Military Munitions Center of Expertise
Technical Update
March 2005

MUNITIONS CONSTITUENT (MC) SAMPLING

1.0 Introduction.

This update has been prepared by the US Army Corps of Engineers (USACE) Military Munitions Center of Expertise (MM CX) to address the planning and performing of MC investigations by USACE Military Munitions Design Centers (MM DCs), Removal Districts, and their contractors at Munitions Response Areas (MRAs) under the Military Munitions Response Program (MMRP). It is focused on Formerly Used Defense Sites (FUDS), but could be applied to Base Realignment and Closure (BRAC) or Installation Restoration Program (IRP) sites with MC concerns. An overview of the environmental chemistry of military munitions and appropriate sampling and analyses at MRAs is provided. Attachment 1 is a checklist for the Project Delivery Team (PDT) to follow when planning MC investigations. Attachment 2 provides example MC language for inclusion in Quality Assurance Surveillance Plans (QASPs).

2.0 Objective.

MC investigations are typically performed at MRAs for one of two purposes:

1) Confirming Presence or Absence of MC Contamination. If no information is available about MC contamination, sampling is conducted to determine whether it exists. This type of investigation is typically biased to look at areas where contamination is suspected to be the worst case. Limited sampling to evaluate the presence or absence of MC contamination should be conducted during the Site Inspection (SI) phase of a munitions response project.
2) Establishing Nature and Extent of MC Contamination. If MC contamination is confirmed to exist, further investigation may be required to determine the nature and extent of the contamination, as well as to define the risk to human health and the environment. This investigation would typically be conducted during the Remedial Investigation /Feasibility Study (RI/FS) phase of a munitions response project and should support preparation of a baseline risk assessment.

The requirements provided in this document focus on scoping and executing investigations to confirm the presence or absence of MC contamination. The sampling requirements for all projects should be determined on a project-specific basis by the PDT through the Technical Project Planning (TPP) process (see EM 200-1-2) and development of a Conceptual Site Model (CSM) (see EM 1110-1-1200).

Most of the requirements outlined in this document also apply to investigations to determine the nature and extent of MC contamination, but those investigations will also include additional requirements not described here. If evaluation of presence or absence of MC contamination is delayed until the RI/FS phase, it is recommended that sampling be conducted in a phased approach. For additional information on RI/FS requirements, see US Environmental Protection Agency's (EPA's) *Guidance on Conducting Remedial Investigations and Feasibility Studies under CERCLA*, EM 1110-1-502, *Technical Guidelines for Hazardous and Toxic Waste Treatment and Cleanup Activities*, and the *MM CX Technical Update on RI/FS for MMRP Projects* (in press, contact MM CX for further information).

Additionally, Long-Term Management (LTM) activities may be required for the MC portion of MMRP projects following the Remedial Action Operation (RA-O) phase. If sampling and analysis is required during the LTM phase, many of the requirements and recommendations provided in this document would also apply.

3.0 Initial MC Investigation Planning.

An MC investigation process that is capable of effectively identifying MC contamination must employ three fully integrated components, as follows:

1) Experienced Personnel. Personnel involved with the MC investigation should be experienced with the theoretical and practical aspects of military munitions chemistry, field sampling, and laboratory analyses. The selection of laboratories and analytical methodology require qualified and experienced individuals. A qualified chemist should actively participate in the management of all MC investigations. A "qualified chemist" is a person with a minimum of a Bachelor's degree in chemistry or a closely related field and at least 5 years of directly related environmental chemistry experience, preferably involving military munitions. Sampling personnel should be trained in appropriate sampling procedures and associated documentation requirements. If field analytical methods are used, personnel executing these methods should have documented training and experience performing the planned methodology.

2) Experienced Laboratory. The laboratory used should have experience in handling military munitions samples. The analytical laboratory should be identified in the proposal and must be identified in the Sampling and Analysis Plan (SAP) and hold applicable state certifications to perform the analytical methods required (if available). Laboratories must also meet the requirements of the Hazardous, Toxic, and Radioactive Waste (HTRW) Chemical Data Quality Management (CDQM) Policy for Environmental Laboratory Testing, to include National Environmental Laboratory Accreditation Program (NELAP) accreditation for all applicable and available fields of testing (FoT) and self declaration of compliance with the Department of Defense (DoD) Quality Systems Manual (QSM) (latest version). For a list of current NELAP accredited labs, please see http://www.epa.gov/nerlesd1/land-sci/nelac/accreditlabs.html.

   Any laboratory performing chemical analysis must provide their self declaration and supporting documentation to the applicable MM DC in order to be approved by that MM DC. The determination of qualifications of the laboratory should be at the discretion of the

MM DC Project Chemist. If the laboratory fails to meet project-specific requirements at any time, the Contracting Officer (CO) or Contracting Officer's Representative (COR) may request use of the laboratory be discontinued and analytical services be procured from another qualified laboratory that can meet project-specific requirements. Samples may not be subcontracted to another laboratory without the approval of the MM DC PDT. The subcontracted laboratory must meet all requirements for the contract laboratory.

3) Accuracy and Precision of Sample Locations. The personnel performing the MC investigation must have the ability to accurately and precisely locate a sample location to other known points, preferably using a common survey grid and/or datum. Sample locations should be recorded to within 3 feet of the actual survey location.

If any of the above three components is lacking, the overall MC process may be unable to meet the project's objectives. Therefore it is important to carefully plan and integrate all aspects of an MC investigation and not to start fieldwork prematurely.

4.0 Sampling and Analysis Considerations.

Sampling and analysis requirements will vary based upon site-specific conditions and must be addressed during TPP activities. Safety concerns must be addressed. If sampling is performed in a potential Munitions and Explosives of Concern (MEC) environment, all requirements from EP 75-1-2, *MEC Support during HTRW and Construction Activities,* apply.

Further considerations that may affect sampling and analysis activities include:

1) MEC Depth. If MEC items are located on the surface, initial sampling should be surficial (0-2"). If MEC items are also found in the subsurface, initial sampling should also be taken from subsurface soil near the identified MEC location.

2) MEC Item Composition. Analytical requirements for MC should be based on the anticipated MEC item composition, if known. If unknown, some assumptions may be made regarding typical composition to establish the analytical requirements for MC. In either case, the anticipated MEC items, along with fill information, if available, should be tabulated in the Work Plan. Information on MEC item composition is available from the MIDAS database (available at https://midas.dac.army.mil/; access requires registration and is restricted to DoD personnel and DoD contractors), various Technical Manuals, and the Common Range Operations Reports (in press, contact HTRW CX (Stan Bauer) for additional information). An ammunition composition database is also in development by USACE. Many types of filler used in MEC items are composition explosives, consisting of two or more explosive compounds mixed to produce an explosive with more suitable characteristics for a particular application. Some typical examples include Amatols, Composition A explosives, Composition B explosives and other Cyclotols, Composition C explosives, Composition D, Octols, Pentolites, Picratols, Tetrytols, and Tritonal. Compositions vary for these and are documented in TM 9-1300-214, Military Explosives.

3) Background Conditions. In some locations, background concentrations of metals may exceed non-site specific risk based screening levels or regulatory limits that are commonly used for screening purposes or response action decision making. If no site-specific background data are available for the project property, background samples should be collected and analyzed for metals.

4) Regulatory Requirements. Varying state and local requirements and requests for sampling and analysis may exist. These should be considered and addressed during TPP and the development stage of overall project objectives and Data Quality Objectives (DQOs).

5) Potential Chemical-Specific Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considereds (TBCs). Potential chemical-specific ARARs and TBCs can impact the choices of the appropriate analytical methodology as part of the DQO process. Anticipated criteria should be established during the planning process to ensure proper sampling procedures can be applied; appropriate analytical methodologies can be utilized; meaningful data can be collected; and DQOs can be achieved.

6) Site Hydrology. If significant surface releases of MC are believed to have occurred, groundwater sampling should be considered. The decision to sample groundwater would be made based on depth to groundwater and its susceptibility to contamination from surface releases, potential receptors, the magnitude of the suspected MC release, and the type of MC suspected at the site. If surface water is located on or near the project property and receives runoff from suspected MC source areas, surface water/sediment sampling should be considered.

4.1 Collecting a Representative Soil Sample from a Range

Cold Regions Research Engineering Laboratory (CRREL), a USACE Engineering Research and Development Center (ERDC) laboratory, has conducted numerous studies to determine the best means to collect a representative sample. These studies have been conducted at primarily active or BRAC sites as part of a Research and Development (R&D) effort. Their current recommendations are documented in full in the Field Analytic Technologies Encyclopedia (FATE) Explosives Module located at http://fate.clu-in.org/exp.asp. These recommendations should be evaluated for implementation, but must be coordinated with PDT members and applicable regulatory personnel, particularly those responsible for explosive safety and risk assessment for the project. It should be noted that all sampling performed under these studies to date have included nitroaromatic/ nitramines/nitrate ester explosives, but not metals or other MC.

4.1.1 Sample Compositing Schemes

All research in the area of secondary explosives contamination at ranges has supported the use of composite sampling (also referred to as multi-increment sampling) rather than discrete sampling. A variety of compositing schemes have been used and documented during CRREL's R&D efforts.

Some examples include:

- 7-Sample Wheel Approach
- TR-02-1 Approach
- FATE Explosives Module Approach

4.1.1.1 7-Sample Wheel Approach

The 7-Sample Wheel approach is described in CRREL's Special Report (SR) 96-15, *Assessment of Sampling Error Associated with Collection and Analysis of Soil Samples at Explosives-Contaminated Sites*, available at http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/SR96_15.pdf. Each of the seven grab samples within the wheel are combined together. Typically the portions used to make the composite are not individually weighed; however, they should be approximately equal in weight.

