

US EPA ARCHIVE DOCUMENT

FINAL WORK PLAN

CRUSHED DRUM REMOVAL
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

MARCH 14, 2002

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

Harding ESE, Inc. has prepared this Work Plan for Textron Systems Corporation (TSC) to address crushed drum removal activities to be conducted at the J-3 Range, Camp Edwards Massachusetts (Figure 1-1). Harding ESE, under contract to TSC, completed an American Society for Testing and Materials (ASTM) Phase I Environmental Site Assessment (ESA) of the J-3 Range (Harding Lawson Associates, 2000) which identified the crushed drums for removal. The relevant site history of the Massachusetts Military Reservation (MMR) and the J-3 Range is set out in the Administrative Order, into which this Work Plan has been incorporated.

Beginning in 1979, process water was generated from the melting and pouring of explosives into test munitions at the Melt-Pour Building. Water was also generated by the cleaning of the work bays after each group of munitions (maximum of six) was cast. In the mid- to late 1980's, the process water was pumped from a 1,500-gallon storage tank located immediately adjacent to the Melt-Pour Building and stored in 55-gallon drums. This process wastewater was released at the J-1 Range in the late 1980's, as reported by TSC. In association with this reported release, other contractors prior to TSC, are also believed to have had releases occur in the similar vicinity of the 1000m target berm.

The drums previously containing the process water were subsequently flattened and disposed of as metal scrap in the Debris Area to the northeast of the warhead firing range on J-3 Range. The crushed drums were reportedly stacked on grade approximately four feet high and covered with several feet of soil. The disposal area for the crushed drums is estimated to be approximately 15 feet square and approximately 5 feet thick above grade. Figure 1-2 identifies the approximate location of these crushed drums.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

TSC, Harding ESE, USA Environmental, and Onyx Environmental will be involved in the drum removal activities. TSC will act as general contractor for the drum removal activities. Harding ESE will collect confirmatory and disposal characterization samples from soil, liquid (if encountered) and the crushed drums. MACTEC, a subcontractor to Harding ESE, will be responsible for conducting a radiation screening survey of the exposed drum area. USA Environmental will provide UXO construction support and conduct excavation activities using a backhoe. Onyx Environmental will be responsible for the identification of a disposal facility and handling of the soil and crushed drums generated during the removal activities.

2.1 PROJECT STAFFING AND RESPONSIBILITIES

The Harding ESE project staff includes:

Project Manager: David Heislein	Technical Review: David Heislein/Robert Nicoloro
Task Manager: Lindi Higgins	Field Operations Leader: Andrew Sutton
Health & Safety Manager: Cynthia Sundquist	Quality Assurance Coordinator: Dr. Willard Murray
Data Validation/Laboratory Services Coordinator: Kelly Ainsworth	Task Health and Safety Officer: Andrew Sutton

The key roles for Harding ESE personnel are discussed in the following Subsections.

2.1.1 Task Manager

The Task Manager is Ms. Lindi Higgins. She is responsible for evaluating the appropriateness and adequacy of the technical services provided for the task, and for developing the technical approaches and levels of effort required to address each task. Ms. Higgins is also responsible for the day-to-day conduct of work for this activity, including integration of input from supporting disciplines and management of subcontractors. The Task Manager will review the on-going quality control (QC) during the performance of work, the technical integrity of conclusions and recommendations, and the clarity and usefulness of all task work products. Specific responsibilities of the Task Manager include the following activities:

- responsibility for the sampling, disposal characterization, and radiological screening tasks;
- initiating project activities;
- participating in work plan preparation and staff assignments;
- identifying and fulfilling equipment and other resource requirements;
- monitoring task activities to ensure compliance with established budget, schedules, and scope of work; and
- interacting regularly with Project Manager, TSC, and others (as appropriate) regarding task status.

2.1.2 Technical Review Committee

David Heislein and Robert Nicoloro comprise the Technical Review Committee for the project, with Mr. Heislein as the lead reviewer. Both Mr. Heislein and Mr. Nicoloro will provide guidance and oversight on the technical aspects of the project associated with sampling environmental media, and providing technical review of all project deliverables. They will also assist the Task Manager by reviewing technical aspects of the project to ensure that services are consistent with the Consent Order, USEPA Docket No. SDWA 01-2002-0009, between TSC and USEPA. Their primary function is to ensure the application of technically sound methodologies and the development of defensible data, interpretations, and conclusions.

2.1.3 Health and Safety Manager

Cynthia Sundquist, Certified Industrial Hygienist (CIH) and Certified Safety Professional (CSP), is Harding ESE's Health and Safety Manager. She, along with the site Task Health and Safety Officer (HSO), Andrew Sutton, will be responsible for the performance of the site-specific health and safety procedures necessary for protecting field personnel from potential chemical hazards, for conducting health and safety briefings in the field for all personnel, and for tracking health and safety related activities. USA Environmental will be responsible for all UXO related site safety activities and MACTEC will be responsible for the radiation screening activities.

2.1.4 Field Operations Leader

Andrew Sutton is the Project Geologist and Field Operations Leader (FOL), and will be responsible for organizing, scheduling, and implementing all field activities. He has participated in the preparation of the project plans to date, and will assist TSC in overseeing field activities and suggest to TSC directions for subcontractors' work at the site. Mr. Sutton will be in frequent communication with the Task and Project Managers, and will make recommendations for any additional activities, if warranted. He will also be responsible for the maintenance of field records and documentation through the completion of sample collection activities.

2.1.5 Data Validation Manager/Laboratory Services Coordinator

Kelly Ainsworth will serve as Data Validation Manager/Laboratory Services Coordinator (LSC), and be responsible for coordinating with the subcontracted laboratory. Ms. Ainsworth will interact with the laboratory contacts, Project Manager, and FOL to ensure that sample delivery and analyses will be completed appropriately and in a timely fashion. She will be responsible for maintenance of the field records and sampling documentation once the field program is completed, and will report any problems to the FOL and Project Manager. Ms. Ainsworth will also be responsible for coordination of the data management and validation activities, which will be performed by Harding ESE.

2.2 LABORATORY ANALYTICAL SERVICES

Harding ESE has established a subcontract agreement with STL Laboratories (Colchester, VT) to provide chemical analytical services for the project. Table 3-4 shows the detection limits that the contract

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laboratory will be required to meet.

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3.0 FIELD ACTIVITIES

3.1 SCOPE AND OBJECTIVES

Harding ESE, under contract to TSC, has completed an ASTM Phase I ESA of the J-3 Ranges to support the site closure of J-3 Range. The Phase I ESA identified empty crushed drums in the J-3 Range as an area of concern. The objective of this task is to remove empty drums from the debris area in the J-3 Range.

Based on the findings of the ASTM Phase I ESA, the sampling activities which will be undertaken as part of the crushed drum removal activities will include:

- Stockpile soil from within and around the crushed drums and collect one composite soil sample for disposal characterization purposes.
- Consolidate residual liquid, if any, from within the drums into a new 55-gallon drum, and collect one sample for characterization and disposal.
- Conduct wipe sampling from twenty percent of the crushed drums (approximately 5 drums) to characterize the drums for disposal.
- Collect four grab surface soil samples at the former location of the crushed drums to evaluate the area for the presence of residual explosives.
- Conduct radiological screening of the area exposed following the drum removal.

The proposed work areas and surface soil sampling locations are shown on Figure 3-1. Field activities conducted by Harding ESE will be performed in conformance with a Site Safety and Health Plan developed for the execution this work (provided under separate cover).

3.2 EQUIPMENT AND SUPPLIES

The equipment and supplies required to support Harding ESE's field activities are listed in Tables 3-1 and 3-2. Table 3-1 presents a summary of the non-expendable equipment necessary for environmental monitoring, multi-media sampling, health and safety monitoring, equipment and personal decontamination, and general field operations. Table 3-2 summarizes the expendable supplies required for the field investigation. Equipment handling, maintenance, and calibration procedures for environmental monitoring instruments are summarized in the following paragraphs:

- Field equipment providing measurements of a chemical or physical parameter will have approved manufacturer's instructions for operation, calibration, and maintenance with them at the field staging location. Updates and/or revised instructions will be provided to field personnel with the instruments and will also be maintained at Harding ESE's Portland, Maine Field Operations Support office.
- Field instruments that have physical or chemical standards appropriate for the accurate operation of the equipment will be calibrated on a routine basis to verify the accuracy of the measurements for each instrument. Physical or chemical standards will be traceable to a known, recognized standard.

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Standards will be documented as to origin, date of receipt, and date of expiration if applicable. This information will be recorded and maintained at the field staging location.

- Field instruments will be inspected and calibrated daily. Field personnel will document the findings of the calibration event on a Calibration Data Sheet (Figure 3-2).

Equipment not in compliance with its calibration criteria will be removed from use until it is repaired. If prior measurements made by the instrument are in question, they will be reported to the Task Manager through the FOL and recorded in the daily log.

3.3 MOBILIZATION

Harding ESE field team and subcontractor personnel meetings will be held prior to implementation of fieldwork. Meetings will focus on project health and safety requirements, including the Harding ESE policies and procedures to be followed. Harding ESE and appropriate personnel will attend an unexploded ordnance (UXO) briefing at Range Control, Camp Edwards, MA prior to mobilizing to the J-3 Range. UXO briefings will also be conducted by USA Environmental at the beginning of every day prior to conducting any fieldwork at the J-3 Range.

3.4 UXO SCREENING

UXO screening will be performed by USA Environmental for each work area, material storage area and access way, not previously screened or otherwise documented as safe for passage. The crushed drum removal area will be cleared at one-foot depth intervals in advance of the heavy equipment, to a depth of approximately 1-2 feet beneath the last layer of crushed drums. Suspected UXO will be flagged and work areas adjusted accordingly.

To our knowledge, the 105mm round is assumed to be the most probable munition (MPM) that will be found on J-3 Range. According to USACE guidance, the minimum separation distance (MSD) for the 105mm munition is 1,939 feet. This MSD will be used for drum removal operations unless directed otherwise by the NGB or USACE to a shorter MSD.

