55	115	45	120
Benzyl alcohol	30	110	15	125
Isophorone	50	110	40	125

**Table 8-D. LCS Control Limits for Semivolatile Organic Compounds
 SW846 Method 8270C
 Solid Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Polynuclear Aromatics				
2-Methylnaphthalene	45	105	35	115
Acenaphthene	45	110	35	120
Acenaphthylene	45	105	35	115
Anthracene	55	105	45	115
Benz(a)anthracene	50	110	40	120
Benzo(a)pyrene	50	110	40	120
Benzo(b)fluoranthene	45	115	35	125
Benzo(g,h,i)perylene	40	125	25	140
Benzo(k)fluoranthene	45	125	30	135
Chrysene	55	110	45	120
Dibenz(a,h)anthracene	40	125	25	140
Fluoranthene	55	115	45	125
Fluorene	50	110	40	115
Indeno(1,2,3-cd)pyrene	40	120	25	135
Naphthalene	40	105	30	120
Phenanthrene	50	110	40	120
Pyrene	45	125	35	135
Phenolic/Acidic				
2,4,5-Trichlorophenol	50	110	40	120
2,4,6-Trichlorophenol	45	110	30	120
2,4-Dichlorophenol	45	110	35	120
2,4-Dimethylphenol	30	105	20	115
2,4-Dinitrophenol	15	130	10	150
2-Chlorophenol	145	105	35	115
2-Methylphenol	40	105	30	115
2-Nitrophenol	40	110	30	120
3-Methylphenol/4-Methylphenol	40	105	30	120
4,6-Dinitro-2-methylphenol	30	135	10	155
4-Chloro-3-methylphenol	45	115	35	125
4-Nitrophenol	15	140	10	160
Pentachlorophenol	25	120	10	135
Phenol	40	100	30	110
Phthalate Esters				
Bis(2-ethylhexyl) phthalate	45	125	35	140
Butyl benzyl phthalate	50	125	35	135
Di-n-butyl phthalate	55	110	45	120
Di-n-octyl phthalate	40	130	25	145
Diethyl phthalate	50	115	40	125
Dimethyl phthalate	50	110	40	120

Table 8-D. LCS Control Limits for Semivolatile Organic Compounds
 SW846 Method 8270C
 Solid Matrix

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
<u>Nitrosoamines</u>				
N-Nitrosodi-n-propylamine	40	115	30	125
N-Nitrosodimethylamine	20	115	10	130
N-Nitrosodiphenylamine	50	115	40	125
<u>Chlorinated Aliphatics</u>				
Bis(2-chlorethoxy)methane	45	110	30	120
Bis(2-chloroethyl) ether	40	105	25	115
Bis(2-chloroisopropyl) ether	20	115	10	130
Hexachlorobutadiene	40	115	25	130
Hexachloroethane	35	110	20	120
<u>Halogenated Aromatics</u>				
1,2,4-Trichlorobenzene	45	110	30	120
1,2-Dichlorobenzene	45	95	35	105
1,3-Dichlorobenzene	40	100	30	110
1,4-Dichlorobenzene	35	105	25	115
2-Chloronaphthalene	45	105	35	115
4-Bromophenyl phenyl ether	45	115	35	130
4-Chlorophenyl phenyl ether	45	110	35	120
Hexachlorobenzene	45	120	35	130
<u>Nitroaromatics</u>				
2,4-Dinitrotoluene	50	115	35	130
2,6-Dinitrotoluene	50	110	35	125
2-Nitroaniline	45	120	30	130
3-Nitroaniline	25	110	15	125
4-Nitroaniline	35	115	20	125
Nitrobenzene	40	115	30	125
<u>Neutral Aromatics</u>				
Carbazole	45	115	30	130
Dibenzofuran	50	105	40	110
<u>Others</u>				
Benzyl alcohol	20	125	10	140
Isophorone	45	110	30	125

**Table 8-E. LCS Control Limits For Explosives
 SW-846 Method 8330
 Water Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,3,5-Trinitrobenzene	65	140	50	150
1,3-Dinitrobenzene	45	160	30	175
2,4-Dinitrotoluene	60	135	50	145
2,6-Dinitrotoluene	60	135	50	150
2,4,6-Trinitrotoluene (TNT)	50	145	35	160
2-Amino-4,6-dinitrotoluene	50	155	35	170
2-Nitrotoluene	45	135	30	150
3-Nitrotoluene	50	130	35	145
4-Amino-2,6-dinitrotoluene	55	155	40	170
4-Nitrotoluene	50	130	35	145
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	50	160	35	180
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	20	175	10	200
Nitrobenzene	50	140	35	155
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	80	115	75	120
Nitroglycerin	60	120	40	150
Pentaerythritol Tetranitrate	60	120	40	150

**Table 8-F. LCS Control Limits For Explosives
 SW-846 Method 8330
 Solid Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,3,5-Trinitrobenzene	75	125	65	135
1,3-Dinitrobenzene	80	125	70	135
2,4-Dinitrotoluene	80	125	75	130
2,6-Dinitrotoluene	80	120	70	130
2,4,6-Trinitrotoluene (TNT)	55	140	45	155
2-Amino-4,6-dinitrotoluene	80	125	75	130
2-Nitrotoluene	80	125	70	130
3-Nitrotoluene	75	120	70	130
4-Amino-2,6-dinitrotoluene	80	125	75	130
4-Nitrotoluene	75	125	70	135
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	70	135	65	145
Nitrobenzene	75	125	70	130
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	75	125	65	135
Nitroglycerin	60	120	40	150
Pentaerythritol Tetranitrate	60	120	40	150