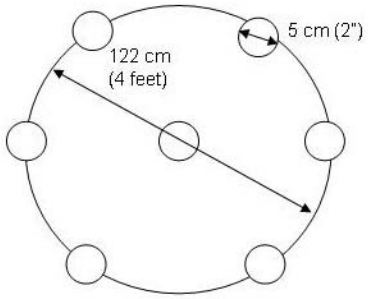

Figure 1 - CRREL 7 Sample Wheel Diagram

4.1.1.2 TR-02-1 Approach

This approach is described in CRREL's Technical Report (TR) 02-1, *Guide for Characterization of Sites Contaminated with Energetic Materials*, available at http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR02-1(ERDC-CRL).pdf. In a small area (1 m × 1 m) multiple units (30 or more, each of the same approximate amount) are randomly collected and placed into a single container. For large-scale areas, systematic gridding is useful for establishing sampling nodes, at which, an area of between 3 m and 10 m square, are randomly sampled, by obtaining 50 or more individual increments.

4.1.1.3 FATE Explosives Module Approach

This approach is described in EPA's FATE Explosives Module, available at http://fate.clu-in.org/exp.asp. In a small area (1 m x 1 m), multiple units (10 or more, each of the same approximate amount) are systematically or randomly collected and placed into a single container. For larger areas, systematic gridding is useful for establishing sampling nodes, at which an area of between 3 m and 10 m diameter are systematically or randomly sampled by obtaining 30 or more individual increments. Another approach that can be used if the area of

concern isn't too large (100 m x 100 m) is the collection of a large composite sample by obtaining the increments at established grid nodes (intervals) or at random intervals while walking around the entire site.

4.2 Sample Size, Depth, and Processing

CRREL recommends collecting a minimum of 500 g of soil. They further recommend sieving and grinding the entire sample prior to subsampling. The sieving and grinding may occur in the field or in the laboratory. Most laboratories are not currently equipped for this process and concern about grinding potential high concentration samples has been raised. Additionally, this process adds another piece of equipment that could cross-contaminate the sample, particularly given the blank criteria required in EM 200-1-3 and the DoD QSM. If grinding is not planned, a smaller sample size would be appropriate, although laboratory subsampling should still be reviewed to confirm that their methodology adequately addresses representativeness concerns. For additional information on laboratory subsampling, see *Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples***,** EPA/600/R-03/027.

A further representativeness issue is vegetation. Typically, vegetation (grass, sticks, leaves, moss, etc.) is removed from soil samples prior to laboratory processing, frequently during actual field sampling. CRREL recommends considering retaining the vegetation within the processed sample in order to account for any particles that may cling to the vegetation. Depending upon the concentrations of concern and the laboratory's chromatographic separation, this may be problematic for the analysis. Therefore, the degree of processing and vegetation process must both be discussed by the PDT, contractor (if applicable) and the laboratory at a minimum. It is recommended that the requirements of SW8330 (sieving and the use of a mortar and pestle to grind the sample) be considered the minimum allowable.

CRREL also recommends sampling surface soil from no deeper than 5 cm (2"), rather than the traditional 6". This MM CX concurs with this recommendation, but risk assessors from PDT and applicable regulatory agencies must also agree with this recommendation to ensure acceptance of data to the data users.

4.3 General Guidance for Sampling to Determine Presence or Absence of MC Contamination.

1) Analysis should be based on MEC fill, if known.
2) Sampling requirements should be determined by development of clear project objectives, definition of data needs, and establishing specific data quality objectives through the TPP process. An appropriate sampling design, including the type and number of samples, should be developed based on those project-specific objectives.
3) Soil samples should be collected from each area suspected to contain MC, such as known target impact areas, firing lines, open burn/open detonation areas, and areas with high concentrations of MEC.

4) Sample representativeness should be maximized to the extent practical as described in Section 4.1. The composite scheme should be, at a minimum, based on the 7-Sample Wheel Approach described above, unless there are state or local requirements to the contrary. If sampling is to be conducted in a high density MEC environment, MC sampling density must be evaluated relative to safety issues for sampling personnel. Additionally, if the PDT chooses to implement the other recommendations described in Section 4.1, coordination with applicable regulatory personnel should occur during TPP and be documented to ensure future acceptance of the data.

5) If site hydrology conditions are appropriate, collecting surface water, sediment, and/or groundwater sampling should be considered, as noted above.

4.4 General Guidance for Sampling during Blow in Place or Consolidated Shot Operations

This type of sampling is typically required during site characterization efforts that require ordnance disposal (more likely at the RI/FS stage during intrusive operations) and during removal/remedial actions.

1) Analysis should be based on MEC fill, if known.

2) Before and/or after (pre-and post-detonation) soil samples should be collected at the location of each specific type of MEC destroyed.

3) Pre-detonation samples should be composite samples located as near to the identified MEC to be detonated as is safe and feasible unless there are state or local requirements to the contrary. Pre-detonation samples are used for comparison with post-detonation samples to determine whether any residual MC is due to existing contamination or contamination left due to the detonation.

4) Post-detonation samples should be biased composite samples unless there are state or local requirements to the contrary. Sample representativeness should be maximized to the extent practical as described in Section 4.1. Composite scheme should be, at a minimum, based on the 7-Sample Wheel Approach described above. If the PDT chooses to implement the other recommendations described in Section 4.1, coordination with applicable regulatory personnel should occur during TPP and be documented to ensure future acceptance of the data.

5.0 Types of MC Analyses.

There are several types of constituents that may require analyses. The actual selection of MC for analysis should be based upon anticipated or known MEC items, as discussed in Section 4. Potential MC include but are not limited to primary explosives, nitrogen-based explosives, perchlorate, chemical warfare agents (CWAs) and agent breakdown products (ABPs), white phosphorous (WP) and metals. Primary explosives are of concern primarily at manufacturing sites, so they are not discussed further here.

For sampling to determine the presence or absence of MC contamination, fixed laboratory sampling is typically used, but project requirements may make field laboratory methods more cost-effective. Field laboratory methods may be used, but it is recommended that at least 10 percent of analyses be confirmed by fixed laboratory methods.

5.1 Nitrogen-Based Explosives.

Commonly evaluated nitrogen-based explosives, co-contaminants, and breakdown products are shown in Table 1. Nitrocellulose (NC), nitroguanidine (NQ), pentaerythritol tetranitrate (PETN), ammonium picrate (AP), picric acid, and RDX breakdown products (typically hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX); hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine (DNX); and hexahydro-1,3,5-trinitroso-1,3,5-triazine (TNX)) may also be required, but are not part of current methods published by the EPA. If analytes that are not part of methods published by the EPA are included in the project, proposed methodology must be accepted by the PDT and documentation regarding any method modifications or unpublished methods should be provided in project SAP.

5.1.1 Field Tests.

Immunoassay and colorimetric tests for nitrogen-based explosives are shown in Table 2. Immunoassays for 2,4,6-trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) have little cross-reactivity with other nitroaromatic/nitramines explosives. Colorimetric tests may be used to analyze for analytes other than TNT, RDX, and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) but require documentation of method modifications used to acquire the other analytes. Fate and transport properties of the analytes should be considered prior to the use of field tests, particularly if the use of TNT or RDX as an indicator compound is intended. It is anticipated that for a range that has been out of use for a substantial period of time, most, if not all TNT, would have broken down due to photodegradation and biodegradation. RDX is less likely to have broken down but may not be an appropriate indicator compound depending upon the age of the range.

5.1.2 Fixed Laboratory Tests.

Several technologies are used to analyze for nitroaromatic/nitramine explosives. Currently available methods are provided in Table 3. SW8330 is typically used unless significant interferences are anticipated. Some laboratories are unable to perform quantitative second column confirmation for explosives per DoD QSM/EM 200-1-3/SW8000C (i.e., five-point calibrations must be performed for each target analyte for the primary and confirmatory columns and quantitative results for each column must be reported). This requirement should not be waived for MC projects. Based upon project requirements, exceptions may be considered for the following co-eluting pairs: 2-amino-4,6-dinitrotoluene (2-Am-DNT)/4-amino-2,6-dinitrotoluene (4-Am-DNT), 2-nitrotoluene (2-NT)/4-nitrotoluene (4-NT), and 2,4-dinitrotoluene (2,4-DNT)/2,6-dinitrotoluene (2,6-DNT), but the exception should be evaluated based upon relevant ARARs and TBCs. SW8095 may be recommended if lower reporting limits are required, but it is not widely available commercially. SW8321 is typically used for complex matrices where there is concern regarding confirmation of positive results. It may also be used by laboratories with coelution problems for SW8330; however, routine use of

Table 1. Common Nitrogen-Based Explosives, Co-Contaminants, and Breakdown Products