The equipment requirements for this activity will be provided by the UXO contractor, USA Environmental, and will include:

- Schonstedt magnetometers and other equipment that will be used to detect subsurface metallic anomalies;
- Miscellaneous common hand tools; and
- Pin flags listed below:

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<u>Color</u>	<u>Used to Mark</u>
<i>Red Pin Flag</i>	<i>Danger, identified UXO, special precaution required</i>
<i>Yellow Pin Flag</i>	<i>Caution, suspect UXO, unidentified subsurface anomalies</i>
<i>Blue Pin Flag</i>	<i>Ordnance/scrap and other items containing no explosive</i>
<i>White Pin Flag</i>	<i>Boundary or temporary marker</i>

Table 1: Color Code for Pin Flags

Adjacent to each work area, the UXO Technician III will establish temporary scrap metal and non-hazardous ordnance explosives (OE) scrap collection points. During operations, scrap metal and OE items that are free of explosive contamination (i.e., fragments, parachutes, etc.) will be placed at these collection points. Upon completion of operations, the materials in these temporary collection points will be transferred to a 10 cubic yard covered roll-off container for disposal by Onyx Environmental, under contract to TSC. As the material is being loaded, the UXO Technician III and UXO Technician II will perform a second inspection of the materials to ensure it is free of explosives and other hazardous materials. At the completion of operations, USA Environmental will turn all recovered scrap over to TSC for disposal coordination.

3.5 CRUSHED DRUM REMOVAL ACTIVITIES

Harding ESE will provide coordination with the NGB, USACE, AMEC, USEPA and the Massachusetts Department of Environmental Protection (MADEP). Harding ESE will also conduct the sampling of the stockpiled soil, residual liquid from within the drums (if any), crushed drums and surface soil sampling, and coordination of investigation-derived-waste (IDW) characterization and disposal. USA Environmental will conduct UXO construction support in the drum area as well as excavation and removal of the drums and surrounding soil. USA Environmental will define the EZ in the field prior to the initiation of any intrusive work. MACTEC, a subcontractor to Harding ESE, will conduct the radiological screening of the exposed drum area.

Harding ESE, USA Environmental, Onyx Environmental (Onyx), and TSC will participate in the crushed drum removal activities. Harding ESE will conduct confirmatory and characterization sampling following the excavation and removal of the estimated 27 55-gallon drums at the J-3 Range. The drums were reportedly crushed and covered by an earthen mound on the J-3 Range after being emptied. The excavation will be conducted by USA Environmental, the UXO contractor, using a backhoe. The drums will be excavated and temporarily stored on site pending disposal characterization. Surface soil from below the drums will be sampled at four locations to evaluate the presence of residual explosives and Phase I Analytes (sampling program shown in Table 3-3, Phase I Analytes shown in Table 3-4). Wipe samples will be collected from the drums for explosives, and a sample will be collected from stockpiled soil for disposal characterization (disposal characterization analytes listed in Table 3-5). Onyx will coordinate the final disposal of the drums and stockpiled soil from around the drums based on characterization data obtained by Harding ESE.

The technical approach is summarized below. The sampling and analytical program is summarized in

Table 3-3, and the approximate locations of the work areas are shown on Figure 3-1.

3.5.1 Soil Removal and Management Methods

The western face of the earthen berm where the crushed drums are located will be removed to expose the drums. The unimpacted topsoil will be removed and stockpiled separately for reuse.

USA Environmental will provide a two-man UXO team and a backhoe with operator to excavate the location of the drums following UXO screening. During intrusive operations USA Environmental will maintain an EZ in accordance with Department of Defense (DOD) 6055.9-STD or NGB/USACE designated MPM distances. Non-essential personnel will not be allowed in the exclusion zone (EZ) during intrusive operations.

The drum area will be investigated and excavated in 1-foot lifts. The UXO team will survey the existing mound of soil with Schonstedt magnetometers to locate near surface (within one foot) metallic anomalies. The surface and subsurface metallic items will be removed to a depth of 1-foot by construction equipment and by hand, as necessary. The backhoe will then remove the first foot of overburden and place it on plastic ground cover. The initial topsoil will be segregated in a separate pile assuming it is clean of UXO and residual explosives. This procedure will continue until the drums are encountered.

Excavation activities will continue until the lowest grade at which the crushed drums are located, or the surrounding grade surface, has been reached. Confirmatory soil samples will be collected from the lowest grade at which the crushed drums are located.

Soil from around and within the crushed drums will be removed and stockpiled separately in a lined 20 cubic yard roll-off container for subsequent analysis and disposal.

If UXO is found during this drum removal, USA Environmental will stop work and conform with their work plan dated September 4, 2001 and applicable MMR UXO procedures.

Heavy equipment utilized onsite will be operated in accordance with the applicable Occupational Safety and Health Act (OSHA) regulations found in 29 Code of Federal Regulations (CFR) 1910, 29 CFR 1926, the requirements of EM 285-1-1, Section 16 and the guidelines listed below:

- The operation of heavy equipment will be limited to authorized personnel specifically trained in its operation;
- The operator will visually inspect heavy equipment daily prior to operation, and report any abnormalities/deficiencies to the UXO Technician III;
- The operator will use the safety devices provided with the equipment, including seat belts, and backup warning indicators and horns will be operable at all times;
- While in operation, all personnel not directly required in the area will keep a safe distance from the equipment;
- The operator's cab will be kept free of all non-essential items and all loose items will be secured;

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- Personnel will avoid moving into the path of operating equipment and areas blinded from the operator's vision will be avoided;
- When heavy equipment must negotiate in tight quarters, or if operators of earth moving equipment cannot see the bucket, a secondary person will be stationed to guide the operator;
- Additional riders will not be allowed on equipment unless it is specifically designed for that purpose (i.e., there is an additional seat with a seat belt).

In order to remove all of the crushed drums, it may be necessary to excavate below the surrounding grade. Excavation below grade will not be undertaken without express authorization from TSC. If excavation below the surrounding grade is required, these excavation activities will be conducted in accordance with EM 385-1-1, Section 25, Subpart P of 29 CFR 1926, and the USA Environmental Safety and Health Program (SHP). The guidelines below are intended to reflect minimum requirements to be followed on this site.

- Prior to initiation of any excavation activity, the location of underground installations will be determined if applicable;
- Excavations will be sloped between 30° and 34° for Class C soil which has been impacted by munitions disposal activities;
- The excavation(s) will be inspected daily by a competent person prior to commencement of work activities;
- Evidence of cave-ins, slides, sloughing, or surface cracks will be cause for work to cease until necessary precautions are taken to safeguard workers;
- Excavations 5 ft. or deeper, which cannot be sloped will require a registered civil engineer or soils specialist, to design and install a protective system;
- No personnel will be allowed to enter an excavation in excess of 5 feet when detonation of OE is in progress in the vicinity of the excavation;
- Protective systems shall be selected from OSHA 29 CFR 1926 Subpart P and/or designed by a registered professional civil engineer;
- Spoils and other materials will be placed 2 ft. or more from the edge of the excavation;
- Materials used for sheeting, shoring, or bracing will be in good condition;
- Timbers will be sound, free of large or loose knots, and of appropriate dimensions for the excavation;
- Safe access will be provided into the excavation(s) by means of a gradually sloped personnel access/egress ramp;
- Excavations 4 ft. or more in depth will have a means of egress at a frequency such that lateral travel to the egress point does not exceed 25 ft.

3.5.2 Crushed Drum Removal Activities

Once the drums are fully exposed, they will be removed by the backhoe and with hand tools by the UXO personnel, as necessary. Prior to removal, the crushed drums will be inspected for liquid content. If liquids are found, the drum will be placed on a separate poly sheet and the liquid will be consolidated into a single new drum for off-site disposal. The crushed drums will then be placed on plastic sheeting with the stockpiled soil from around the drums and brushed with brooms, brushes, etc., to remove residual soil prior to placing the crushed drums in a lined roll-off container.

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3.5.3 Radiological Screening Methods

Following the removal of the crushed drums and associated soil, radiological screening of the exposed soil surface and, to the extent practical, the interior and exterior surfaces of the crushed drums, will be conducted by a MACTEC health physicist and Harding ESE personnel. This radiological screening is not associated with the drum removal operation but rather the protocol established by USEPA for various portions of MMR. The drum removal activity provides an opportunity for USEPA to collect radiological data at this location.

This radiological scanning will be conducted using a 2" by 2" sodium iodide (NaI) detector and rate meter near the ground surface. This instrument measures gamma radiation and is capable of detecting the gamma signal present in aged (>20 year old) depleted uranium if it is present in significant quantities¹. Following completion of the gamma screening, additional screening will be conducted using a beta-gamma detector and at the ground surface. This instrument measures beta and gamma radiation.

According to specifications established by the USEPA for this scanning measurement activity, the sentinel criterion is an observed count rate in excess of twice the established background count rate for the site. If such a location is identified:

- It will be marked with a visual indicator (e.g., stake, pin flag);
- The areal extent will be demarcated (e.g., with line locator paint);
- If a count rate in excess of twice the established background rate is observed while scanning a crushed drum, the location will be scanned using an alpha detector; and
- If the count rate in excess of twice the established background rate is observed while scanning the exposed soil surface, a confirmatory soil sample will be collected from the identified location of that measurement.

Confirmatory soil samples from areas exceeding twice background will be submitted for laboratory analysis by gamma spectroscopy (with analytical emphasis on uranium series radionuclides). Following gamma analysis, an aliquot of the sample will be analyzed by alpha spectroscopy in order to determine the concentrations of uranium (U-234, U-235, and U-238) and thorium (Th-230 and Th-232) isotopes. Isotopic information will be used to evaluate whether the elevated gamma measurement is due to the presence of DU².

No data analysis or data reports for scanning surveys are to be generated for this scope of work other than maps indicating the areas scanned, and areas, if found, where scanning survey results exceed the two-times background criterion. The locations of soil samples collected for laboratory analysis will be

¹ The quantity of depleted uranium that is judged "significant" has not been specified. However, if depleted uranium rounds have in fact been test fired on the site, amounts of depleted uranium necessary to result in a detectable radiation signal should be present at least in localized areas.

² The USEPA has not provided any specifications for confirmatory sampling or for data quality objectives associated with laboratory analytical measurements.

indicated, and copies of the laboratory analytical report will be provided.

3.5.4 Surface Soil Sample Collection Methods

Once the soils from below the drums are exposed and radiological screening completed, soil samples will be collected and characterized in accordance with the procedures described in this section. These soil samples will be collected from the lowest grade at which the crushed drums were present prior to removal. Harding ESE anticipates that a total of four grab soil samples will be collected from below the drums for laboratory analysis of Phase I Analytes (Figure 3-1).

Grab soil samples will be collected using a stainless steel spatula. Samples will be made up of material gathered from the top six inches of exposed soil. Soil textures, other visual observations, odors, and photoionization detector (PID) meter readings will be recorded for each sample. To minimize the potential for cross-contamination, sampling equipment will not be reused. The sample material will be observed and documented using procedures outlined as follows:

1. Scan the soil with a PID and record the reading. Note the physical characteristics of the soil, including soil classification nomenclature, color, particle size, moisture content, and staining or odors (if present).
2. For samples that are to be submitted for off-site analysis, place the sample soil in the laboratory containers, using a clean stainless steel spatula.
3. The sampling spatula will be placed in the roll-off container with the crushed drums, and disposed of appropriately. Spatulas will not be reused.
4. Soil sampling data will be recorded in the field logbook.

