5.0 SAMPLING PLAN

5.1 Introduction

The Army Corps of Engineers (COE) Huntsville is responsible for management, control and overseeing the removal of explosive ordnance items from Formerly Used Defense (FUD) Sites that contain Unexploded Ordnance (UXO). The COE's intent is to safely cleanup these sites and at the same time mitigate the potential for additional contamination resulting from the cleanup activities. Sampling is required to establish the relative site conditions both before and after remediation. This document provides the protocol to be used during sampling activity.

5.1.1 Plan Objective

This sampling plan is part of a larger task intended to develop a set of baseline data that characterizes the air soil and water contamination levels which can be expected to result from the OB/OD of explosive ordnance items found while restoring a typical FUD site. The intent of this plan is to develop the sampling methodology in a generic format that can be used during investigation activities. This plan has been developed in a generic format with the intent that it be used at any FUDS designated for study. This format that should be adjusted as necessary to conform to the specific site activities and conditions.

5.1.2 Background

The Huntsville Division, Corps of Engineers is responsible for the remediation of FUD sites which still have unexploded ordnance and explosive waste (OEW). Open burning and open detonation (OB/OD) has traditionally been the means of disposing of explosive ordnance, however concern has been expressed over the environmental effects of this activity. Alternate methods of disposal are both costly and increase the risk to personnel assigned to the task of disposal. The primary goal of this plan is to establish methods to collect soil and water samples from areas to be used for OB/OD operations at selected FUD sites. This will enable the determination of environmental effects, if any, associated with OB/OD and enable a comparison the effectiveness OB/OD to other disposal techniques.

5.2 Standard Sampling Procedures

Standard sampling procedures ensure the consistency in the collection of the samples and data derived from the samples collected. A flow chart for sample collection procedures is shown in Figure 5.1. Consistent data and sample collection is essential to the development of defensible site data. These procedures include:

required sampling equipment

health and safety precautions

field documentation
standard sampling procedures for water, soils and air
decontamination procedures and
proper handling of samples by field and laboratory personnel