Compound	Description (1)	Abbreviation	CAS Number (2)
Octahydro-1, 3, 5, 7-tetranitro-1,3,5,7-tetrazocine	Nitramine explosive; also RDX co-contaminant	HMX	2691-41-0
Hexahydro-1,3,5-trinitro-1,3,5-triazine	Nitramine explosive; also HMX co-contaminant	RDX	121-82-4
1,3,5-Trinitrobenzene	TNT co-contaminant and breakdown product	1,3,5-TNB	99-35-4
1,3-Dinitrobenzene	DNT breakdown product and TNT co-contaminant	1,3-DNB	99-65-0
Methyl-2,4,6-trinitrophenylnitramine	Nitramine explosive	Tetryl	479-45-8
Nitrobenzene	DNT co-contaminant	NB	98-95-3
2,4,6-Trinitrotoluene	Nitroaromatic explosive	2,4,6-TNT	118-96-7
4-Amino-2,6-dinitrotoluene	TNT breakdown product	4-Am-DNT	1946-51-0
2-Amino-4,6-dinitrotoluene	TNT breakdown product	2-Am-DNT	355-72-78-2
2,4-Dinitrotoluene	Nitroaromatic explosive/ propellant; also TNT co-contaminant	2,4-DNT	121-14-2
2,6-Dinitrotoluene	Nitroaromatic explosive/ propellant; also TNT co-contaminant	2,6-DNT	606-20-2
2-Nitrotoluene (o-Nitrotoluene)	DNT co-contaminant	2-NT	88-72-2
3-Nitrotoluene (m-Nitrotoluene)	DNT co-contaminant	3-NT	99-08-1
4-Nitrotoluene (p-Nitrotoluene)	DNT co-contaminant	4-NT	99-99-0
Nitroglycerine	Nitrate ester explosive/propellant	NG	55-63-0

(1) Information gathered from TM 9-1300-214, Military Explosives; ATSDR Toxicological Profiles for 2,4- and 2,6-Dinitrotoluene and for 2,4,6-Trinitrotoluene (located at http://www.atsdr.cdc.gov/toxprofiles/) and the Hazardous Substances Data Bank (located at http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB).

(2) Chemical Abstracts Service registry number.

Table 2. Field Tests for Nitrogen-Based Explosives

Method No.	Title
SW4050	TNT Explosives in Soil by Immunoassay
SW4051	RDX in Soil by Immunoassay
SW8515	Colorimetric Screening Method for TNT in Soil
SW8510	Colorimetric Screening Procedure for RDX and HMX in Soil

Table 3. Fixed Laboratory Tests for Nitrogen-Based Explosives, Co-Contaminants, and Breakdown Products

Method No.	Title
SW8330A	Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC)
SW8332	Nitroglycerine by HPLC
SW8095	Explosives by Gas Chromatography (GC)
SW8321A [(1)]	Explosives by HPLC/Mass Spectrometry (MS)
EPA 529	Determination of Explosives and Related Compounds in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS)

[(1)] This method is typically cited for HPLC/MS of explosives. However, no published version includes explosives

liquid chromatography/mass spectrometry (LC/MS) confirmation to compensate for the laboratory's failure to properly execute SW8330 should not incur additional cost to the government. For all aqueous samples, sample preparation should be performed in accordance with SW3535A rather than by the SW8330 salting out procedure.

5.2 Perchlorate.

Perchlorate is the anion of perchloric acid. Two salts of primary concern are Ammonium Perchlorate (CAS Number 7790-98-9, NH_4ClO_4) and Potassium Perchlorate (CAS Number 7778-74-7, $KClO_4$). If munitions containing perchlorate are suspected to exist at a project property, a perchlorate evaluation should be completed according to the latest perchlorate guidance that can be found in the following references:

- http://hqi.environmental.usace.army.mil/programs/fuds/perchlorate/perchlorate.html (only available to USACE personnel)
- *Department of Army Guidance for Addressing Potential Perchlorate Contamination*
- *Procedure to Request Perchlorate Sampling at FUDS* (if applicable)

Additional information on perchlorate is anticipated to become available later in 2005, specifically, the Interstate Technology Regulatory Council (ITRC) Overview of Perchlorate and the DoD Environmental Data Quality Workgroup (EDQW) Perchlorate Handbook. For additional information contact the MM CX.

5.2.1 Field Tests.

Field tests based on an ion-selective electrode (ISE), colorimetry, capillary electrophoresis, and ion mobility/mass spectroscopy exist for perchlorate, but they have not been widely used at this time. The ISE method is documented in *Perchlorate Screening Study: Low Concentration Method for the Determination of Perchlorate in Aqueous Samples Using Ion Selective Electrodes: Letter Report of Findings for the Method Development Studies, Interference Studies, and Split Sample Studies, including Standard Operating Procedure*, "available at http://www.clu-in.org/programs/21m2/letter_of_findings.pdf. The colorimetry test is documented in CRREL TR 04-8, *Field Screening Method for Perchlorate in Water and Soil*, available at http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR04-8.pdf.

5.2.2 Fixed Laboratory Tests.

All fixed laboratory tests for perchlorate are based on ion chromatography, but substantial method development is currently underway to develop more specific methods with less interference from other common anions. For latest status on methodology recommendations, contact the MM CX. EPA 314.0, a method developed for analysis of drinking water is the only promulgated method for perchlorate. SW9058 was published in SW846, Draft IVB for surface water, mixed domestic water, and industrial wastewater. No published methods exist for perchlorate in soil. Laboratories that analyze for perchlorate in soil typically identify their method as EPA 314.1M, and conduct the analysis on a water extract. Conductivity of the water or the water extract is a key factor in perchlorate analysis and should be reported along with perchlorate results. The Sampling and Testing for Perchlorate at DoD Installations, Interim

Guidance, February 2004 requires that detections of perchlorate above action levels be confirmed with determinative methods (i.e., 2nd column confirmation or mass spectrum confirmation). Current methods under development for perchlorate are shown in comparison to EPA 314.0 in Table 4.

5.3 CWAs and ABPs.

CWAs and ABPs are listed in Table 5. No methods published by EPA exist for CWAs or ABPs. Methods available have primarily been developed by Edgewood Chemical Biological Center (ECBC). Analyses are performed based on ECBC (or commercial laboratory) standard operating procedures. Most are based on GC/MS or GC/Flame Photometric Detection (FPD). Several ABP methods are in development by HPLC and Capillary Electrophoresis. CWA analysis must go to either ECBC or a commercial laboratory with a Bailment Agreement. Additional requirements for sampling and analysis related to CWAs and ABPs are found in EP 75-1-3. Note that if CWA-contaminated soil is suspected, the Chemical Warfare Materiel (CWM) Design Center should be contacted, as a Chemical Safety Submission for DoD Explosives Safety Board (DDESB) review and concurrence would be required.

5.4 White Phosphorus.

WP (CAS 7723-14-0, P_4) reacts with air and requires special handling for sampling and analysis. Typically, if significant levels of WP are present in soil that is excavated, visible smoke will be observed. If visible smoke is observed, notify contract laboratory and confirm willingness to accept for analysis.

5.4.1 Field Tests.

No field tests have been developed for WP.

5.4.2 Fixed Laboratory Tests.

Fixed laboratory tests for WP are all based on gas chromatography. The only published method for WP is SW7580, a GC method with a nitrogen-phosphorus detector (NPD). A GC/MS method is also available, but is not published. Due to increased regulation of WP by the Drug Enforcement Agency, the standard is currently unavailable. Therefore, analytical capabilities for this compound are very limited. Contact the MM CX for methodology recommendations.

5.4.3 Other Considerations.

If dewatering in an identified WP area or decontamination of WP contaminated equipment is required, water must be collected and analyzed prior to disposal. Appropriate disposal procedure should be followed according to the analytical results. WP is considered a Resource Conservation and Recovery Act (RCRA) reactive waste; therefore, careful planning is required prior to conducting an investigation. Planning considerations, to include disposal options, should be discussed in the Work Plan

Table 4. Fixed Laboratory Tests for Perchlorate

Method (Technique)	Applicability	Analytical Limitations	Reporting Limits
EPA 314.0 (Ion Chromato-graphy (IC))	• Mandatory for drinking water samples reported under Unregulated Contaminant Monitoring Rule (UCMR) I • Aqueous samples with low dissolved solids (conductivity < 1 mS/cm Total Dissolved Solids (TDS)) and chloride, sulfate, and carbonate concentrations < 100 mg/L each	• Analysis is subject to false positives due the unspecific nature of the conductivity detector • Method has been validated in drinking water only; drinking water methods are not intended for use with soils, biota, etc. • The lower reporting limit of 0.5 ppb is achievable only in samples with very low TDS • Inappropriate for use in samples with high TDS	5 µg/L
EPA 314.1 ("Improved" IC)	• Aqueous samples with up to 10 mS/cm TDS • Planned option for UCMR II	• False positives will be reduced but not eliminated • Not a published EPA method • Drinking water methods are not intended for use with soils, biota, etc.	0.5 -1 µg/L
SW9058 ("Improved" IC)	• Aqueous samples with up to 10 mS/cm TDS • Soil samples	• False positives will be reduced but not eliminated • EPA method currently under revision	0.5 -1 µg/L
SW 6850 (LC/MS or LC/MS/MS)	• Aqueous samples, to include those with high TDS • Soil and sludge samples • Technique documented for biota and milk analysis	• Not a published EPA method	0.2 µg/L for water; 2.0 µg/kg for soil