3.5.5 IDW Sampling and Disposal

Harding ESE will collect one sample from the drummed liquid (if any), and one composite sample from stockpiled soil from within and adjacent to the drums for disposal characterization. If visual soil contamination is identified by Harding ESE, the composite soil sample will include this material within the composite. Wipe samples will be collected from 20-percent of the drums (approximately five drums) for explosives analysis.

The sample material will be observed and documented using procedures outlined as follows:

1. Note the physical characteristics of the material including color, staining, or odors (if present).
2. For samples that are to be submitted for off-site analysis, place the soil, liquid, or wipe sample soil in the laboratory-supplied pre-cleaned containers.
3. Stainless steel sampling equipment will be placed in the roll-off container with the crushed drums for offsite disposal.

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Analytical methods will consist of those shown on Tables 3-4 and 3-5. The analytical data will be used to determine the subsequent disposal for the excavated soil, liquid (if any) and crushed drums. Stockpiled soil from in and around the drums, liquid collected from within the drums (if any) and the crushed drums will be disposed offsite, based on these sample results. The drums will be disposed of off-base as scrap metal if sample results permit. The stockpiled soil may remain onsite pending analytical results.

3.5.6 Decontamination Methods

To minimize the potential for cross-contamination, sampling equipment will not be reused. Unused stainless steel bowls, spoons, and spatulas will be brought to the site with original wrapping intact and discarded following sample collection. Full sample containers will be wiped clean at the sample site, transferred to a clean carrier, and transported to the sample handling area.

Heavy equipment will be cleaned with a steam cleaner or pressure wash by UXO personnel.

Monitoring equipment will be protected contamination by draping, masking, or otherwise covering as much of the instrument as practical with plastic without hindering the operation of the unit. The PID may be placed in a clear plastic bag, keeping the sensor tip and discharge port clear, to allow reading of the scale and operation of the knobs.

Protective coverings that are used and stained will be drummed with other disposable protective materials as IDW. On a daily basis, any direct or obvious contamination on the instrument will be brushed or wiped with a disposable paper wipe. The units can then be wiped off as usual with damp disposable wipes, and dried. Monitoring equipment will be checked, calibrated, and recharged as necessary for the next day's operation, and will then be prepared with new protective coverings.

3.6 ANALYTICAL PROGRAM

Samples will be analyzed using USEPA SW-846 Methods (USEPA, 1996a), as well as CLP methods, as specified in Table 3-4. Explosive compounds analysis will be performed in accordance with USEPA Method 8330 and will include Photo Diode Array (PDA) confirmation of detected compounds. In addition, the standard USEPA Method 8330 parameter list will be modified to include the following: 2,6-diamino-4-nitrotoluene, 2,4-diamino-6-nitrotoluene, nitroglycerin, pentaerythritol tetranitrate, and ammonium 2,4,6-trinitrophenoxide/2,4,6-trinitrophenol. Table 3-3 provides a summary of the sampling and analysis plan (SAP). Analytical methods and reporting limits are summarized on Table 3-4 for Phase I analytes. Two quality assurance and quality control (QA/QC) wipe samples are anticipated due to the limited nature of the sampling program. One duplicate soil sample will be collected.

The sample containers proposed for use during the crushed drum removal activities include glass jars with Teflon[®]-lined lids. Sample bottles will be prepared in accordance with the procedures specified as USEPA Level I QA for sample containers. These procedures include washing according to USEPA protocols, QC analysis of washed containers, custody sealing of containers prior to shipment, and full documentation of QC analytical results.

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The bottles for the field program will be prepared and provided by Severn Trent Laboratories (STL) of Colchester, Vermont. Where preservatives are required, pre-preserved sample jars/bottles will be provided. A summary of specific containers, sample volume, preservation, and holding time requirements is provided, by analysis, in Table 3-6. Sample identification and tracking field procedures are described in Section 5.0.

3.7 DATA VALIDATION

3.7.1 Analytical Data Quality Objectives

Data quality objectives (DQOs) are quantitative or qualitative statements developed by the data user to specify the quality needed from a particular data collection activity to support specific decisions. The DQOs for this project are to provide analytical data of known quality and to be able to defend the quality of the data generated from the samples. The data from the analysis of field samples are to be used to characterize the material in terms of target compounds and physical characteristics.

Data quality is assessed in terms of accuracy, precision, detection limits, completeness, representativeness, and comparability, as discussed below. QC measures, objectives, and detection limits for analytical procedures that will be used for this project are presented in Table 3-4.

Accuracy is defined as the degree to which the analytical measurement reflects the true concentration level present. Accuracy will be measured by percent recovery for laboratory control samples (LCS) and matrix spikes as the primary criteria, and percent recovery of the surrogate spikes as a secondary QC criterion.

Precision is a measure of the agreement among individual measurements of the same parameter under similar conditions, expressed as relative percent difference (RPD). The RPD of all laboratory duplicates will be reported by the laboratory. Precision will be assessed by reviewing QC information from the matrix spikes, field duplicates, blank spike/blank spike duplicates (BS/BSD), and lab replicates.

Detection limits are defined as quantitation limit goals for each analyte. Quantitation limits establish a lower concentration value where accurate data should be obtained for the given method and target analyte. Quantitation limits are established based on instrument calibration curves and instrument or method detection limit (MDL) studies. (Procedures for determining detection limits are those given in 40 CFR CH.1 (7-1-85) Pt 136 App. B).

Completeness is a measure of the amount of valid data obtained from the analytical measurement system, expressed as a percentage of the number of valid measurements that should have been or were planned to be collected. The QA objective for this project is to obtain acceptable data for 90 percent of the samples collected. Completeness will be evaluated by comparing stated project objectives with the validated data results, and identifying shortfalls, if any, in needed information.

Representativeness is defined as the degree to which the data accurately and precisely represent the true environmental contamination existing at the site. Representativeness of samples will be achieved to the greatest degree possible by adhering to the procedures specified in this document. Representativeness is

also evaluated through collection and analysis of field duplicate samples, rinsate blanks, and trip blanks.

Comparability expresses the confidence with which one set of data can be compared with another. Quantitatively, comparability can be assessed in terms of the precision and accuracy of two sets of data. The use of standard analytical methods, standard reporting units and thorough documentation will achieve this objective.

3.7.2 Data Validation

Data validation will be completed by Harding ESE on all data generated at the contract laboratory, STL. Validation will be completed using USEPA Region I validation guidelines for Tier II and Tier III validation (USEPA, 1996b; USEPA, 1989). Tier III validation will be completed on 10 percent of the samples. Tier II validation will be completed on the remaining samples. For explosives data generated using USEPA Method 8330, the general processes outlined in the USEPA Region I guidelines will be followed with professional judgement used when evaluating Method 8330 analytical protocols and laboratory performance.

Hard copy data deliverables will be obtained from STL. The laboratory deliverable packages will contain forms summarizing sample results and associated raw data generated in support of the reported results. Results of the QC measurements including calibration data, laboratory control data, matrix spike/matrix spike duplicate data, surrogate recovery, laboratory duplicate summaries, associated QC blank summaries, and internal standard summaries will be provided on forms similar to the USEPA Contract Laboratory Program (CLP) reporting requirements summarizing QC measurements that are applicable to the USEPA SW846 method. Raw data will include copies of associated instrument printouts and laboratory notebook records that were generated during the sample preparation and analysis. The data validation process will include project chemist reviews of the following items:

- A. Review of chain-of-custody (COC) documents to verify sample identities.
- B. Review of sample log-in documents regarding problems with custody seals, container integrity, sample preservation, labeling, etc.
- C. Review of method blank data to determine the presence of any sources of contamination in the analytical process.
- D. Review of surrogate recovery data to assess extraction efficiency, effectiveness of sample introduction, and possible loss during cleanup activities. Surrogate recoveries will be compared to laboratory generated and project specified acceptance criteria to determine if they are within or outside of acceptable limits.
- E. Review of sample dates, extraction/digestion dates, and analysis dates.

Data qualifiers may be added to the final analytical results as indicators of data quality and usability. Data qualifiers will be added in accordance with USEPA Region I data validation guidelines for organic methods (USEPA, 1996b). Professional judgements may be made on the qualification of data.

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Professional judgements will be described on validation documentation records, and validation reports provided in the closure report prepared by Harding ESE.

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4.0 SAMPLE CHAIN OF CUSTODY/DOCUMENTATION

The following is a summary of the steps anticipated for recording and documenting the conditions of the field investigation and all pertinent data. Emphasis is placed on sample designation and documentation procedures that will be followed during sample collection to ensure that samples collected during the field program can be tracked. Field personnel involved in the investigation program will be trained and aware of these procedures prior to implementation of the field investigation.

Forms will be completed in permanent blue or black ink. Errors will be corrected by crossing out with a single line and dating and initialing the change. The use of correction fluid is not permissible. The field forms generated during the investigation will remain on site during the entire effort. Forms used will be kept organized in a central file maintained in the field vehicle until completion of the field program.

4.1 LOGBOOKS

Logbooks will be maintained throughout the field investigation. The site master log, field logbooks, and field equipment logbook are briefly described below.

4.1.1 Site Master Log

The site master log is the primary field investigation document to be maintained by the FOL. Its primary purpose is to contain, within one document, the actual field data or references to other field documents that contain a specific description of every activity that has occurred in the field on any given day. Any administrative occurrences, conditions, or activities that have affected the fieldwork also should be recorded.

4.1.2 Field Books

Separate field books, as necessary, are typically maintained by each field team responsible for sampling and support activities. However, because only one sampling team will operate at any given time on this project, the site master log will also serve as the field book. Field books will be sequentially numbered by the user and bound with a hard cover. Entries will be in permanent blue or black ink with changes initialed and dated. In general, these books will contain specific details supporting the tasks performed by the person maintaining the field logbook, including monitoring instrument readings. The following is a partial list of the types of information expected to be recorded in the field books or on supporting field data forms:

- name and title of author, date and time of entry, and physical/environmental conditions during the field activity;
- name and titles of field crew, including subcontractors;
- names and titles of all visitors;
- documentation of health and safety activities and UXO briefings;
- drum numbering system (each drum will be given sequential number) and horizontal and vertical location at which each was encountered;

- purpose of sampling activity;
- type of sampled media (i.e., soil, groundwater);
- sample collection method (i.e., grab or composite);
- number and volume of samples taken;
- description of sampling points and correlation with drum numbers;
- date and time of collection;
- sample identification numbers;
- references for all maps and photographs of the sampling sites;
- field observations;
- decontamination procedures;
- instrument calibration;
- Field measurements including the dimensions of excavation and crushed drum area, volume of clean topsoil, volumes of material in each stockpile, volume of liquids encountered, etc.; and
- Documentation of field conditions such as number of drums removed, burial configuration, drum number and burial depth, drums containing liquids, etc.