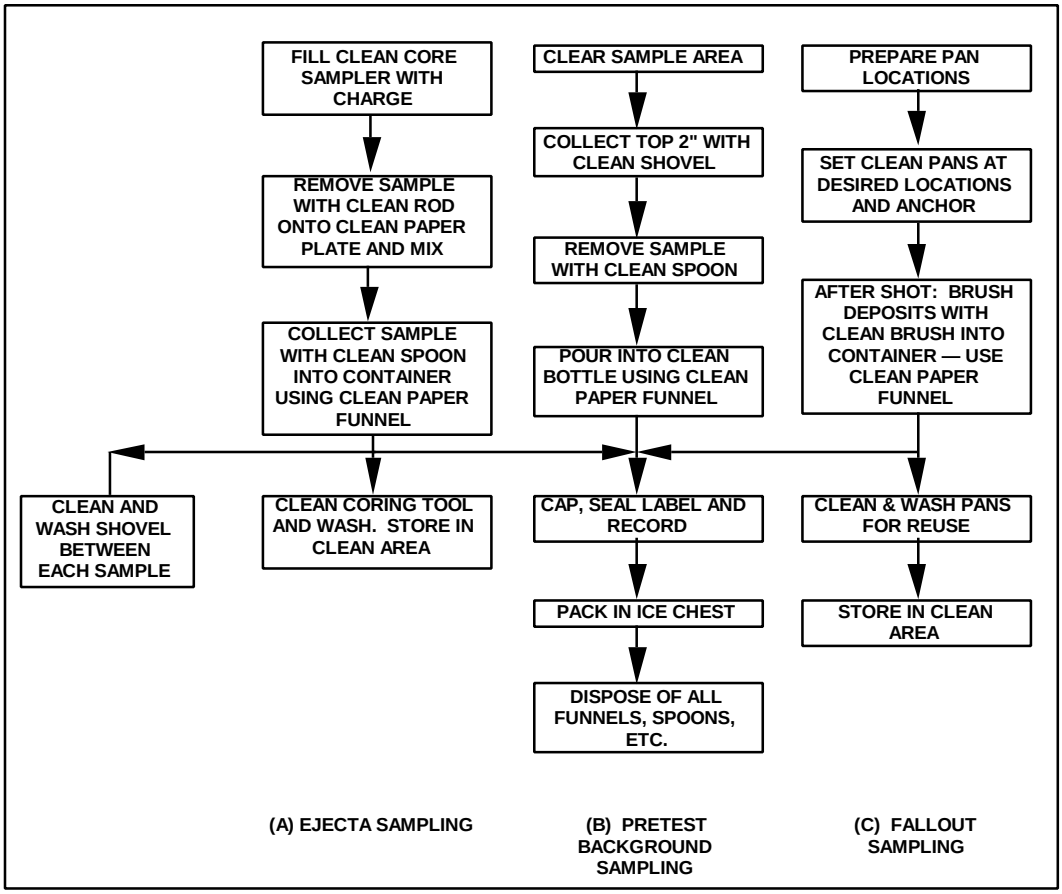

Figure 5.1 Sample Collection Procedure

5.2.1 Required Sampling Equipment

Presented in Appendix A is a list of field equipment necessary for sampling activities at a typical FUD site. The variety of activity at each site in addition to changing conditions (such as weather) may require additional equipment. Field personnel will note equipment changes in the field book

5.2.2 Health and Safety Precautions

Historically, environmental considerations have been secondary to overriding safety concerns at OB/OD sites. This has resulted in numerous sites being contaminated to varying degrees as a result of past activities. Safety is still the primary concern at all FUD sites. However, there is now a need to document the amount and type of contamination.

All sampling activity detailed in this plan and conducted at FUD sites will operate within the established Health and Safety Plan (H-S plan) for that site. Specific safety concerns detailed in this plan address the sampling activity itself with the site specific H-S plan taking precedence over all other safety aspects developed as part of this plan. In view of this, only cursory detail is required for the health and safety aspects in this plan. The detail provided here is intended to append to the site specific health and safety plan for the site under study.

Based on previous health and safety monitoring at FUD sites, sampling activity will be performed using limited personal protective equipment. Most activity can be conducted using level D protection with the addition of latex or nitrile gloves (to prevent sample contamination) and Safety Glasses. Additional guidance on health and safety precautions is provided in the specific site health and safety plan (SSHP) for the site under study.

SAFETY: The primary goal of the remediation action is to reduce the potential risk to the public that may occur due to the presence of unexploded ordnance or explosive waste. Therefore the site workers and the public must be protected and/or restricted from access to the site as appropriate. All activity related to UXO handling and destruction takes priority over the ancillary sampling activity.

5.3 Field Documentation

Field log book:

All field notes for sampling activities should be recorded in a bound field log book dedicated to the sampling activity. During each day of sampling all occurrences and activity should be recorded. The logbook should provide a record of all events of the day that relate to the sampling activities. All entries into the logbook must be recorded in ink. If corrections are required, the incorrect entry will be lined through with a single line, and the corrected entry written in. As a minimum the following information should be recorded:

Current date
Weather conditions
Sampling team members
Visual condition of the sampling area
Description and deviations from the sampling plan
Brief description of activities around the sampling area
Maps and sketches of the sampling area
Observations that may influence sampling activity

Sampling Log Form

In addition to the field log book a sample log form should be completed for each sample taken. A copy of this log form is included in Appendix B. These forms will be maintained for future reference. The following information is recorded on the sample log form:

Sample ID, date, time weather conditions

Description of the material sampled (water, soil, munitions, residue)

Sampling area and location

Relative time of sampling: (pre or post detonation sequence)

Expectations of sampling

Sampling technique used

Material sampled

Number and type containers filed according to Appendix B

5.4 Standard Sampling Procedures :

Standard sampling procedures consist of the following tasks:

Collection site preparation

Removal of undesirable loose materials by sweeping and segregation (rocks, sticks and leaves)

Collection of samples and filling of containers, marking containers

Field QA/QC activities, photos if necessary

Sample labels and chain of custody documentation

Decontamination of sampling equipment as necessary

Cleanup and removal of any collection materials

Sample handling and shipment

5.4.1 Collection Site Preparation

Fallout samples will be collected at surface level with metal pans at set intervals from ground zero. Sample areas will be cleared to virgin soil to receive these pans and provide access to the soil for pre- OB/OD soil sampling (background samples). These sites will be selected as close to detonation time as is allowed by the safety officer taking into account the prevailing wind direction and to insure pan cleanliness. Locations will be marked on a map of the OB/OD area to approximate scale.

Standing water area(s) within 200 to 300 meters of ground zero will have any leaves and debris moved to provide a clear surface on which fallout will be deposited.

Stakes marking area where pre-test and post-test samples have been taken will be driven within 2 inches of the surface and spray painted a bright color for ease of later re-location. Landmarks and any possible measurements which will aide in locating the

approximate location of the markers will be entered into the map of the test area and in the OB/OD Field Logbook.

To aid in subsequent analysis of dust cloud dynamics, video of the dust cloud will be used to aid in the subsequent analysis. For reference, stakes with flagging easily visible will be placed at 100 meter intervals along the anticipated fallout collection area. Two cameras will be located (1) as close as safety allows and (2) at a distance which allows for the capture of the entire dust cloud in each frame.

Figure 5.2 shows the anticipated geometry of the sample collection sites and reference markers. A second ring (three if NEW is large: > 2000 kg) can be added with pans spaced 90^{o} apart.