Table 4. Fixed Laboratory Tests for Perchlorate

Method (Technique)	Applicability	Analytical Limitations	Reporting Limits
SW6860 (IC/MS or IC/MS/MS)	• Aqueous samples, to include those with high TDS • Soil and sludge samples • Technique has been documented to analyze biota and milk samples	• Not a published EPA method	0.01 µg/L for water; 0.1 µg/kg for soil (both by IC/MS/MS)
EPA 331.0 (LC/MS or LC/MS/MS)	• Method limited to aqueous samples to include those with high TDS • Planned option for UCMR II	• Pretreatment recommended in Winkler, et al, 2004 method • Drinking water methods are not intended for use with soils, biota, etc.	0.02 µg/L
EPA 332.0 (IC/MS)	• Method limited to aqueous samples to include those with high TDS • Planned option for UCMR II	• False positives will be substantially reduced but may not be eliminated • Not a published EPA method • Drinking water methods are not intended for use with soils, biota, etc.	0.1 µg/L
EPA 332.0 (IC/MS/MS)	• Method limited to aqueous samples to include those with high TDS • Planned option for UCMR II	• Not a published EPA method • Drinking water methods are not intended for use with soils, biota, etc.	0.02 µg/L

Table 5. Chemical Warfare Agents and Agent Breakdown Products

Compound	Description	Abbreviation	CAS Number [1]	Analytical Technology
Chemical Warfare Agents				
Sulfur Mustard (bis(2-chloroethyl)sulfide)	Blister Agent	H, HS, HD	505-60-2	GC/MS
Lewisite (Dichoro(2-chlorovinyl)arsine)	Blister Agent	L	541-25-3	GC/MS [2]
Nitrogen Mustard (bis(2-chloroethyl)ethylamine)	Blister Agent	HN-1	538-07-8	GC/MS
Nitrogen Mustard (tris(2-chloroethyl)amine)	Blister Agent	HN-3	555-77-1	GC/MS
Tabun (Ethyl n, n-dimethylphosphoramido-cyanidate)	Nerve Agent	GA	77-81-6	GC/MS
Sarin (Isopropyl methylphosphonofluoridate)	Nerve Agent	GB	107-44-8	GC/MS
Soman (Pinacolyl methylphosphonofluoridate)	Nerve Agent	GD	96-64-0	GC/MS
o-Ethyl S-(2-diisopropylaminoethyl) Methylphosphonothiolate)	Nerve Agent	VX	50782-69-9	GC/MS
Agent Breakdown Products				
1,4-Dithiane	HD ABP	--	505-29-3	GC/MS
1,4-Thioxane	HD ABP	--	15980-15-1	GC/MS
Thiodiglycol	HD ABP	TDG	540-63-6	GC/MS or HPLC
2-Chlorovinyl Arsenous Acid	L ABP	CVAA	85090-33-1	GC/MS [2]
2-Chlorovinyl Arsenous Oxide	L ABP	CVAO	3088-37-7	GC/MS [2]
Triethanolamine	HN-3 ABP	TEA	102-71-6	CE
Ethyldiethanolamine	HN-1 ABP	--	139-87-7	CE
Isopropyl methyl phosphonic acid	GB	IMPA	1832-54-8	IC

Table 5. Chemical Warfare Agents and Agent Breakdown Products

Compound	Description	Abbreviation	CAS Number (1)	Analytical Technology
Methylphosphonic Acid	GB, GD, and VX ABP	MPA	993-13-5	IC
Dimethyl methylphosphonate	GB stimulant and precursor	DMMP	756-79-6	GC
Ethyl methylphosphonic acid	VX ABP	EMPA	1832-53-7	IC
Diisopropyl methylphosphonate	GB ABP	DIMP	1445-75-6	GC
Pinacolyl methylphosphonic acid	GD ABP	PMPA	616-52-48	IC
S-(2-diisopropylaminoethyl)-methylphosphonothioic acid	VX ABP	EA2192	73207-98-4	GC/MS

(1) Chemical Abstracts Service registry number.

(2) L, CVAA, and CVAO must be derivatized and form the same derivative. They are analyzed and reported together.

5.5 Metals.

Metals are found in all military munitions. Certain munitions only contain metals (i.e., incendiaries). Metal analyses may be based on a specific list if the type of ordnance is known. If not, it is recommended to analyze for the 23 Total Analyte List (TAL) metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc), unless a state-specific list exists. Depending upon munitions used on the site, zirconium, titanium, and strontium may also be potential metals of concern. Running a more extensive list of metals is often desirable when it is important to establish background for metals. This will allow a geochemical approach to data interpretation. For example, a correlation between a non-site related metal (i.e., background) such as aluminum or magnesium in soil with a potential site related metal (e.g., arsenic) could suggest that the metal is indeed native.

5.5.1 Field Tests.

There are two published field tests available for metals: SW4500, Mercury in Soil by Immunoassay and SW6200, Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment. SW6200 is appropriate for some, but not all of the metals of interest. Other field tests may be used on munitions response projects, if appropriate, but their use must be approved by the MM-DC.

5.5.2 Fixed Laboratory Tests.

There are several published methods for metals other than mercury. Currently available tests for metals are shown in Table 6. Determination of the appropriate method should depend upon the established DQOs. For soil analysis, SW6010B is typically appropriate, although it may require the use of "Inductively Coupled Plasma (ICP) trace" rather than ICP. For lower reporting limits, SW6020 or SW7000 series (to be replaced by SW7010) may be required.

Table 6. Fixed Laboratory Tests for Metals

Method Number	Title
SW6010B	Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)
SW6020	Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)
SW7010	Graphic Furnace Atomic Absorption (GFAA) Spectrophotometry
SW7000 series	Individual Metals by GFAA
SW7470A/ SW7471A	Mercury by Cold Vapor Atomic Absorption (CVAA)

6.0 Sampling and Analysis Plan.

Prior to initiating field activities, a SAP should be prepared. The SAP may be a stand-alone document or be an appendix of the Work Plan. It describes the project requirements for all sampling and analysis activities that should take place during a munitions response project. The SAP must consist of the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) when sampling for MC as required by ER 200-3-1. A SAP Review Checklist is provided in Appendix J of EM 200-1-3.

6.1 SAP Requirements.

The SAP should:

1) Address each requirement as identified in ER 1110-1-263.

2) Be prepared in accordance with (IAW) EM 200-1-3 including both format and content requirements.

3) Include the laboratory Quality Assurance/Quality Control (QA/QC) plan and applicable Standard Operating Procedures as an appendix (Compact Disk (CD) submittal preferred).

4) Clearly identify any DoD QSM requirements that a laboratory cannot meet.

5) Document DoD QSM self declaration of compliance

Previously prepared Work Plans for the project property should be used as much as possible in the preparation of the plan. As a minimum, the level of data quality and QC requirements should be equivalent to what is required in the existing Work Plans with the addition of any new requirements that have been added to improve the defensibility of the data quality since the last work plan submittal.

The laboratory must meet all of the requirements specified in the DoD QSM, unless approved in advance in the SAP. As noted above, the requirement for the laboratory to provide quantitative second column confirmation for explosives per DoD QSM/EM 200-1-3/SW8000C should not be waived.

6.2 SAP Review and Approval.

The SAP should be submitted to the Life Cycle Project Manager (LCPM) at the FUDS Geographic District and the MM DC. The MM DC should route the plan to the appropriate MM DC technical staff for review, comment, and approval. For FUDS, SAPs must be submitted to the lead regulatory agency for notice and opportunity to comment IAW ER 200-1-3. For other projects, this is recommended also. Once approved by the CO, the SAP represents the standard to which all sampling and analysis activities will be compared to assure compliance for the project.

7.0 Data Interpretation, Validation, Reporting, and Decision Making.

7.1 Data Interpretation.

After a project property undergoes sampling and analysis, it is necessary to carefully interpret all data and determine if project objectives have been met. Project related information such as possible MEC composition (if available) and donor explosive composition should be provided as part of data interpretation. If numeric DQOs have been identified for the project, a comparison of those DQOs must take place. Environmental Data Management System (EDMS) software is available to USACE personnel and contractors for DQO comparison. Data gaps may exist and should be identified and explained. Data gaps may require additional action as part of the remedial response.

7.2 Data Review.

The contractor should perform data review according to their approved SAP requirements. Although they were developed for the Contract Laboratory Program (CLP), review procedures should be based on the latest versions of the CLP National Functional Guidelines (EPA 540-R-99-008 and EPA 540-R-04-004, available at http://www.epa.gov/oerrpage/superfund/programs/clp/guidance.htm) and any applicable state or regional requirements. During TPP, the amount of review should be coordinated with regulatory agencies. The review should be documented in the draft and final engineering reports. Review documentation should address review of laboratory and field QC results. Persons performing the data validation should have appropriate experience as determined by their contractual requirements. It is recommended that QC for the data validation process be performed by an individual with a minimum of 10 years experience plus directly relatable laboratory experience coupled with two years data review and two years of data validation experience IAW current guidelines.

7.3 Data Reporting.

Laboratories and contractors each have data reporting responsibilities.

Laboratories must provide data reporting elements for definitive data IAW DoD QSM Appendix DoD-A – Reporting Requirements". They should report all analytical results greater than the Method Detection Limit (MDL) that, in the analyst's professional judgment, are believed to be reliably detected. Concentrations reported between the MDL and the Practical Quantitation Limit (PQL) must be flagged as estimated. PQLs must be at least 3 times MDLs for all analytes, as required by the DoD QSM. Data packages should be organized and assembled such that the analytical results are reported on a per-batch basis.

Contractors should submit the complete data packages to the MM DC and reference them as part of the large study report. They should include the analytical data in the draft and final engineering reports in tabular format. There should be, at a minimum, two types of data tables. The first should include all analytical results for all samples collected. The second should include all analytical results greater than the MDL for all samples collected. Tables should be sorted by sample field ID, method, analyte, and include appropriate data flags resulting from laboratory review and contractor's data validation.