4.1.3 Field Equipment Notebook

The purpose of the field equipment notebook is to document the use, maintenance, and calibration of the field testing equipment. Equipment will be inspected and approved by the FOL before being used. A Calibration Data Sheet (Figure 3-2) will be maintained daily for all monitoring instruments used on site; the bound data sheets will comprise the Field Equipment Notebook. Information recorded on the data sheets or on separate pages in the notebook will include the following items:

- name and identifying number of the instrument;
- date calibrated;
- calibration points;
- identification of the calibrator;
- manufacturer;
- lot number of calibration standards;
- expiration date of calibration standards;
- results of the calibration;
- field maintenance; and
- problems encountered/resolution of problems.

4.2 PHOTOGRAPHS

Field personnel may take photographs during the field investigation to aid in documentation of field activities, site conditions, and/or sample characteristics. A written description of the photographs will be recorded in the field logbook. Developed and/or undeveloped film will be maintained in the project file. No motion pictures/videography are planned for this investigation.

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4.3 SAMPLE NUMBERING SYSTEM

Samples collected during the investigation will be identified using a 12-digit numbering system, as described below:

Digits 1 & 2	<u>Site Designation</u> J3 – J-3 Range
Digits 3 & 4	<u>Sample Type</u> SS - Surface Soil ST - stockpiled soil DL - drum liquid WP - Drum Wipe Sample ID - IDW Water Sample
Digits 5, 6	<u>Drum Number</u> – indicates the drum sampled (e.g., 02, 03).
Digits 7, 8	Used as <u>sampling event</u> numbers when more than one round of sampling is required. For example: 01 – indicates Round 1 02 – indicates Round 2
Digits 9, 10	<u>Modifiers</u> XX – Regular field sample XD – Duplicate sample (to contract laboratory) XS – Matrix Spike XM – Matrix Spike Duplicate

For example, a wipe sample collected from drum number 5, from 6 feet bgs during sampling round one, would have an identification number of:

J3WP0501XX

Samples collected for laboratory analysis will be handled according to Harding ESE's standard procedures outlined in this Section.

4.4 SAMPLE DOCUMENTATION

4.4.1 Sample Labels

Samples obtained at the site for off-site analysis will be placed in appropriate sample containers for shipment to the laboratory. Each sample bottle will be identified with a separate identification label. Labeling will be printed in indelible/waterproof ink. Entry errors will be crossed out with a single line, dated, and initialed. Each securely affixed label will include the following information:

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- project identification
- sample identification number
- sampling personnel
- preservatives added
- date and time of collection
- analytical method

4.4.2 Chain of Custody Records

COC will be maintained throughout the duration of sample collection, shipment, storage, and analysis, as a legal record of sample possession. Possession will be traceable by means of a COC Record (Figure 4-1), which remains with the samples at all times and bears the signatures of the persons responsible for possession of the samples. Procedures for maintaining appropriate sample custody information are presented in the following Subsections.

4.4.2.1 Sample Custody

Harding ESE has established a program of sample custody that is followed during sample handling activities from the field through laboratory operations. This program is designed to assure that each sample is accounted for at all times. To maintain this level of sample custody, computer-generated sample container labels and overnight carrier shipping manifests are normally employed.

Field data records and COC Records (Figure 4-1) will also be completed by the appropriate sampling and laboratory personnel for each sample.

The objective of the Harding ESE sample custody identification and control system is to assure, to the extent practicable, that the following conditions are met:

- samples scheduled for collection are uniquely identified;
- the correct samples are analyzed and are traceable to their records;
- important sample characteristics are preserved;
- samples are protected from loss or damage;
- any alteration of samples (e.g., filtration, preservation) is documented; and
- a forensic record of sample integrity is established.

The COC protocol followed by the sampling crews involves the following activities:

- documenting procedures and amounts of reagents or supplies (e.g., filters) which become an integral part of the sample from sample preparation and preservation;
- recording sampling locations, sample bottle identification, and specific sample acquisition measures on the appropriate forms;
- using the prepared sample labels (whenever possible) to document all information necessary for effective sample tracking; and

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- completing standard field data record forms to establish sample custody in the field before sample shipment.

Prepared labels will be numbered to correspond with each unique sample to be collected.

The COC record is used to document the following information:

- sample handling procedures, including sample location, sample number, and number of containers corresponding to each sample number;
- the sample including sample matrix, container types, and preservation techniques; and
- the COC process.

The COC description section requires the following information:

- the sample number and sample bottle identification number, where applicable;
- the names of the sampler(s) and the person shipping the samples;
- the date and time that the samples were collected;
- the date and time that the samples were delivered for shipping;
- the names of those responsible for receiving the samples at the laboratory; and
- Any other pertinent information relating to the sample or sampling process.

A sample COC Record is shown in Figure 4-1. The COC record is completed in quadruplicate. Two copies accompany the samples to the laboratory, another is kept by the sample crew chief and transferred to the FOL, and the last copy is maintained in the project file. Chain of custody is also assured by the use of custody seals on sample shipments.

4.4.2.2 Sample Tracking

Tracking of samples will commence at the time of sample container label generation. A list of samples collected will be created and updated as COC forms are received from the field. A letter of receipt from the laboratory will provide the information to verify:

- analytical program;
- turnaround time;
- laboratory internal identification numbers; and
- chain-of-custody for shipped samples.

Reports from the contract laboratory will provide a means of identifying and initiating pursuit of missing data packages or missing results within a package.

5.0 SAMPLE PACKAGING AND SHIPPING

Following sample collection, samples will be transported in a clean carrier to the sample holding area. The sample identities will be noted, and COC procedures will be initiated as described in Section 4.0, after which the sample containers will be stored on ice in a secure area and packed for transportation to the analytical laboratory prior to shipment.

5.1 SAMPLE PACKING

Sample containers will generally be packed in insulated coolers for shipment. Bottles will be packed tightly using packing materials such as Styrofoam or plastic bubble wrap so that motion is limited. Ice will be placed in double Ziploc® bags (or equivalent) and added to the cooler along with all paperwork in a separate Ziploc® bag. “Blue ice” may also be used to maintain a temperature below 4 degrees Celsius. The cooler top will then be taped shut. The use of custody seals and taping of coolers is required.

5.2 SAMPLE SHIPPING

The standard procedure that will generally be followed for shipping environmental samples to the analytical laboratories is as follows:

1. Environmental samples collected by Harding ESE personnel must be shipped through Federal Express or equivalent overnight delivery service, or transported directly to the laboratory by a courier employed by the laboratory.
2. Prior to leaving for the field, the person responsible for sample collection will notify the LSC of the number, type, and approximate collection and shipment dates for the samples. If the number, type, or date of shipment changes due to site constraints or program changes, the task leader must notify the LSC of the changes. This notification from the field also needs to occur when sample shipments will arrive on Saturdays. The LSC will coordinate sample pick-up with the laboratory.
3. If prompt shipping and laboratory receipt of the samples cannot be guaranteed (e.g., Sunday arrival), the samplers will be responsible for proper storage of the samples until adequate transportation arrangements can be made or sample collection schedules are modified by the FOL.

The LSC or FOL will keep the appropriate laboratory informed of field sampling activities. The samples will be shipped to the laboratory together with the COC Records (Figure 4-1).

6.0 INVESTIGATION DERIVED WASTES (IDW)

As part of the field activities, solid and liquid IDW may be generated in association with personal protective equipment (ppe), decontamination, screening sample preparation and handling, and crushed drum removal activities. Effort will be made to reduce the amount of IDW. Each material type (e.g., soil and water) will be drummed separately. The majority of these materials will be uncontaminated, but some IDW potentially will have had contact with contaminated media.

Excavated soil will be stockpiled pending disposal characterization, stored in a covered roll-off container, and transported to a disposal facility pending receipt of laboratory analytical results.

Crushed drums will be stored in a covered roll-off container and transported to a disposal facility after laboratory analytical results are received.

Any other metal debris, concrete, rebar, plastic, or construction debris discovered during excavation activities will be stockpiled separately and left onsite.

Residual water contained in the crushed drums (if encountered) will also be containerized in a 55-gallon drum.

Following the field investigation, TSC will coordinate with Onyx Environmental to classify the wastes for disposal using analytical data obtained during this field investigation.

6.1 WASTE MATERIAL HANDLING

Personal protective clothing (e.g., Tyvek, gloves), laboratory glassware, standards, and other disposable material which may come in contact with contaminated soil or water will be placed in a plastic trash bag. This material will then be screened using a PID, and disposed of as solid waste if no PID reading above 10 ppm is noted.

6.2 WASTE DRUM LABELING

Drums will be labeled at the point of origin and will have labels attached at all times. Labeling information will include:

1. Facility name;
2. Contents (e.g., purge water or personal protective clothing);
3. Location where material was generated (e.g., J3DW01);
4. Date when filled;
5. PID meter headspace, and screening results in parts per million (ppm); and
6. If IDW fails screening criteria, the label will also include the phrase "pending analysis".

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Prior to off-site disposal, each drum label will also include the names of points of contact with telephone numbers. Points of contact will include the TSC and Harding ESE Project Managers and a representative of the contracted waste hauler.

7.0 CORRECTIVE ACTIONS

Corrective or preventive action is required when potential or existing conditions are identified that may adversely impact data quantity or quality. Corrective action could be immediate or long term. In general, members of the program staff who identify a condition adversely affecting quality can initiate corrective action by notifying the FOL and Harding ESE's Quality Assurance Coordinator (QAC), Dr. Willard Murray, in writing. The written communication will identify the condition and explain how it may affect data quality or quantity.

7.1 IMMEDIATE CORRECTIVE ACTION

Immediate corrective action is usually applied to spontaneous, nonrecurring problems (e.g., instrument malfunction). The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, or methods, will immediately notify the FOL. The FOL will then investigate the extent of the problem and take the necessary corrective steps. If a large quantity of data is affected, the FOL must prepare a memorandum to the Harding ESE Project and Task Managers. These individuals will collectively decide how to proceed. If the problem is limited in scope, the FOL will decide on the corrective action measure and document the solution in the field logbook.

7.2 LONG-TERM CORRECTIVE ACTION

Long-term corrective action procedures are devised and implemented to prevent the recurrence of a potentially serious problem. Dr. Murray will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. The QAC will then file a corrective action request with the FOL and Project Manager. In case of dispute, the Corporate Officer will make a final determination for the company. If the corrective action will impact the project schedule, the TSC Project Manager will be notified.