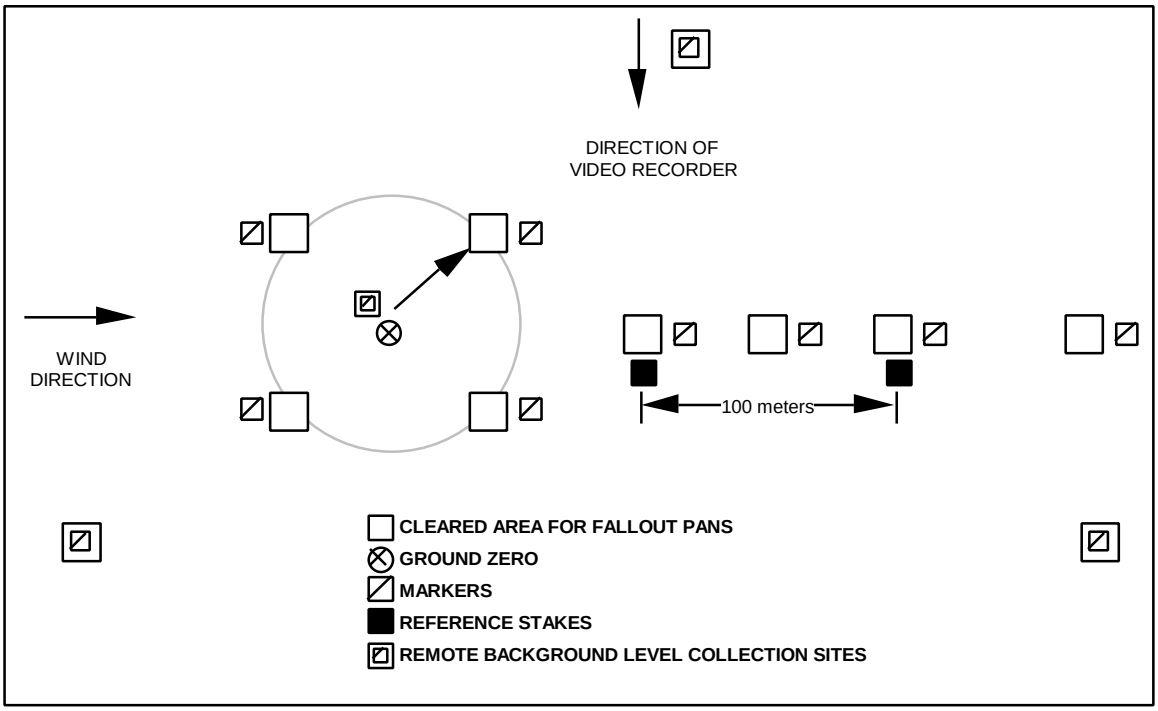

Figure 5.2 Layout of Collection Sites and Markers

5.4.2 Sample Collection

Sample collection includes standard procedures to retrieve samples as conditions and resources warrant. Proper handling of samples and preservatives is required. The collection methods should remain consistent for each sampling event and sample taken. Note that sampling parameters and schedules may change between sampling points therefore the sampling schedule Appendix C, Table C.1 should be checked prior to each sampling event. Refer to Appendix C for a listing of container types, sizes and preservatives for each media sampled.

5.4.2.1 Background

At the locations chosen in 5.4.1 initial soil samples are collected from the top 1 to 2 inches of soil with a shovel. Using a clean spoon, a smaller amount is selected and poured into a clean container using a paper funnel. Spoon and funnel are disposed of and a clean one used for each sample. A sample will be taken at ground zero prior to any detonation. Where a water sample is to be collected, the bottle is immersed until full, removed and then capped.

Excess samples are to be collected to insure backups are available should anomalies in the Assay occur. Correction of anomalies may require additional samples to resolve.

5.4.2.2 Ejecta

Upon given clearance by the safety officer/personnel, core samples will be taken of the ejecta material at the edge of the crater and (if allowed) within the crater). Depth will be determined based on eject thickness calculations prior to the explosion. A clear tube will be inserted into the soil for collection of each sample. The material collected will be ejected onto clean paper and a spoon used to collect the final sample which is put into a clean collection bottle through a clean paper funnel. Spoon and funnel are discarded after each use.

Excess samples are to be collected for reasons as stated in 5.4.2.1.

5.4.2.3 Fallout

Material which is deposited in each collection pan is collected as follows:

(a)a clean brush is used to sweep all material in a pan to one end.

(b)this material is then brushed into a bottle using a paper funnel.

(c)paper funnel is discarded - brush is saved for later decontamination.

Should insufficient sample material result from one detonation the collected material will be consolidated, the pans must be cleaned in accordance with 5.10, dried and stored in a clean area until ready for emplacement for the next or subsequent shot. Brushes are cleaned and dried at the same time and returned to a clean storage bag.

5.4.2.4 Surface Water

Preservatives may be required in water samples for analysis of metals and other tests. Water samples will be collected using clean glass sample retrieval containers. In most cases containers will be provided from the laboratory with preservatives already in them. If the sample containers are filled directly from the water source, preservatives should be added after the container is filled.

5.4.2.5 Soils and Explosive Residues

Soil and residue samples will be collected with clean shovels and placed in the containers with spoons and disposable paper funnels.

5.5 Field QA/QC

The QA/QC samples are collected in the field to assess the quality of the sampling activities and laboratory analysis. These QA/QC samples consist of the following:

Trip Blanks

Matrix spike and Matrix spike duplicates

Rinsate samples and

Duplicate samples

5.5.1 Trip Blanks:

Trip blanks are used to determine if contaminants are introduced to the field samples during the sample handling, storage and transportation. This sample is prepared by the laboratory and transported and stored with the routine samples. The trip blank is not opened in the field but is subjected to the same handling and shipping procedures as the normal samples.

5.5.2 Matrix Spike and Matrix Spike Duplicates:

Matrix spike (MS) and Matrix spike duplicate (MSD) samples are used to determine if the matrix affects the analytical process. These samples should be taken from areas that are known to contain contamination. One MS and MSD each should be taken for each analytical method and for every 20 samples. The MS and MSD samples will be marked as such on the containers.