The analytical data should also be provided electronically to the MM DC by the Contractor in the Staged Electronic Data Deliverable (SEDD) format for all FUDS projects. Other project-specific Electronic Data Deliverable requirements should be documented in project Statements of Work (SOWs)/Performance Work Statements (PWSs). For more information on the SEDD format, see http://www.epa.gov/superfund/programs/clp/sedd.htm. The SEDD formatted deliverable will require data parsing for use in the Automated Data Review (ADR) software. ADR software is intended to automate certain data review functions that are strictly comparisons to numeric criteria (i.e., holding time compliance, comparison to recovery/relative percent difference limits, etc.) Table A1 and A3 should be mandatory submittals. Table A2 should be provided if the laboratory is capable. Use of the ADR software will require that the contractor develop a comprehensive library file for all of the methods to be analyzed under the SOW/PWS. The library file should accurately reflect all of the analytical quality requirements as documented in the final SAP for the project and should be provided to both MM DC and the subcontract lab for use in screening Electronic Data Deliverable (EDD) submittals. The electronic deliverable must include appropriate data flags resulting from laboratory review and contractor's data validation. All electronic data submitted by the contract laboratory is required to be error-free, and in complete agreement with the hardcopy data. Data files are to be delivered both by electronic-mail and on high density compact disc accompanying the hard copy data reports. The disk must be submitted with a transmittal letter from the laboratory that certifies that the file is in agreement with hardcopy data reports and has been found to be free of errors using the latest version of ADR evaluation software provided to the laboratory. The contract laboratory, at their cost, should correct any errors identified by MM DC. The contractor is responsible for the successful electronic transmission of field and laboratory data. The laboratory is responsible for archiving the electronic raw data, associated software, and sufficient associated hardcopy data (e.g., sample login sheets and sample preparation log sheets) to completely reconstruct the analyses that were performed for a period of 10 years after completion of the applicable contract.

7.4 Decision Making.

The sampling and analysis data and evaluations are usually incorporated into a larger study (e.g., SI, Engineering Evaluation/Cost Analysis (EE/CA), RI/FS, Site Characterization, etc.) and project stakeholders are involved in making decisions regarding future work to be performed.

8.0 Quality Management.

8.1 Data Quality.

The contractor must provide data quality of a level sufficient to support the project's objectives as defined in the SAP. The contractor must provide QC of the various analytical tasks performed. The contractor is responsible for achieving data quality as defined in the SAP. Analytical data that does not meet QA requirements may be rejected by the government. Re-sampling and re-analysis may be required at no additional cost to the government.

8.2 Quality Control.

It is recommended that field duplicates be collected at a rate of ten percent (10%) per matrix per analysis per sampling event. Each project sample designated for a field duplicate must be homogenized thoroughly, and then divided equally (if sampling and analysis of volatile organic compounds is required for an MC site, the duplicate should be collocated). Both portions should be sent to the contractor's laboratory, but the identity of the duplicate should not be provided to the laboratory. The QC samples should include all sample matrices and analytical parameters except disposal parameters (i.e., Toxicity Characteristic Leaching Procedures (TCLP), reactivity, corrosivity, and ignitability). The contractor should administer all QC sample handling and custody requirements in a similar manner to that used for the environmental samples.

8.3 Coordination with QA Laboratory.

The contractor must provide coordination and QA samples (collected and transported by the contractor) to the QA laboratory identified in the SOW/PWS. It is recommended that QA splits be collected at a rate of ten percent (10%) per matrix per analysis per sampling event. The contractor should provide sample containers, shipping, etc. for QA samples. QA samples should be taken as splits of the same samples as QC duplicates (i.e., sample should be homogenized and split in triplicate) (if sampling and analysis of volatile organic compounds is required for an MC site, the QA split should be collocated). The QA split samples should include the same matrices and parameters as QC duplicate samples. The contractor should provide the QA laboratory a minimum of 2 weeks advance notice of sample shipment, unless an alternate notification requirement is proposed and accepted by the CO. The notification must include a list of laboratory-related DQOs. The DQOs should include, but should not be limited to, identification of extraction and analysis method numbers, a list of analytes with required limits, estimated number of tests, approximate sampling dates, and requested completion date for QA testing. All QA sample handling and custody requirements should be administered by the contractor similar to the environmental samples. The QA samples should be sent to the QA Laboratory by overnight delivery for government contract compliance monitoring. See the MMRP QA chapter of upcoming update to EM 1110-1-4009 and HTRW QA manual (EM 200-1-6) for additional guidance.

REFERENCES

ER 200-3-1
Formerly Used Defense Sites (FUDS) Program Policy

ER 1110-1-263
Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities

EM 200-1-2
Technical Project Planning (TPP) Process

EM 200-1-3
Requirements for the Preparation of Sampling and Analysis Plans

EM 200-1-4
Risk Assessment Handbook: Volume I - Human Health Evaluation
Risk Assessment Handbook: Volume II - Environmental Evaluation

EM 1110-1-502
Technical Guidelines for Hazardous and Toxic Waste Treatment and Cleanup Activities

EM 1110-1-1200
Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Waste (HTRW) Projects

EM 1110-1-4009
Ordnance and Explosives

EP 75-1-2
Munitions and Explosives of Concern (MEC) Support during Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities

EP 75-1-3
Recovered Chemical Warfare Materiel (RCWM) Response

ERDC/CRREL SR 96-15
Jenkins, Thomas F., Clarence L. Gant, Gurdarshan S. Brar, Philip G. Thorne, Thomas A. Ranney, and Patricia W. Schumaker (1996). *Assessment of Sampling Error Associated with Collection and Analysis of Soil Samples at Explosives-Contaminated Sites*.
http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/SR96_15.pdf

ERDC/CRREL TR-02-1
Thiboutot, Sonia, Guy Ampleman, and Alan D. Hewitt (2002). *Guide for Characterization of Sites Contaminated with Energetic Materials.*
http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR02-1(ERDC-CRL).pdf

ERDC/CRREL TR-04-8
Thorne, Philip (2004). *Field Screening Method for Perchlorate in Water and Soil.*
http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR04-8.pdf

TM 9-1300-214, Military Explosives.

MM CX Technical Update on RI/FS for MMRP projects (in press, contact MM CX for further information).

Common Range Operations Reports (in press, contact HTRW CX for further information)

HQ USACE Memorandum: HTRW Chemical Data Quality Management (CDQM) Policy for Environmental Laboratory Testing, September 30, 2004 http://www.environmental.usace.army.mil/info/technical/chem/chemval/HTRW_CDQM_Policy_for_Lab_Testing.pdf

DAIM-ZA, Department of Army Guidance for Assessing Potential Perchlorate Contamination, 11 June 2004, http://www.epa.gov/swerffrr/pdf/armyguidance_062004.pdf

DoD Quality Systems Manual (DoD QSM) (latest version). https://www.denix.osd.mil/denix/DOD/Working/EDQW/admin.html

DUSD(ATL), Interim Guidance on Perchlorate Sampling, 23 September 2003 https://www.denix.osd.mil/denix/DOD/Library/Water/Perchlorate/Policy/perchlorate_sampling_policy.pdf

Sampling and Testing for Perchlorate at DoD Installations - Interim Guidance, February 2004. http://www.navylabs.navy.mil/Archive/PerchlorateInterim.pdf

EPA/540/G-89/004, OSWER Directive 9355.3-01, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988 , http://www.epa.gov/superfund/resources/remedy/pdf/540g-89004-s.pdf

OSWER Directive 9345.1-05, Guidance for Performing Site Inspections under CERCLA; Interim Final, September 1992

A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, OSWER 9200.1-23P, EPA 540-R-98-031 July 1999, http://www.epa.gov/superfund/resources/remedy/rods/index.htm

Risk Assessment Guidance for Superfund (RAGS) (Parts A-E) http://www.epa.gov/superfund/programs/risk/tooltrad.htm

*Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples***,** EPA/600/R-03/027, November 2003. http://www.clu-in.org/goto.cfm?link=%2Fdownload%2Fchar%2Fepa%5Fsubsampling%5Fguidance%2Epdf&id=482

Perchlorate Screening Study: Low Concentration Method for the Determination of Perchlorate in Aqueous Samples Using Ion Selective Electrodes: Letter Report of Findings for the Method Development Studies, Interference Studies, and Split Sample Studies, including Standard Operating Procedure, "available at http://www.clu-in.org/programs/21m2/letter_of_findings.pdf.

Attachment 1

Munitions Constituents Sampling Checklist

Project Name: _____

Project Location: _____

MM DC Representative: _____

Preparer's Name and Title: _____

Date of Preparation: _____

	Y	N	N/A
Objective			
Has the objective for the munitions response investigation been identified?	_____	_____	_____
Initial MC Investigation Planning			
Has the MC investigation system employed the following components:			
• Experienced personnel?	_____	_____	_____
• Experienced laboratory?	_____	_____	_____
• Navigational accuracy and precision?	_____	_____	_____
Sampling and Analysis Considerations			
Have the following factors been considered for sampling and analysis:			
• MEC depth?	_____	_____	_____
• MEC composition?	_____	_____	_____
• Background conditions?	_____	_____	_____
• Regulatory requirements?	_____	_____	_____

	Y	N	N/A
Sampling and Analysis Plan			
1. Has the SAP been prepared prior to initiating field activities?			
2. Has the SAP been prepared IAW ER 1110-1-263, ER 200-3-1, and EM 200-1-3?			
3. Are the Laboratory QA/QC plan and applicable Standard Operating Procedures included in the SAP?			
4. Has the SAP submitted to PM and MM DC been approved?			
Data Interpretation, Validation, Reporting, and Decision Making			
Have the requirements outlined in Section 7-8 been met?			
Quality Management			
1. Has the QC of the various analytical tasks been provided?			
2. Have the handling and custody requirements for all QC samples been administered?			
Electronic Data Deliverables			
1. Has EDD been specified in SOW/PWS?			
2. Is implementation included in the Work Plan?			
3. If ADR (or similar EDD) specified, does Work Plan address automated portions of data review?			