Corrective actions may also be initiated as a result of other activities, including (1) performance audits; (2) system audits; (3) laboratory/field comparison studies; and (4) ongoing project audits.

The QAC will be responsible for documenting all notifications, recommendations, and final decisions. The Project Manager and the QAC will be jointly responsible for notifying project staff and implementing the agreed-upon course of action. The QAC will be responsible for verifying the efficacy of the implemented actions. The development and implementation of preventive and corrective actions will be timed, to the extent possible, so as to not adversely affect either project schedules or subsequent data generation/processing activities. The QAC will also be responsible for developing and implementing routine program controls to minimize the need for corrective action.

Examples of long-term type of actions include:

- staff training in technical skills or in implementing the QA Program;
- rescheduling of laboratory routine to ensure analysis within allowed holding times;

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- identifying vendors to supply reagents of sufficient purity; and
- revision of Contractor QA system or replacement of personnel.

For either immediate or long-term corrective actions, steps comprising a closed-loop corrective action system are as follows:

- define the problem;
- assign responsibility for investigating the problem;
- investigate and determine the cause of the problem;
- determine a corrective action to eliminate the problem;
- assign and accept responsibility for implementing the corrective action;
- establish effectiveness of the corrective action and implement the correction; and
- verify that the corrective action has eliminated the problem.

Depending on the nature of the problem, the corrective action employed may be formal or informal. In either case, occurrence of the problem, corrective action employed, and verification that the problem has been eliminated will be documented.

8.0 PROJECT SCHEDULE

TSC proposes to conduct this work following the granting of site access by NGB and USACE. The work described in this work plan is currently anticipated to begin on or about March 25, 2002, pending resolution of site access issues. Harding ESE will coordinate site access with the NGB and USACE to avoid interference with other ongoing Phase II activities being conducted at the J-3 Range.

The proposed schedule for the execution of the crushed drum removal field program is provided below:

Drum Removal Activities and Precondition Sampling (work plan under separate cover) are anticipated to require 6 days of work (including mobilization, demobilization, UXO construction support, excavation, and sampling); more time may be needed. The schedule for Drum Removal Activities and Precondition Sampling does not account for interruption or delay caused by a number of factors, including weather, site safety issues, discovery of UXO, etc. If these or other unexpected events arise, the completion date will be later. Information about this delay will be given to the USEPA, MADEP, NGB, and USACE.

Laboratory data should be received within 45 calendar days following the completion of the field program.

Onyx will identify a disposal facility within 14 calendar days of receipt of laboratory analytical data and will submit a disposal summary letter for regulatory approval by USEPA and MADEP.

Pending resolution of site access and site safety issues with NGB and USACE, removal of the roll-offs containing the crushed drums and soil is expected to take place within 14 calendar days following regulatory approval of the disposal facility. USA Environmental and Onyx will coordinate this removal.

Harding ESE will prepare a summary report of Drum Removal activities within 45 calendar days of the removal of the crushed drums and soil from J-3 Range for disposal at the approved disposal facility.

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AOC	Area of Concern
ARRADCOM	U.S. Army Armament Research and Development Command
ASTM	American Society for Testing and Materials
bgs	below ground surface
BS	blank spike
BSD	blank spike duplicate
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CLP	Contract Laboratory Program
USACE	U.S. Army Corps of Engineers, New England District
COC	chain of custody
CSP	Certified Safety Professional
DoD	Department of Defense
DQOs	Data Quality Objectives
ESA	Environmental Site Assessment
EZ	exclusion zone
FOL	Field Operations Leader
HSO	Health and Safety Officer
IDW	investigation-derived waste
LCS	laboratory control sample
LSC	Laboratory Services Coordinator
MAANG	Massachusetts Air National Guard
MAARNG	Massachusetts Army National Guard
MADEP	Massachusetts Department of Environmental Protection
MDL	method detection limit
mm	millimeter
MMR	Massachusetts Military Reservation
MPM	most probable munition
MS/MSD	matrix spike/matrix spike duplicate
NGB	National Guard Bureau
OE	ordnance explosives

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

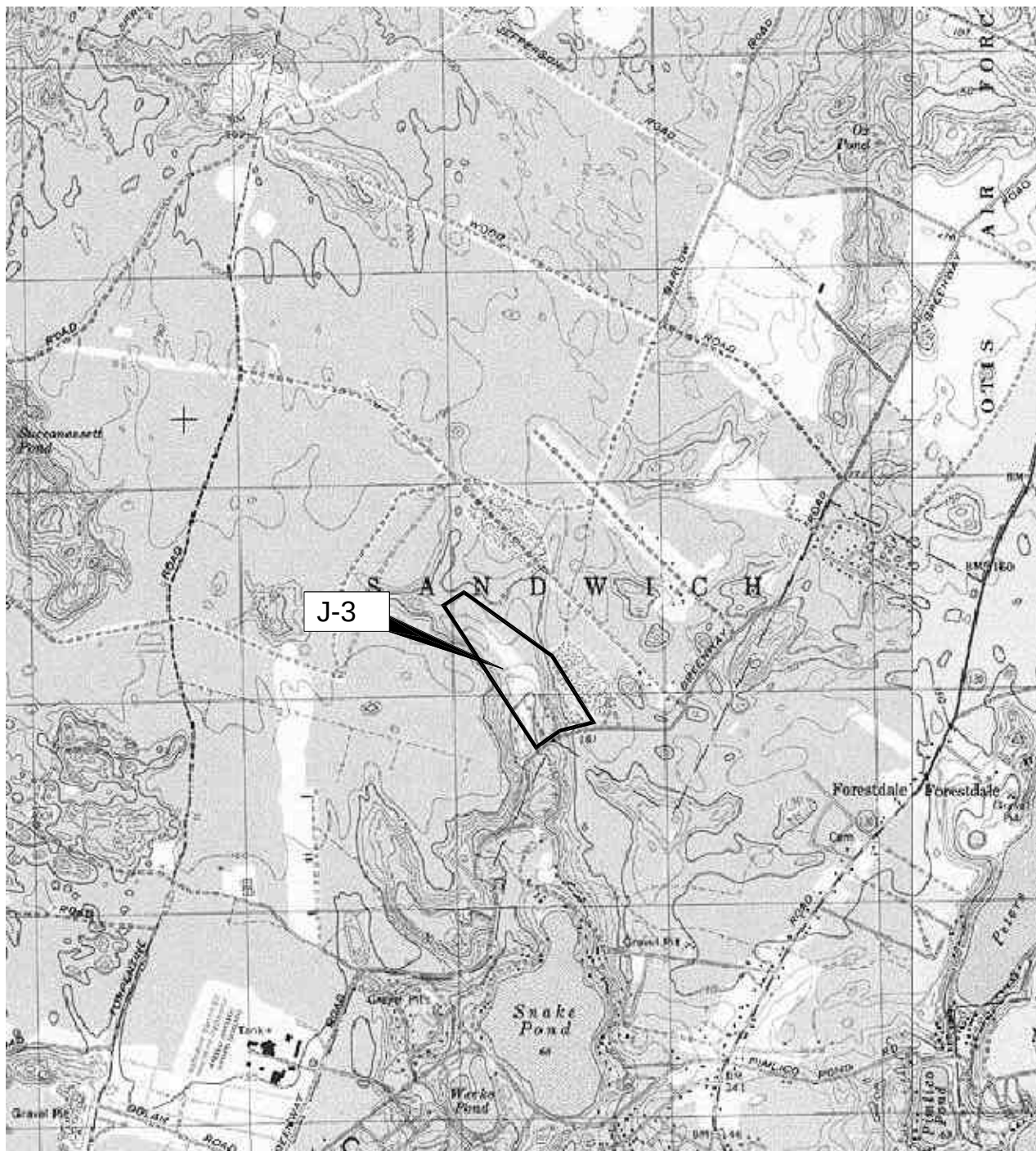
OHM	Oil or Hazardous Materials
OSHA	Occupational Safety and Health Act
PDA	Photo Diode Array
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
QA	quality assurance
QAC	Quality Assurance Coordinator
QC	quality control
RECs	Recognized Environmental Conditions
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SHP	Safety and Health Program
TNT	Trinitrotoluene
TSC	Textron Systems Corporation
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance

REFERENCES

REFERENCES

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- U.S. Environmental Protection Agency, 1996a. "Test Methods for Evaluating Solid Waste"; Laboratory Manual Physical/Chemical Methods; Office of Solid Waste and Emergency Response; Washington, DC; SW-846; November 1986; Revision 4 – December 1996.
- U.S. Environmental Protection Agency (USEPA), 1996b. "Region 1 EPA-NE Data Validation Guidelines for Evaluating Environmental Analyses"; Quality Assurance Unit Staff; Office of Environmental Measurement and Evaluation; December 1996.