5.5.3 Rinsate Samples:

Rinsate samples are taken to determine if the sampling equipment is causing contamination in the samples. This sample is taken by pouring clean (contaminant free) de ionized or reagent grade water (provided by the laboratory) over the sample retrieval equipment. This rinsing will be done once for every 20 samples taken and for each analysis method.

5.5.4 Duplicate Samples:

Duplicate samples are taken to provide a measure of method variability (imprecision) in both the sampling and analytical procedures. For water samples, this will be done by emptying the contents of the retrieval container into two sample containers, and alternating between the two while filling. The duplicates will be labeled the same as other samples so the lab will not be able to identify which samples are duplicates. Soil and residue samples will be done in the same way, however to avoid stratification the material should be homogenized before being placed into the two

containers. Duplicate samples will be done once for every 20 samples taken and for each analysis method.

5.6 Sample Labels and Chain of Custody Documentation

Sample documentation includes the correct use of labels and chain of custody records. Both labels, seals and the chain of custody forms will be provided by the laboratory along with the sample containers.

5.6.1 Labels:

Sampling personnel must affix a label to each sample container with the unique sample number marked in ink. This sample number will be date and time encoded. (i.e. if sample was taken at 1:35 on July 4, 1995 the sample number would be: 9507041335). In addition the preservative and analysis method and sample personnel will be noted. The labels should then be covered with clear tape to prevent tampering and insure they are affixed and legible after they have been immersed and refrigerated.

5.6.2 Chain of Custody Seals:

All samples will have a chain of custody seal placed over the lid of each container. The seal will be placed in such a way that it must be broken to remove the lid.

5.6.3 Chain of Custody (COC) Records:

This Chain of Custody (COC) record documents the possession and handling of individual samples form the time of field collection to the laboratory submittal. This record must include the following information:

Sample number

Type of sample

Signature of sampler

Requested analysis

Type of container and preservative used.

A copy of the chain of custody record is presented in Appendix B. A copy of the COC record must be retained by the sampler prior to shipment. Shipping receipts used by the courier service (i.e.: Federal Express) will suffice as evidence of custody and tracking between the sampler and courier and the courier and laboratory receipt.

5.7 Sample Handling and Shipment

After sample containers are filled, marked and labeled they must be placed in an ice chest and cooled to 4 degrees C. Ice should be place in double plastic bags and placed on the containers. Packing materials will be used to separate the containers.

At the end of each day of sampling all samples must be packed on ice with packing material. Ice chests used for transporting samples will be supplied by the laboratory and must be durable and waterproof. Packing materials will be used to fill void

spaces. Containers should be upright, with ice in plastic on top and more packing material placed over the ice. COC forms should be placed in Ziplock bags and affixed to the lid of the chest. The top should then be sealed with tape around all sides. The drain should also be taped shut. Shipping labels should be affixed to the top. Labels indicating this side up and fragile should also be placed on the outside of the chest.

The ice chests will be delivered to the analytical laboratory via overnight delivery service at the minimum of every 2 days or once per week. Samples shipped on Friday should be picked up or delivered to the laboratory on Saturday.

5.8 Decontamination Procedures for Sampling Equipment

In most cases only limited amounts of contamination is expected on the sampling equipment. This contamination will consist of limited soil and dirt attached to the sampling equipment. All equipment used in sampling must be cleaned before and after usage to guard against cross contamination of samples. These items must be cleaned as appropriate with the following sequence:

scrub equipment with alconox detergent in potable water.

rinse with potable water

rinse with reagent grade or deionized water

allow to air dry

Rinse water from the decontamination of the sampling equipment is considered to be relatively uncontaminated. This water can be disposed of on the ground near the sampling area.