Attachment 2

QASP Template

General. The following is the portion of a QASP template that pertains to Munitions Constituents. The QASP template should be modified for specific project needs.

ROLES AND RESPONSIBILITIES OF PARTICIPATING GOVERNMENT OFFICIALS

The USACE Chemist: **[*Should be modified for project needs*]**

- Evaluates acceptability of contract laboratory through review of their self declaration of DoD QSM compliance along with their method-specific SOPs
- Reviews the work plan for compliance with standard protocols for Environmental Sampling and Chemical Analysis.
- Conducts reviews of Environmental Sampling and Chemical Analysis Data.
- Conducts Periodic Inspections of contractor compliance with environmental sampling requirements of the work plan to ensure that contractors are utilizing appropriate sampling techniques, collecting the quantity of primary and QA/QC samples as stated in the work plan, and completing the COC correctly with the approved analytical methodology.
- Reviews contractor Investigative Derived Waste (IDW) Plan.
- Conducts, or coordinates with USACE Team members to conduct, Periodic Inspections of contractor compliance with the IDW Plan.
- Reviews QCP reporting requirements and accepts reported QC measures/standards.
- Review Daily Quality Control Reports for Environmental Sampling.

Attachment 3

Surveillance Activities Table

General. The following appendix provides: (1) instructions for documenting surveillance activities; and (2) a sample Surveillance Activities Table (completed for MC activities only). The sample Surveillance Activities Table was completed for a particular project and is provided for informational purposes only and should be modified for project-specific needs.

Instructions for Documenting Surveillance Activities Table.

a. General. The Surveillance Activities Table is used to document the project delivery team's QA activities. Results of these government activities fulfill two primary functions:

(1) Assures that project objectives have been met, and

(2) Supports annual and/or closeout contractor performance ratings in the PPIMS.

b. Column 1 - Definable Feature of Work. Definable features of work are those products or processes that can be identified as having results that can be measured. For the purposes of QA Surveillance activities, only those definable features of work that impact the overall quality or safety of the project should be included.

c. Column 2 - Reference - Contract/Task Order requirement or other applicable reference that requires the stated Definable Feature of Work from Column 1.

d. Column 3 - Method of Surveillance - Common accepted surveillance methods are:

(1) Random Sampling: Random Sampling is a statistically based method that assumes receipt of acceptable performance if a given percentage or number of scheduled surveillance activities have found the product or service to be acceptable. If performance is considered marginal or unsatisfactory, the project team should document the discrepancy or finding on a Corrective Action Request (CAR). If performance is satisfactory, very good, or exceptional, the project team should consider adjusting the sample size or sampling frequency. Random sampling is the most appropriate method for frequently recurring tasks. It works best when the number of instances is very large and a statistically valid sample can be obtained.

(2) Periodic Inspection - Periodic inspection (i.e., Weekly, Monthly, Quarterly, etc.) consists of the evaluation of tasks selected on other than a 100% or random basis. It may be appropriate for tasks that occur infrequently, and where 100% inspection is neither required nor practicable. A predetermined plan for inspecting part of the work is established using subjective judgment and analysis of agency resources to decide what work to inspect and how frequently to inspect it. Selecting this tool to determine a contractor's compliance with contract requirements can be quite effective and it allows for assessing confidence in the contractor without consuming a significant amount of time.

(3) 100 Percent Inspection - This is usually the most appropriate method only for infrequent tasks or tasks with stringent performance requirements. With this method,

performance is inspected/evaluated at each occurrence. The cost-benefit of one hundred percent inspection should be considered prior to its implementation.

(4) Customer Feedback - Customer feedback is firsthand information from the actual users of the service or product. It should be used to supplement other forms of evaluation and assessment, and it is especially useful for those areas that do not lend themselves to the typical forms of surveillance. However, customer feedback information should be used prudently. Sometimes customer feedback is complaint-oriented, likely to be subjective in nature, and may not always relate to actual requirements of the contract. Such information requires thorough validation.

(5) Third-party Audits - The term "third-party audits" refers to a contractor evaluation made by a third-party organization that is independent of the government and the contractor. All documentation supplied to, and produced by, the third party should be made available to both the government and the contractor.

e. Column 4 - Documentation of Surveillance Activities Performed. Identify the document(s) to be used by the project team to record that specified surveillance activities have been performed and describe the results of those surveillance activities.

f. Column 5 - QA Surveillance Record File. Identify where the Quality Assurance Reports (or other documentation, from Column 4) are filed by the project team. The preferred method is to have a central location or file for all QA Surveillance documentation, but if multiple files/locations (i.e., project team members) will be used, identify them in this column.

g. Column 6 - PPIMS Performance Assessment Record (PAR) Category. This column is used to identify the PAR category under which the associated Definable Feature of Work will be rated. More than one PAR Category may apply to a given Definable Feature of Work. PAR Categories may include, but are not limited to:

(1) *Quality of Product or Service* - Assess the contractor's conformance to contract requirements, specifications and standards of good workmanship (e.g., commonly accepted technical or professional standards).

(2) *Schedule* - Assess the timeliness of the contractor against the completion of the contract, task orders, milestones, delivery schedules, administrative requirements, etc. Assess the contractor's adherence to the required delivery schedule by assessing his/her efforts during the assessment period that contribute to or effect the schedule variance.

(3) *Cost Control* - Assess the contractor's effectiveness in forecasting, managing, and controlling contract cost. Assess for all contracts except Firm Fixed Price (FFP) or Firm Fixed Price with Economic Price Adjustment contracts.

(4) *Business Relations* - Assess the timeliness, completeness, and quality of problem identification, corrective action plans, proposal submittals, the contractor's history of reasonable and cooperative behavior, and customer satisfaction. Assess the contractor's success with timely award and management of subcontracts, including whether the contractor met small/small disadvantaged and women-owned business participation goals. Assess the extent to which the

contractor discharges its responsibility for integration and coordination for all activity needed to execute the contract.

(5) *Management of Key Personnel* - (For Services and Information Technology Business Sectors Only) - Assess the contractor's performance in selecting, retaining, supporting, and replacing, when necessary, key personnel.

(6) *Safety*- Assess any element not covered in this section or provide additional comments on the contractor's overall performance level. For MMRP projects, this is where Safety is rated. Assess the contractor's adherence to approved safety plans, explosives/chemical agent safety requirements, and ability to prevent safety related incidents/accidents.

h. Column 7 - Basic Performance Indicators. Performance indicators are the standards and measures by which the project delivery team determines acceptability of contractor performance regarding the associated Definable Feature of Work (Column 1). For example: If "Draft Plans and Reports" is the Definable Feature of Work, then Basic Performance Indicators might be "Plans and Reports are concise and technically accurate, plans are in accordance with applicable regulations, reports are logical and support subsequent decisions." The associated Performance Metric when rating contractor performance might be related to the number and seriousness of comments generated and/or the need for subsequent government reviews.

Table 1. Surveillance Activities Table

(1) Definable Feature of Work (Product or Process being Rated) *(Each Definable Feature of Work should have at least one corresponding metric associated with it.)*	(2) Reference *(Self explanatory)*	(3) Method of Surveillance *(100%, Random Sampling, Periodic-(i.e., Weekly, Monthly, Quarterly etc.,)*	(4) Documentation of Surveillance Activities Performed (Objective Evidence) *(Identify what documentation will be generated as evidence that surveillance activities were conducted)*	(5) QA Surveillance Record File *(e.g. CARs in Contract file, Form-7 comments in PM file, QARs in project engineer files, etc.)*	(6) PPIMS Performance Assessment Record (PAR) Category *(One or more categories may apply, but each definable feature of work, Column 1, must be directly linked to at least one Performance Metric)*	(7) Basic Performance Indicator(s) *(To be used as the basis for contractor ratings described in the performance metrics when completing the Contractor Performance Assessment Record (PAR) in PPIMS)*
Environmental Sampling and Chemical Analyses	Section C, Chapter 2, Sub-section 2.8, Chapter 4, Sub-section 4.5, T.O. para 3.2	Periodic Inspection (during sampling events) 100% review of all DID MR005-10 Section 1.4 submittals except the Chemistry Data Package. 5% review of the Chemistry Data Package	Trip reports, CARs, QARs, and/or statements of reviewed chemical data	Project Chemist file	1. Quality of Product or Service. 2. Management of Key Personnel and Resources	1. Data submittals pass Automated Data Review. Meet project DQOs for sampling methods, data analyses and validation. Number and type of corrective action requests based on government observation regarding contractor: Compliance with approved plans, personnel knowledgeable and effective regarding their responsibilities. 2. Personnel meet position qualification and resources managed efficiently.