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QUADRANGLE LOCATION
SOURCE: TOPO, 1998 WILDFLOWER PRODUCTIONS

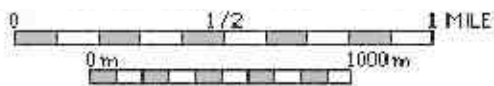
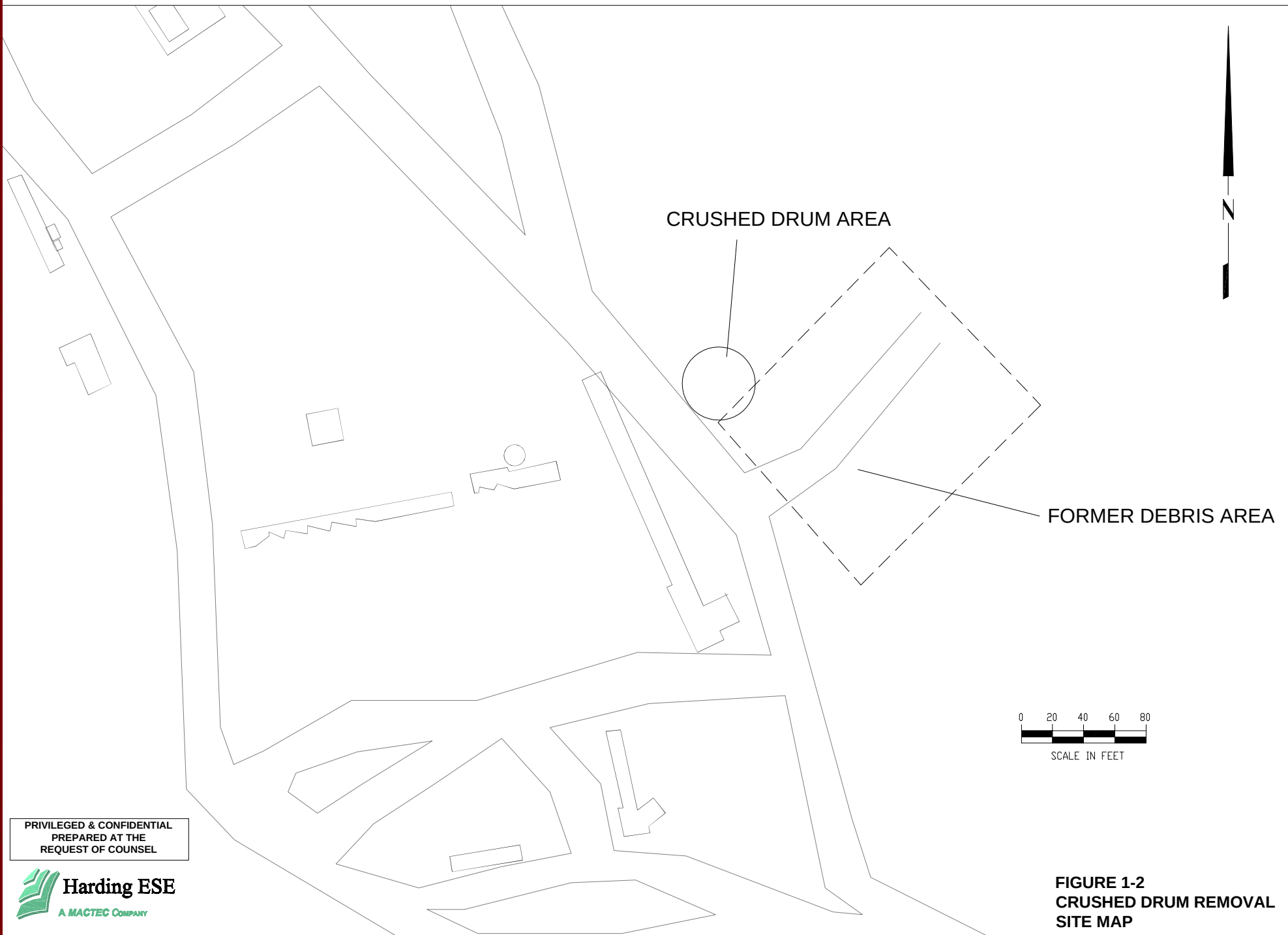
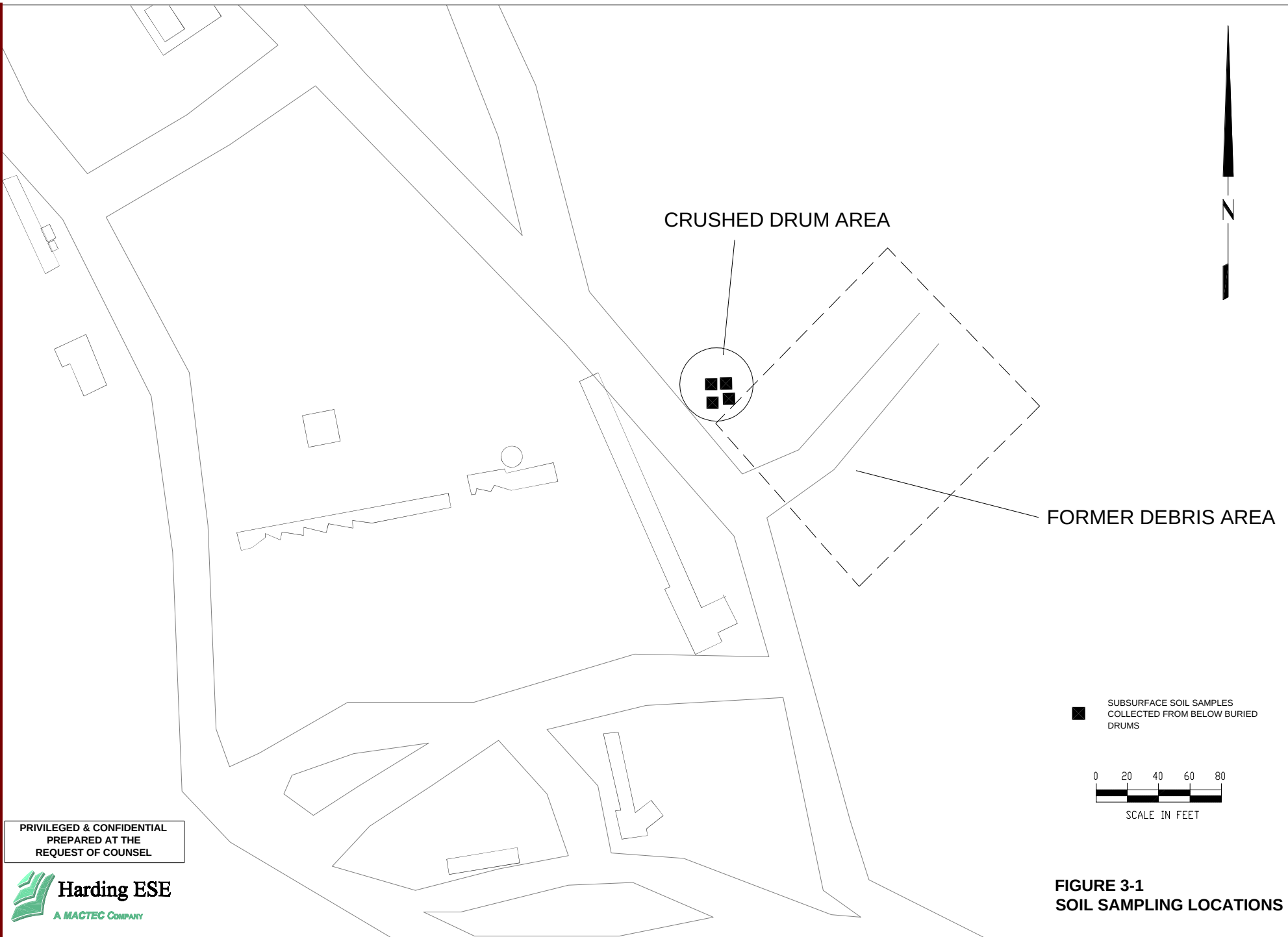


FIGURE 1-1
SITE LOCATION MAP
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS



PRIVILEGED & CONFIDENTIAL
PREPARED AT THE
REQUEST OF COUNSEL





**FIGURE 3-1
SOIL SAMPLING LOCATIONS**

CALIBRATION DATA SHEET

Project _____

Job No. _____

Date _____

Field Instrumentation Calibration Data

Equipment Type/I.D.

Battery
Condition

Calibration Information

_____	_____	pH 4 _____ pH 7 _____ pH 10 _____
_____	_____	pH 4 _____ pH 7 _____ pH 10 _____
_____	_____	pH 4 _____ pH 7 _____ pH 10 _____
_____	_____	Cond. Std. _____/_____ Cond. Std. _____/_____
_____	_____	Cond. Std. _____/_____ Cond. Std. _____/_____
_____	_____	Cond. Std. _____/_____ Cond. Std. _____/_____

Dissolved Oxygen

Avg. Winkler Value _____ ppm Meter Value _____ ppm

Redox

Zorbell Sol. Value _____ Meter Value _____

Photoionization Meter

Zero/Zero Air? ☐ Yes ☐ No Span Gas Value _____ ppm Equiv.
Meter Value _____ ppm Equiv.

Zero/Zero Air? ☐ Yes ☐ No Span Gas Value _____ ppm Equiv.
Meter Value _____ ppm Equiv.

Other

Fluids/Materials Record

Deionized Water Source: ☐ ABB Staging ☐ Portable System ☐ Other _____

Trip Blank Water Source: ☐ ABB Lab; Lot No. _____ ☐ Other; ID _____

Decontamination Fluids: ☐ Methyl Hydrate; Lot No. _____ ☐ Other _____ Lot No. _____

Sampler Blank Water Source: ☐ ABB Staging ☐ Port. System ☐ Other _____

HNO₃/DI Rinse Solution: ABB Staging; I.D. No. _____

Preservation Chemical Lot I.D.s: Chemicals Used: HNO₃ Lot No. _____

Filtration Paper ID: H₂SO₄ Lot No. _____

Manuf./Type _____ HCL Lot No. _____

Lot No. _____ NaOH Lot No. _____

_____ ZnAOC Lot No. _____

Standards

Manuf. _____

Lot No. _____

Sampler Signature _____

Pay. of.

HLA

FIGURE 4-1
CHAIN OF CUSTODY RECORD

TABLE 3-1: SUMMARY OF NON-EXPENDABLE EQUIPMENT**CRUSHED DRUM REMOVAL****J-3 RANGE****CAMP EDWARDS, MA**

Item	Unit	Quantity
Environmental Monitoring Equipment		
PID Meter	Day	5
Sampling Equipment		
Stainless Steel Spatula	Week	5
Health & Safety		
Level D Protection Overboots Insulated Gloves Steel-Toed Boots Hard Hat Goggles Coveralls (cotton or Tyvek™)	Day/Per Person	5
Portable Eye Wash Station	Day	5
Fire Extinguisher, ABC	Week	1
First Aid Kit	Week	1
Radiation Monitor	Day	5
Draeger Pump	Day	5
Miscellaneous Equipment		
Camera, Film, Development	Roll	5
Mobile Phone	Day	5

TABLE 3-2. SUMMARY OF EXPENDABLE SUPPLIES**CRUSHED DRUM REMOVAL****J-3 RANGE****CAMP EDWARDS, MA**

Item	Unit	Quantity
Gloves, Disposable	Box	1
Marking Pens	Each	2
Tape, Duct	Roll	1
Tape, Clear	Roll	1
Tape, Filament	Roll	1
Decontamination Fluid		
Liquinox	Gallon	1
Deionized Water	Gallon	5
Decon Package		
Washtubs	Each	3
Kimwipes	Box	1
Paper Towels	Roll	3
Baggies	Box	2
Tyvek TM Suits	Each	10
Ice	Bag	3
Bubble Pack	Foot	20
Log Book	Each	1
Trash Bags	Box	1
SS Spoons	Each	10
SS Spatulas	Each	10
Plastic Sheeting	Roll	1
Flagging	Each	75
Span Gas for PID	Each	2
Tape Dispenser, Filament	Each	2
Tape Dispenser, Clear	Each	2
Miscellaneous Sample Containers	Each	1

**Table 3-3. Summary of Sampling and Analytical Program
Crushed Drum Removal
J-3 Range
Camp Edwards, Massachusetts**

	Stockpiled Soil from Around the Drums (0-6")	Exposed Soil	Liquid within Drums (if any)		Drum Wipe Samples	
Area of Concern	Disposal Characterization	Phase I Analytes	Phase I Analytes	Disposal Characterization	Explosives	Comments
11. Crushed Drum Area	1	4	1	1	5 ¹	Collecton of samples upon removal of crushed drums
Totals:	1	4	1	1	5	

¹ Wipe samples will be collected from 20 percent of the drums. This is anticipated to include 5 samples.