5.9 Sampling Area Descriptions

This section provides information pertaining to a generic sampling area. When the sites are defined this generic sampling plan will be modified to accommodate the specific site conditions and sampling program. A typical site will have two distinct sampling events occur, one before and one after the detonation activity. This is detailed in the following two sections:

5.10 Pre Detonation Sampling (Background Samples):

Baseline samples may be required to establish the background site conditions prior to detonation. Samples considered "uncontaminated" will be taken as necessary of existing soils and water in the general area of the detonation. In some instances sites may contain UXO washout materials, or other environmental contamination due to historical uses. Regardless of the previous uses that have caused environmental contamination, it is necessary to establish current pre-detonation conditions as a baseline. This will be done by sampling the following areas:

detonation site
fall out area
surface water (if any)
ground water (if well(s) is/are available)

During pre detonation sampling, one or more of the four site area conditions may exist :

5.10.1 Unaffected Background Samples: Some areas of a site may not have been affected by ordnance use. These areas will be sampled to provide baseline conditions and provide information on the "pristine" condition of an unaffected area. This information will be compared against other samples to determine the relative condition of each area.

5.10.2 Historical Contamination: In most cases sites have known ordnance use that has occurred in the past. Sampling will be done to provide "quick look" screening and determine to what degree historical ordnance use has caused contamination at the site.

5.10.3 Surface Water, Pre Detonation: Surface water (if any) may be sampled to determine if explosives residues have caused contamination and are already present before planned detonation activity occurs.

5.10.4 Ground Water Historical Contamination: If available, water from local wells will be sampled to determine if explosives use in the area has induced contamination to reach and contaminate ground water. No post detonation sampling of ground water is anticipated since the sampling visit will not be of sufficient duration to allow contamination to reach ground water wells.

5.11 Post Detonation Sampling

The intent of post detonation sampling is to monitor contamination induced by the current open detonation activity. A comparison of pre and post sample conditions should reveal this net change. Although the media sampled for both events is similar, the post detonation affected area will be apparent by observing disturbed soils and debris. During post detonation sampling, one or more of the four site area conditions may exist :

5.11.1 Ejecta: After an explosion, a mass of soil will be thrown a short distance and land near the crater. This soil can be sampled for explosive byproducts analysis.

5.11.2 Crater Debris: After an explosion some material will be compacted into the bottom and sides of the crater. Samples will be taken from these areas at a depth interval of 0-6 inches, the sample will be analyzed for metals and explosives byproducts.

5.11.3 Fallout Collection: Considerable airborne dust is generated during detonations. This dust will eventually return to the ground as fallout. If sufficient quantities can be collected for a sample, detonation byproducts in these materials will be analyzed.

5.11.4 Surface Water: Surface water will be sampled after detonation to determine if explosives residues were caused by fallout from the detonation activity.

5.12 Contaminated Soils Near UXO Washout

Some UXO may be lying on the ground. After the item has been removed, soil from this site may be sampled and analyzed for explosives residues that may have washed out .

5.13 UXO and Munitions Debris

Historical UXO may be left on the site in a broken and leaking condition. If necessary the munitions debris may be sampled and analyzed for explosives residues to determine if natural conditions over time has degraded the chemical makeup of the explosives material.

5.14 Air Sampling

Sampling of airborne byproducts resulting from explosive detonations are both hard to capture because of rapid dispersal and hard to characterize and use as representative. Experiments done by others describe and through reliable methods have already characterized, these detonation byproducts. The sampling of air contaminants in explosives clouds is not feasible in this study, however the work done by others will be evaluated to determine what contamination is being sent into the air during detonation activity. The fate of these contaminants will be evaluated to determine what, if anything, should be done to understand the consequences of airborne releases from open burning and open detonation activity.

5.15 Follow-up Sampling

Sites that have the higher detected concentrations of explosives in the soil may be characterized in greater detail by others to determine the vertical and lateral extent of explosives contamination. Information gathered during this phase of the work may be utilized to develop cost-effective and regulatory acceptable remediation and/or disposal options. Follow up sampling will be the responsibility of others with specific tasking by the COE.