GLOSSARY

GLOSSARY

Section I

Abbreviations

ABP.....Agent Breakdown Product
ADR .....Automated Data Review
AES .....Atomic Emission Spectrometry
2-Am-DNT.....2-Amino-4,6-Dinitrotoluene
4-Am-DNT 4-Amino-2,6-Dinitrotoluene
ARAR .....Applicable or Relevant and Appropriate Requirement
AP .....Ammonium Picrate
ASR.....Archives Search Report
BRAC.....Base Realignment and Closure
CAS.....Chemical Abstracts Service
CDQM.....Chemical Data Quality Management
CERCLA.....Comprehensive Environmental Response, Compensation, and Liability Act
CFR.....Code of Federal Regulations
CLP .....Contract Laboratory Program
CO .....Contracting Officer
COR .....Contracting Officer's Representative
CRREL.....Cold Regions Research Engineering Laboratory
CSM .....Conceptual Site Model
CVAA .....Cold Vapor Atomic Absorption
CWA .....Chemical Warfare Agent
CWM.....Chemical Warfare Materiel
CX.....Center of Expertise
DA.....Department of the Army
DA Pam.....Department of the Army Pamphlet
DASA (ESOH).....Deputy Assistant Secretary of the Army (Environment, Safety, and Occupational Health)
DDESB .....DoD Explosives Safety Board

DERP .....Defense Environmental Restoration Program
DID .....Data Item Description
DNX.....Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine
2,4-DNT.....2,4-Dinitrotoluene
2,6-DNT.....2,6-Dinitrotoluene
DOD.....Department of Defense
DQO.....Data Quality Objective
ECBC.....Edgewood Chemical Biological Center
EDD .....Electronic Data Deliverable
EDMS .....Environmental Data Management System
EDQW.....Environmental Data Quality Workgroup
EE/CA.....Engineering Evaluation/Cost Analysis
EM.....Engineer Manual
EP.....Engineer Pamphlet
EPA.....U.S. Environmental Protection Agency
ER .....Engineer Regulation
ERDC.....Engineering Research and Development Center
FATE.....Field Analytic Technologies Encyclopedia
FoT.....Field of Testing
FPD .....Flame Photometric Detection
FSP.....Field Sampling Plan
FUDS .....Formerly Used Defense Sites
GC.....Gas Chromatography
GFAA.....Graphic Furnace Atomic Adsorption
HE .....High Explosive
HMX Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HPLC .....High Performance Liquid Chromatography
HQUSACE.....Headquarters, U.S. Army Corps of Engineers
HTRW.....Hazardous, Toxic, and Radioactive Waste
IAW.....In Accordance With

ICP .....Inductively Coupled Plasma
IRP .....Installation Restoration Program
ISE.....Ion Selective Electrode
ITRC .....Interstate Technology Regulatory Council
LC/MS.....Liquid Chromatography/Mass Spectrometry
LCPM.....Life-Cycle Project Manager
LTM .....Long-Term Management
MC .....Munitions Constituents
MDL.....Method Detection Limit
MM CX.....Military Munitions Center of Expertise
MM DC.....Military Munitions Design Center
MMRP.....Military Munitions Response Program
MNX Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine
MRA .....Munitions Response Area
MS.....Mass Spectrometry
NC .....Nitrocellulose
NCP.....National Oil and Hazardous Substances Pollution Contingency Plan
NELAP.....National Environmental Laboratory Accreditation Program
NG.....Nitroglycerine
NPD.....Nitrogen Phosphorous Detector
NQ.....Nitroguanidine
2-NT 2-Nitrotoluene
3-NT 3-Nitrotoluene
4-NT 4-Nitrotoluene
OB .....Open Burn
OD.....Open Detonation
PDT .....Project Delivery Team
PETN.....Pentaerythritol tetranitrate
PM.....Project Manager
PQL .....Practical Quantitation Limit

PWS .....Performance Work Statement
QA.....Quality Assurance
QAPP .....Quality Assurance Project Plan
QASP .....Quality Assurance Surveillance Plan
QC.....Quality Control
QSM.....Quality Systems Manual
R&D.....Research and Development
RA-O.....Remedial Action Operation
RCRA.....Resource Conservation and Recovery Act
RDX.....Hexahydro-1,3,5-trinitro-1,3,5-triazine
RI/FS.....Remedial Investigation / Feasibility Study
SAP .....Sampling and Analysis Plan
SEDD .....Staged Electronic Data Deliverable
SI.....Site Inspection
SOW.....Statement of Work
SR.....Special Report
TAL.....Total Analyte List
TBC.....To Be Considered
TCLP.....Toxicity Characteristic Leaching Procedures
TDS.....Total Dissolved Solids
TM.....Technical Manual
TNT.....2,4,6-Trinitrotoluene
TNX Hexahydro-1,3,5-trinitroso-1,3,5-triazine
TPP.....Technical Project Planning
TR .....Technical Report
UCMR.....Unregulated Contaminant Monitoring Rule
USACE .....U.S. Army Corps of Engineers
USAESCH .....U.S. Army Engineering and Support Center, Huntsville
WP.....White Phosphorous

Section II
Terms

Anomaly Avoidance

Techniques employed by EOD or UXO personnel at sites with known or suspected MEC to avoid any potential surface MEC and any subsurface anomalies. This usually occurs at mixed hazard sites when HTRW investigations will occur prior to execution of a munitions response. Intrusive anomaly investigation is not authorized during ordnance avoidance operations.

Applicable or Relevant and Appropriate Requirements (ARARs)

Applicable requirements are cleanup standards, standards of control, and other substantive environmental protection requirements promulgated under federal or state environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site. Relevant and appropriate requirements are cleanup standards that while not "applicable", address situations sufficiently similar to those encountered at a CERCLA site that their use is well-suited to the particular site.

Archives Search Report (ASR)

A detailed investigation to report on past OE activities conducted on an installation. The principal purpose of the Archives Search is to assemble historical records and available field data, assess potential ordnance presence, and recommend follow-up actions at a DERP-FUDS. There are four general steps in an Archives Search: records search phase, site safety and health plan, site survey, archives search report including risk assessment.

Center of Expertise (CX)

A CX is a USACE organization that has been approved by HQUSACE as having a unique or exceptional technical capability in a specialized subject area that is critical to other USACE commands. Specific services to be rendered by a CX are identified on the CX's homepage at http://www.hnd.usace.army.mil/oew. These services may be reimbursable or centrally funded. The U.S. Army Engineering and Support Center, Huntsville is the MM CX for the USACE. (ER 1110-1-8153)

Chemical Warfare Materiel (CWM)

An item configured as a munition containing a chemical substance that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. Also includes V- and G- series nerve agent, H- series blister agent, and lewisite in other- than-munition configurations. Due to their hazards, prevalence, and military-unique application, chemical agent identification sets (CAIS) are also considered CWM. CWM does not include: riot control agents, chemical herbicides; smoke and flame producing items; or soil, water, debris, or other media contaminated with chemical agent.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

Congress enacted CERCLA, commonly known as Superfund, on 11 December 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.

Construction Support

Support provided by qualified UXO personnel during construction activities at potential Munitions Response Areas to ensure the safety of construction personnel from the harmful effects of MEC. When a determination is made that the probability of encountering MEC is low (e.g., current or previous land use leads to an initial determination that MEC may be present), a minimum of a two person munitions response team will stand by in case the construction contractor encounters suspected MEC. When a determination is made that the probability of encountering MEC is moderate to high (current or previous land use leads to a determination that MEC was employed or disposed of in the parcel of concern, e.g., open burn and open detonation areas, maneuver areas, etc.), munitions response teams are required to conduct subsurface munitions response for the known construction footprint either in conjunction with the construction contractor or prior to construction intrusive activities. The level of effort will be determined on a case-by-case basis in coordination with the MM CX.

Conventional Munitions and Explosives of Concern

The term "conventional MEC" refers to munitions and explosives of concern (see definition) other than CWM, BWM and nuclear ordnance.

Data Quality Objective (DQO)

A DQO is a qualitative and quantitative statement developed to clarify study objectives, define the type of data needed, and specify the tolerable levels of potential decision errors. A DQO is used as the basis for establishing the type, quality and quantity of data needed to support the decisions that will be made.

Design Center (DC)

A specified USACE field office assigned a singular technical mission that is permanent and USACE-wide in scope. The designated office is to be considered the "lead activity" in a specialized area where capability needs to be concentrated for maximum effectiveness, economy, and efficiency. The MM DC (in coordination with the PM) will execute all phases of the munitions response project after the approval of the INPR unless the munitions response action is transferred to an approved district.

Explosive Soil

Explosive soil refers to mixtures of explosives in soil, sand, clay, or other solid media at concentrations such that the mixture itself is explosive.

(a) The concentration of a particular explosive in soil necessary to present an explosion hazard depends on whether the particular explosive is classified as "primary" or "secondary." Guidance on whether an explosive is classified as "primary" or "secondary" can be obtained from the MM CX.

(b) Primary explosives are those extremely sensitive explosives (or mixtures thereof) that are used in primers, detonators, and blasting caps. They are easily detonated by heat, sparks, impact, or friction. Examples of primary explosives include Lead Azide, Lead Styphnate, and Mercury Fulminate.

(c) Secondary explosives are bursting and boostering explosives (i.e., they are used as the main bursting charge or as the booster that sets off the main bursting charge). Secondary explosives are much less sensitive than primary explosives. They are less likely to detonate if struck or when exposed to friction or to electrical sparks. Examples of secondary explosives include Trinitrotoluene (TNT), Composition B, and Ammonium Picrate (Explosive D).

(d) Soil containing 10 percent or more by weight of any secondary explosive or mixture of secondary explosives is considered "explosive soil." This determination was based on information provided by the USAEC as a result of studies conducted and reported in USAEC Report AMXTH-TE-CR 86096.

(e) Soil containing propellants (as opposed to primary or secondary high explosives) may also present explosion hazards.