**Table 8-G. LCS Control Limits for Organochlorine Pesticides
 SW-846 Method 8081A
 Water Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	25	150	10	170
4,4'-DDE	35	140	15	160
4,4'-DDT	45	140	30	155
Aldrin	25	140	10	155
alpha-BHC	60	130	50	140
alpha-Chlordane	65	125	55	135
beta-BHC	65	125	55	135
delta-BHC	45	135	30	150
Dieldrin	60	130	50	140
Endosulfan I	50	110	40	120
Endosulfan II	30	130	10	150
Endosulfan sulfate	55	135	40	150
Endrin	55	135	45	145
Endrin aldehyde	55	135	40	150
Endrin ketone	75	125	70	135
gamma-BHC	25	135	10	155
gamma-Chlordane	60	125	50	135
Heptachlor	40	130	30	145
Heptachlor epoxide	60	130	50	140
Methoxychlor	55	150	40	165

**Table 8-H. LCS Control Limits for Organochlorine Pesticides
 SW-846 Method 8081A
 Solid Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	30	135	10	155
4,4'-DDE	70	125	60	135
4,4'-DDT	45	140	30	155
Aldrin	45	140	30	155
alpha-BHC	60	125	50	135
alpha-Chlordane	65	120	55	130
Beta-BHC	60	125	50	135
delta-BHC	55	130	45	145
Dieldrin	65	125	55	135
Endosulfan I	15	135	10	155
Endosulfan II	35	140	20	160
Endosulfan sulfate	60	135	50	145
Endrin	60	135	50	145
Endrin aldehyde	35	145	20	165
Endrin ketone	65	135	55	145
gamma-BHC	60	125	50	135
gamma-Chlordane	65	125	55	135
Heptachlor	50	140	35	155
Heptachlor epoxide	65	130	55	140
Methoxychlor	55	145	45	155

**Table 8-I. LCS Control Limits for Polychlorinated Biphenyls
 SW-846 Method 8082
 Water Matrix**

Analyte	Lower Control Limit	Upper Control Limit
Aroclor 1016	25	145
Aroclor 1260	30	145

**Table 8-J. LCS Control Limits for Polychlorinated Biphenyls
 SW-846 Method 8082
 Solid Matrix**

Analyte	Lower Control Limit	Upper Control Limit
Aroclor 1016	40	140
Aroclor 1260	60	130

**Table 8-K. LCS Control Limits for Inorganics
 SW-846 Methods 6010B, 6020, 7470A, and 7580
 Water Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Aluminum	80	120	80	120
Antimony	80	120	80	120
Arsenic	80	120	80	120
Barium	80	120	80	120
Beryllium	80	120	80	120
Cadmium	80	120	80	120
Calcium	80	120	80	120
Chromium	80	120	80	120
Cobalt	80	120	80	120
Copper	80	120	80	120
Iron	80	120	80	120
Lead	80	120	80	120
Magnesium	80	120	80	120
Manganese	80	120	80	120
Mercury	80	120	N/A	N/A
Molybdenum	80	120	75	120
Nickel	80	120	80	120
Potassium	80	120	80	120
Selenium	80	120	75	120
Silver	80	120	75	120
Sodium	80	120	80	120
Strontium	80	120	80	120
Thallium	80	120	80	120
Titanium	80	120	80	120
Vanadium	80	120	80	120
White Phosphorus	75	125	N/A	N/A
Zinc	80	120	80	120
Zirconium	80	120	80	120

**Table 8-L. LCS Control Limits for Inorganics
 SW-846 Methods 6010B, 6020, 7471A, and 7580
 Solid Matrix**

Analyte	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Aluminum	80	120	75	120
Antimony	80	120	75	120
Arsenic	80	120	80	120
Barium	80	120	80	120
Beryllium	80	120	80	120
Cadmium	80	120	80	120
Calcium	80	120	80	120
Chromium	80	120	80	120
Cobalt	80	120	80	120
Copper	80	120	80	120
Iron	80	120	80	120
Lead	80	120	80	120
Magnesium	80	120	80	120
Manganese	80	120	80	120
Mercury	80	120	N/A	N/A
Molybdenum	80	120	75	120
Nickel	80	120	80	120
Potassium	80	120	80	120
Selenium	80	120	75	120
Silver	75	120	70	125
Sodium	80	120	80	120
Strontium	80	120	80	120
Thallium	80	120	80	120
Titanium	80	120	80	120
Vanadium	80	120	80	120
White Phosphorus	75	125	N/A	N/A
Zinc	80	120	75	120
Zirconium	80	120	80	120

Table 9. Data Qualifier Flags

Data Qualifier	Definition
U	The material was analyzed for, but was not detected above the level of associated value. The associated value is either the sample quantitation limit or sample detection limit.
J	The associated value is estimated. For values greater than the MDL, but less than the PQL, the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification". The associated numerical value represents its approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