Methods:

Phase I Analytes: Please see Table 3-4 for Phase I Analyte methods and detection limits

Explosives: Explosives analyses will be by USEPA Method 8330M.

Disposal Characterization: Analytes and methods for disposal characterization are shown inTable 3-5.

All soil samples will be screened with a PID for the presence of VOCs, in accordance with MADEP guidance.

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
Water			
300.0	CHLORIDE (AS CL)	0.059	MG/L
300.0	SULFATE (AS SO ₄)	0.034	MG/L
310.1	ALKALINITY, BICARBONATE (AS CaCO ₃)	1	MG/L
310.1	ALKALINITY, CARBONATE (AS CaCO ₃)	1	MG/L
310.1	ALKALINITY, HYDROXIDE (AS CaCO ₃)	1	MG/L
310.1	ALKALINITY, TOTAL (AS CaCO ₃)	1	MG/L
350.2M	NITROGEN, AMMONIA (AS N)	0.015	MG/L
353.2M	NITRATE/NITRITE (AS N)	0.005	MG/L
365.2	PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	0.005	MG/L
504	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.0033	NG/L
8021W	TERT-BUTYL METHYL ETHER	0.036	UG/L
8151	2,4 DB	0.696	UG/L
8151	2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0.216	UG/L
8151	2,4-D (DICHLOROPHENOXYACETIC ACID)	0.651	UG/L
8151	3,5-DICHLOROBENZOIC ACID	0.575	UG/L
8151	4-NITROPHENOL	0.778	UG/L
8151	ACIFLUORFEN	0.0695	UG/L
8151	BENTAZON	0.468	UG/L
8151	CHLORAMBEN	0.0911	UG/L
8151	DALAPON	1.08	UG/L
8151	DCPA (DACTHAL)	0.0487	UG/L
8151	DICAMBA	0.0524	UG/L
8151	DICHLOROPROP	0.837	UG/L
8151	DINOSEB	0.288	UG/L
8151	MCPA	83.5	UG/L
8151	MCPP	56.7	UG/L
8151	PENTACHLOROPHENOL	0.0201	UG/L
8151	PICLORAM	0.14	UG/L
8151	SILVEX (2,4,5-TP)	0.047	UG/L
8330N	1,3,5-TRINITROBENZENE	0.182	UG/L
8330N	1,3-DINITROBENZENE	0.055	UG/L
8330N	2,4,6-TRINITROTOLUENE	0.032	UG/L
8330N	2,4-DIAMINO-6-NITROTOLUENE	0.112	UG/L
8330N	2,4-DINITROTOLUENE	0.044	UG/L
8330N	2,6-DIAMINO-4-NITROTOLUENE	0.127	UG/L
E900	ALPHA, GROSS	0.0001	PCI/L
E900	BETA, GROSS	0.0001	PCI/L
ILSBTL	ANTIMONY	2.3	UG/L
ILSBTL	THALLIUM	1.5	UG/L
8330N	2,6-DINITROTOLUENE	0.072	UG/L
8330N	2-AMINO-4,6-DINITROTOLUENE	0.03	UG/L
8330N	2-NITROTOLUENE	0.019	UG/L
8330N	3-NITROTOLUENE	0.047	UG/L
8330N	4-AMINO-2,6-DINITROTOLUENE	0.155	UG/L
8330N	4-NITROTOLUENE	0.048	UG/L
8330N	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	0.045	UG/L
8330N	NITROBENZENE	0.055	UG/L
8330N	NITROGLYCERIN	4.212	UG/L
8330N	OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TET	0.054	UG/L
8330N	PENTAERYTHRITOL TETRANITRATE	3.477	UG/L
8330N	PICRIC ACID	0.172	UG/L
8330N	TETRYL	0.105	UG/L
CYAN	CYANIDE	5.95	UG/L
E314.0	PERCHLORATE	0.35	UG/L
IM40HD	HARDNESS (AS CaCO ₃)	0.3191	MG/L
IM40HG	MERCURY	0.0646	UG/L
IM40MB	ALUMINUM	48	UG/L
IM40MB	ANTIMONY	9.8	UG/L

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
IM40MB	ARSENIC	4	UG/L
IM40MB	BARIUM	27.7	UG/L
IM40MB	BERYLLIUM	0.7	UG/L
IM40MB	BORON	16.4	UG/L
IM40MB	CADMIUM	0.8	UG/L
IM40MB	CALCIUM	784	UG/L
IM40MB	CHROMIUM, TOTAL	2.2	UG/L
IM40MB	COBALT	6.3	UG/L
IM40MB	COPPER	4.7	UG/L
IM40MB	IRON	73.1	UG/L
IM40MB	LEAD	1.8	UG/L
IM40MB	MAGNESIUM	829.3	UG/L
IM40MB	MANGANESE	2.5	UG/L
IM40MB	MOLYBDENUM	3.6	UG/L
IM40MB	NICKEL	5.2	UG/L
IM40MB	POTASSIUM	988.9	UG/L
IM40MB	SELENIUM	3.9	UG/L
IM40MB	SILVER	1.8	UG/L
IM40MB	SODIUM	852.8	UG/L
IM40MB	THALLIUM	3.5	UG/L
IM40MB	VANADIUM	6.3	UG/L
IM40MB	ZINC	5	UG/L
OC21V	1,1,1-TRICHLOROETHANE	0.137	UG/L
OC21V	1,1,2,2-TETRACHLOROETHANE	0.106	UG/L
OC21V	1,1,2-TRICHLOROETHANE	0.0878	UG/L
OC21V	1,1-DICHLOROETHANE	0.126	UG/L
OC21V	1,1-DICHLOROETHENE	0.192	UG/L
OC21V	1,2,4-TRICHLOROBENZENE	0.1	UG/L
OC21V	1,2-DIBROMO-3-CHLOROPROPANE	0.157	UG/L
OC21V	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.0876	UG/L
OC21V	1,2-DICHLOROBENZENE	0.0759	UG/L
OC21V	1,2-DICHLOROETHANE	0.0486	UG/L
OC21V	1,2-DICHLOROPROPANE	0.0804	UG/L
OC21V	1,3-DICHLOROBENZENE	0.0865	UG/L
OC21V	1,4-DICHLOROBENZENE	0.109	UG/L
OC21V	2-CHLOROETHYL VINYL ETHER	0.118	UG/L
OC21V	2-HEXANONE	0.455	UG/L
OC21V	ACETONE	2	UG/L
OC21V	BENZENE	0.171	UG/L
OC21V	BROMOCHLOROMETHANE	0.123	UG/L
OC21V	BROMODICHLOROMETHANE	0.0838	UG/L
OC21V	BROMOFORM	0.0759	UG/L
OC21V	BROMOMETHANE	0.301	UG/L
OC21V	CARBON DISULFIDE	0.367	UG/L
OC21V	CARBON TETRACHLORIDE	0.187	UG/L
OC21V	CHLOROBENZENE	0.0639	UG/L
OC21V	CHLOROETHANE	0.16	UG/L
OC21V	CHLOROFORM	0.0474	UG/L
OC21V	CHLOROMETHANE	0.225	UG/L
OC21V	CIS-1,2-DICHLOROETHYLENE	0.0887	UG/L
OC21V	CIS-1,3-DICHLOROPROPENE	0.11	UG/L
OC21V	DIBROMOCHLOROMETHANE	0.131	UG/L
OC21V	DIBROMOMETHANE	0.102	UG/L
OC21V	ETHYLBENZENE	0.0596	UG/L
OC21V	METHYL ETHYL KETONE (2-BUTANONE)	1.02	UG/L
OC21V	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTA	0.573	UG/L
OC21V	METHYLENE CHLORIDE	0.154	UG/L
OC21V	STYRENE	0.0857	UG/L
OC21V	TETRACHLOROETHYLENE(PCE)	0.102	UG/L

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
OC21V	TOLUENE	0.0695	UG/L
OC21V	TRANS-1,2-DICHLOROETHENE	0.121	UG/L
OC21V	TRANS-1,3-DICHLOROPROPENE	0.0729	UG/L
OC21V	TRICHLOROETHYLENE (TCE)	0.0877	UG/L
OC21V	VINYL ACETATE	0.173	UG/L
OC21V	VINYL CHLORIDE	0.161	UG/L
OC21V	XYLENES, TOTAL	0.249	UG/L
OL21P	ALDRIN	0.0038	UG/L
OL21P	ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	0.0043	UG/L
OL21P	ALPHA ENDOSULFAN	0.0042	UG/L
OL21P	ALPHA-CHLORDANE	0.0035	UG/L
OL21P	BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.004	UG/L
OL21P	BETA ENDOSULFAN	0.0079	UG/L
OL21P	DDD (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROE	0.0085	UG/L
OL21P	DDE (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROE	0.0063	UG/L
OL21P	DDT (1,1-BIS(CHLOROPHENYL)-2,2,2-TRICHLO	0.0085	UG/L
OL21P	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	0.0043	UG/L
OL21P	DIELDRIN	0.009	UG/L
OL21P	ENDOSULFAN SULFATE	0.01	UG/L
OL21P	ENDRIN	0.0085	UG/L
OL21P	ENDRIN ALDEHYDE	0.012	UG/L
OL21P	ENDRIN KETONE	0.0078	UG/L
OL21P	GAMMA BHC (LINDANE)	0.0043	UG/L
OL21P	GAMMA-CHLORDANE	0.004	UG/L
OL21P	HEPTACHLOR	0.0042	UG/L
OL21P	HEPTACHLOR EPOXIDE	0.0034	UG/L
OL21P	METHOXYCHLOR	0.047	UG/L
OL21P	PCB-1016 (AROCHLOR 1016)	0.018	UG/L
OL21P	PCB-1221 (AROCHLOR 1221)	0.018	UG/L
OL21P	PCB-1232 (AROCHLOR 1232)	0.018	UG/L
OL21P	PCB-1242 (AROCHLOR 1242)	0.018	UG/L
OL21P	PCB-1248 (AROCHLOR 1248)	0.015	UG/L
OL21P	PCB-1254 (AROCHLOR 1254)	0.015	UG/L
OL21P	PCB-1260 (AROCHLOR 1260)	0.015	UG/L
OL21P	TOXAPHENE	0.15	UG/L
SW8270	1,2,4-TRICHLOROBENZENE	0.64	UG/L
SW8270	1,2-DICHLOROBENZENE	1.16	UG/L
SW8270	1,3-DICHLOROBENZENE	1.26	UG/L
SW8270	1,3-DIETHYL-1,3-DIPHENYL UREA	0.677	UG/L
SW8270	1,4-DICHLOROBENZENE	0.92	UG/L
SW8270	2,2'-OXYBIS(1-CHLORO)PROPANE	1.38	UG/L
SW8270	2,4,5-TRICHLOROPHENOL	0.87	UG/L
SW8270	2,4,6-TRICHLOROPHENOL	1.65	UG/L
SW8270	2,4-DICHLOROPHENOL	1.51	UG/L
SW8270	2,4-DIMETHYLPHENOL	1.88	UG/L
SW8270	2,4-DINITROPHENOL	2.19	UG/L
SW8270	2,4-DINITROTOLUENE	0.62	UG/L
SW8270	2,6-DINITROTOLUENE	0.65	UG/L
SW8270	2-CHLOROBENZALDEHYDE	0.727	UG/L
SW8270	2-CHLOROBENZOIC ACID	18.8	UG/L
SW8270	2-CHLORONAPHTHALENE	1.02	UG/L
SW8270	2-CHLOROPHENOL	2.08	UG/L
SW8270	2-METHYL-3-NITROANILINE	0.876	UG/L
SW8270	2-METHYL-5-NITROANILINE	1.03	UG/L
SW8270	2-METHYLNAPHTHALENE	1.38	UG/L
SW8270	2-METHYLPHENOL (O-CRESOL)	1.51	UG/L
SW8270	2-NITROANILINE	1.25	UG/L
SW8270	2-NITRODIPHENYLAMINE	0.624	UG/L
SW8270	2-NITROPHENOL	1.33	UG/L