Formerly Used Defense Site (FUDS) Property

A FUDS is defined as a facility or site (property) that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances. By the Department of Defense Environmental Restoration Program (DERP) policy, the FUDS program is limited to those real properties that were transferred from DOD control prior to 17 October 1986. FUDS properties can be located within the 50 States, District of Columbia, Territories, Commonwealths, and possessions of the United States.

Geographic Military Districts

Geographic Military Districts consist of 22 districts within the Geographic Military Divisions. The Geographic Military District is the overall manager for the entire life cycle (i.e., "cradle to grave") for approved FUDS projects (except for PRP projects). The Geographic Military District, through the project manager (PM), leads and facilitates the project delivery team (PDT) towards effective project development and execution. The district is responsible for managing project cost, schedule, and scope to ensure quality and proper coordination with

government and non-government entities. The district is also responsible for programming funding and for upward reporting. (ER 200-3-1)

Geographic Military Division

USACE military divisions have regional responsibility for the FUDS program and consist of seven military divisions. (ER 200-3-1)

Hazardous, Toxic, and Radioactive Waste (HTRW) Activities

HTRW activities include those activities undertaken for the Environmental Protection Agency's Superfund program, the Defense Environmental Restoration Program (DERP), including Formerly Used Defense Sites (FUDS), and Installation Restoration Program (IRP) sites at active DOD facilities, HTRW actions associated with Civil Works projects, and any other mission or non-mission work performed for others at HTRW sites.

Inventory Project Report (INPR)

The report resulting from the determination of FUDS eligibility. The INPR includes data as well as a recommendation for further action and guides investigators through further site studies. The INPR documents whether DOD is responsible for contamination at a FUDS.

Lessons Learned

Past experiences or recognized potential problems or better business practices that are captured and shared to: (1) Prevent the recurrence of repetitive design/execution deficiency; (2) Clarify interpretation of regulations or standards; (3) Reduce the potential for mistakes in high risk/probability areas of concern; (4) Pass on information specific to an installation or project; (5) Promote a good work practice that should be ingrained for repeat application; and (6) Promote efficient and cost effective business practices.

Mandatory Center of Expertise (MCX)

An MCX is a USACE organization that has been approved by HQUSACE as having a unique or exceptional technical capability in a specialized subject area that is critical to other USACE commands. Specific mandatory services to be rendered by an MCX are identified on the CX's homepage at http://www.hnd.usace.army.mil/oew. These services may be reimbursable or centrally funded. USAESCH is the MCX for the USACE.

Military Munitions

All ammunition products and components produced for or used by the U armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. The term does not include wholly inert items,

improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, except that the term does include non-nuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954, (42 U.S.C. 2011 et seq.) have been completed. (10 U.S.C. 2710(e)(3)(A))

Military Munitions Response Program (MMRP)

The MMRP category is defined as response actions (i.e., the identification, investigation, and remedial actions, or a combination of removal and remedial actions) to address Munitions and Explosives of Concern (MEC) or Munitions Constituents (MC). This includes the removal of foreign military munitions if it is incidental to the response addressing DOD military munitions at a FUDS property. (ER 200-3-1)

Munitions and Explosives of Concern (MEC)

This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means:

(a) Unexploded Ordnance (UXO), as defined in 10 U.S.C. 2710 (e) (9);

(b) Discarded Military Munitions (DMM), as defined in 10 U.S.C. 2710 (e) (2), or

(c) Munitions constituents (e.g., TNT, RDX) present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC)

Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance and munitions. (10 U.S.C. 2710(e)(4))

Munitions Response

Response actions, including investigation, removal and remedial actions to address the explosives safety, human health, or environmental risks presented by unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC).

Munitions Response Area

Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites.

Munitions Response Site

A discrete location within a MRA that is known to require a munitions response.

National Oil and Hazardous Substance Pollution Contingency Plan (NCP)

Revised in 1990, the NCP provides the regulatory framework for responses under CERCLA. The NCP designates the Department of Defense as the removal response authority for ordnance and explosives hazards.

Non-Stockpile Chemical Warfare Materiel

CWM (see definition) that is not included in the chemical stockpile. Non-stockpile CWM is divided into five categories: buried CWM, recovered chemical weapons (items recovered during range clearing operations, from chemical burial sites, and from research and development testing), former chemical weapon production facilities, binary chemical weapons, and miscellaneous CWM (unfilled munitions and devices and equipment specially designed for use directly in connection with employment of chemical weapons).

Performance Based Contracts (PBC)

The PBC is a mechanism that solicits bids on the basis of what results you want achieved rather than what activities you want conducted (i.e., contract for "What" and not "How"). Characteristics of PBC include clearly defined performance expectations and measures (baseline versus expected results), clearly defined due dates and milestones, use of incentives for performance, and flexibility in exchange for accountability for results. The goal of PBC for environmental cleanup is to achieve one or more of the following performance objectives for each site identified in the performance work statement; a) response complete b) remedy in place and c) long-term monitoring/successful 5-year review.

Project Delivery Team (PDT)

The PDT is a multi-disciplined project team lead by the Project Manager with responsibility for assuring that the project stays focused, first and foremost on the public interest, and on the customer's needs and expectations, and that all work is integrated and done in accordance with a PMP and approved business and quality management processes. The PDT focuses on quality project delivery, with heavy reliance on partnering and relationship development to achieve better performance. The PDT should consist of everyone necessary for successful development and execution of all phases of the project. The PDT will include the customers, the PM, technical experts within or outside the local USACE activity, specialists, consultants/contractors, stakeholders, representatives from other Federal and state agencies, and higher level members from Division and Headquarters who are necessary to effectively develop and deliver the project actions. The customer is an integral part of the PDT.

Quality

The totality of features and characteristics of a product or service that bear on its ability to meet the stated or implied needs and expectations of the project. Quality expectations need to be negotiated among the PDT members (which include the customer) and are set in the Project Management Plan. (ER 5-1-11). More specifically, the quality of a response action is measured by how closely that response action meets the standards and expectations of the customer.

Quality Assurance (QA)

An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed to meet project requirements defined in the PMP.

Quality Assurance Surveillance Plan (QASP)

All service contracts require the development and implementation of a QASP. A QASP describes how government personnel will evaluate and assess contractor performance. The purpose of the QASP is to describe how project performance will be measured and assessed against performance standards. It is based on the premise that the contractor, not the government, is responsible for managing quality control (QC).

Quality Control (QC)

The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established in the PMP; operational techniques and activities that are used to fulfill requirements for quality.

Remedial or Remedial Action (RA)

Those actions consistent with permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health, welfare or the environment. The term includes, but is not limited to, such actions at the location of the release as storage; confinement; perimeter protection using dikes, trenches, or ditches; clay cover; neutralization; cleanup of released hazardous substances and associated contaminated materials; recycling or reuse; diversion; destruction; segregation of reactive wastes; dredging or excavations; repair or replacement of leaking containers; collection of leachate and runoff; onsite treatment or incineration; provision of alternative water supplies; and any monitoring reasonably required to assure that such actions protect the public health, welfare and the environment. The term includes the costs of permanent relocation of residents and businesses and community facilities where the President determines that, alone or in combination with other measures, such relocation is more cost-effective and environmentally preferable to the transportation, storage, treatment, destruction, or secure disposition offsite of hazardous substances, or may otherwise be necessary to protect the public health or welfare. The term includes offsite transport and offsite storage, treatment, destruction, or secure disposition of hazardous substances and associated contaminated materials. (DERP Management Guidance)

Remedial Investigation/Feasibility Study (RI/FS)

An in depth study designed to gather the data necessary to determine the nature and extent of known contamination at a site, assess risk to human health and the environment, and establish criteria for cleaning up the site. During the FS, the RI data is analyzed and remedial alternatives are identified. The FS serves as the mechanism for the development, screening, and detailed evaluation of alternative remedial actions.

Removal or Removal Action

The cleanup or removal of released hazardous substances from the environment. Such actions may be taken in the event of the threat of release of hazardous substances into the environment,

such actions as may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances, the disposal of removed material, or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release. The term includes, in addition, without being limited to, security fencing or other measures to limit access, provision of alternative water supplies, temporary evacuation and housing of threatened individuals not otherwise provided for, action taken under section 9604(b) of this title, and any emergency assistance which may be provided under the Disaster Relief and Emergency Assistance Act [42 U.S.C. 5121 et seq.] The requirements for removal actions are addressed in 40 CFR §§300.410 and 330.415. The three types of removals are emergency, time-critical, and non time-critical removals.

Response Action

A CERCLA-authorized action involving either a short-term removal action or a long-term removal response. This may include, but is not limited to, removing hazardous materials, containing or treating the waste on-site, and identifying and removing the sources of ground water contamination and halting further migration of contaminants.

Site Inspection (SI)

Activities undertaken to determine whether there is a release or potential release and the nature of associated threats. The purpose is to augment the data collected in the PA and to generate, if necessary, sampling and other field data to determine the presence, type, distribution, density, and location of hazardous substances or military munitions.

Stakeholder

Stakeholders include Federal, state, and local officials, tribal officials, community organizations, property owners, and others having a personal interest or involvement or having a monetary or commercial involvement in the FUDS Property that is to undergo a remedial/response action.

Unexploded Ordnance (UXO)

Military munitions that:

(a) Have been primed, fuzed, armed, or otherwise prepared for action;

(b) Have been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and

(c) Remain unexploded either by malfunction, design, or any other cause. (U.S.C. 2710 (e) (9))