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
SW8270	3,3'-DICHLOROBENZIDINE	3.2	UG/L
SW8270	3,5-DINITROANILINE	1.17	UG/L
SW8270	3-CHLOROBENZALDEHYDE	0.677	UG/L
SW8270	3-NITROANILINE	2.58	UG/L
SW8270	4,6-DINITRO-2-METHYLPHENOL	1.74	UG/L
SW8270	4-BROMOPHENYL PHENYL ETHER	0.98	UG/L
SW8270	4-CHLORO-3-METHYLPHENOL	2.11	UG/L
SW8270	4-CHLOROANILINE	3.81	UG/L
SW8270	4-CHLOROBENZALDEHYDE	0.713	UG/L
SW8270	4-CHLOROPHENYL PHENYL ETHER	0.56	UG/L
SW8270	4-METHYLPHENOL (P-CRESOL)	3.87	UG/L
SW8270	4-NITROANILINE	2.49	UG/L
SW8270	4-NITROPHENOL	1.56	UG/L
SW8270	ACENAPHTHENE	0.75	UG/L
SW8270	ACENAPHTHYLENE	0.64	UG/L
SW8270	ANILINE	2.14	UG/L
SW8270	ANTHRACENE	0.56	UG/L
SW8270	BENZO(A)ANTHRACENE	0.65	UG/L
SW8270	BENZO(A)PYRENE	0.88	UG/L
SW8270	BENZO(B)FLUORANTHENE	1.03	UG/L
SW8270	BENZO(G,H,I)PERYLENE	1.07	UG/L
SW8270	BENZO(K)FLUORANTHENE	1.2	UG/L
SW8270	BENZOIC ACID	1.99	UG/L
SW8270	BENZYL ALCOHOL	1.74	UG/L
SW8270	BENZYL BUTYL PHTHALATE	0.68	UG/L
SW8270	BIS(2-CHLOROETHOXY) METHANE	3.07	UG/L
SW8270	BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL	1.07	UG/L
SW8270	BIS(2-ETHYLHEXYL) PHTHALATE	0.95	UG/L
SW8270	CARBAZOLE	0.84	UG/L
SW8270	CHRYSENE	0.7	UG/L
SW8270	DI-N-BUTYL PHTHALATE	0.73	UG/L
SW8270	DI-N-OCTYLPHTHALATE	1.24	UG/L
SW8270	DI-N-PROPYL ADIPATE	0.795	UG/L
SW8270	DIBENZ(A,H)ANTHRACENE	0.75	UG/L
SW8270	DIBENZOFURAN	1.34	UG/L
SW8270	DIETHYL PHTHALATE	0.46	UG/L
SW8270	DIMETHYL PHTHALATE	1.74	UG/L
SW8270	FLUORANTHENE	0.98	UG/L
SW8270	FLUORENE	0.53	UG/L
SW8270	HEXACHLOROBENZENE	0.83	UG/L
SW8270	HEXACHLOROBUTADIENE	0.76	UG/L
SW8270	HEXACHLOROCYCLOPENTADIENE	2.4	UG/L
SW8270	HEXACHLOROETHANE	1.36	UG/L
SW8270	INDENO(1,2,3-C,D)PYRENE	0.65	UG/L
SW8270	ISOPHORONE	1.78	UG/L
SW8270	N-NITROSODI-N-PROPYLAMINE	1.46	UG/L
SW8270	N-NITROSODIMETHYLAMINE	1.11	UG/L
SW8270	N-NITROSODIPHENYLAMINE	2.66	UG/L
SW8270	NAPHTHALENE	0.6	UG/L
SW8270	NITROBENZENE	1.11	UG/L
SW8270	PENTACHLOROPHENOL	2.39	UG/L
SW8270	PHENANTHRENE	0.7	UG/L
SW8270	PHENOL	1.12	UG/L
SW8270	PYRENE	0.89	UG/L
TOC	TOTAL ORGANIC CARBON	0.3563	MG/L
Soil			
350.2M	NITROGEN, AMMONIA (AS N)	1.5	MG/KG
353.2M	NITRATE/NITRITE (AS N)	0.0043	MG/KG

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
365.2	PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	1	MG/KG
8151	2,4 DB	54.3	UG/KG
8151	2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	6.01	UG/KG
8151	2,4-D (DICHLOROPHENOXYACETIC ACID)	47.6	UG/KG
8151	3,5-DICHLOROBENZOIC ACID	64.8	UG/KG
8151	4-NITROPHENOL	256	UG/KG
8151	ACIFLUORFEN	8.41	UG/KG
8151	BENTAZON	26.8	UG/KG
8151	CHLORAMBEN	4.37	UG/KG
8151	DALAPON	105	UG/KG
8151	DCPA (DACTHAL)	5.2	UG/KG
8151	DICAMBA	6.25	UG/KG
8151	DICHLOROPROP	97.2	UG/KG
8151	DINOSEB	34.1	UG/KG
8151	MCPA	4823	UG/KG
8151	MCPP	4956	UG/KG
8151	PENTACHLOROPHENOL	1.78	UG/KG
8151	PICLORAM	4.5	UG/KG
8151	SILVEX (2,4,5-TP)	5.26	UG/KG
8260LS	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.108	UG/KG
8260LS	TERT-BUTYL METHYL ETHER	0.116	UG/KG
8330N	1,3,5-TRINITROBENZENE	17.84	UG/KG
8330N	1,3-DINITROBENZENE	10.19	UG/KG
8330N	2,4,6-TRINITROTOLUENE	17.27	UG/KG
8330N	2,4-DIAMINO-6-NITROTOLUENE	42.78	UG/KG
8330N	2,4-DINITROTOLUENE	20.21	UG/KG
8330N	2,6-DIAMINO-4-NITROTOLUENE	28.42	UG/KG
8330N	2,6-DINITROTOLUENE	53.59	UG/KG
8330N	2-AMINO-4,6-DINITROTOLUENE	19.57	UG/KG
8330N	2-NITROTOLUENE	19.38	UG/KG
8330N	3-NITROTOLUENE	15.07	UG/KG
8330N	4-AMINO-2,6-DINITROTOLUENE	22.21	UG/KG
8330N	4-NITROTOLUENE	28.85	UG/KG
8330N	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	23.65	UG/KG
8330N	NITROBENZENE	13.35	UG/KG
8330N	NITROGLYCERIN	1641	UG/KG
8330N	OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TET	17.59	UG/KG
8330N	PENTAERYTHRITOL TETRANITRATE	1209.4	UG/KG
8330N	PICRIC ACID	55.42	UG/KG
8330N	TETRYL	28.48	UG/KG
CYAN	CYANIDE	0.29	MG/KG
IM40HG	MERCURY	0.0055	MG/KG
IM40MB	ALUMINUM	5.2	MG/KG
IM40MB	ANTIMONY	1.4	MG/KG
IM40MB	ARSENIC	1	MG/KG
IM40MB	BARIUM	5.4	MG/KG
IM40MB	BERYLLIUM	0.2	MG/KG
IM40MB	BORON	2.5	MG/KG

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
IM40MB	CADMIUM	0.1	MG/KG
IM40MB	CALCIUM	96.1	MG/KG
IM40MB	CHROMIUM, TOTAL	0.3	MG/KG
IM40MB	COBALT	1.4	MG/KG
IM40MB	COPPER	0.8	MG/KG
IM40MB	IRON	5.6	MG/KG
IM40MB	LEAD	0.4	MG/KG
IM40MB	MAGNESIUM	97.2	MG/KG
IM40MB	MANGANESE	0.4	MG/KG
IM40MB	MOLYBDENUM	0.5	MG/KG
IM40MB	NICKEL	1.1	MG/KG
IM40MB	POTASSIUM	224	MG/KG
IM40MB	SELENIUM	1	MG/KG
IM40MB	SILVER	0.5	MG/KG
IM40MB	SODIUM	116.7	MG/KG
IM40MB	THALLIUM	1.2	MG/KG
IM40MB	VANADIUM	1.4	MG/KG
IM40MB	ZINC	3.4	MG/KG
OM31P	ALDRIN	0.273	UG/KG
OM31P	ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	0.238	UG/KG
OM31P	ALPHA ENDOSULFAN	0.264	UG/KG
OM31P	ALPHA-CHLORDANE	0.285	UG/KG
OM31P	BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.263	UG/KG
OM31P	BETA ENDOSULFAN	0.524	UG/KG
OM31P	DDD (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROE	0.534	UG/KG
OM31P	DDE (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROE	0.523	UG/KG
OM31P	DDT (1,1-BIS(CHLOROPHENYL)-2,2,2-TRICHLO	1.63	UG/KG
OM31P	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	0.301	UG/KG
OM31P	DIELDRIN	0.534	UG/KG
OM31P	ENDOSULFAN SULFATE	0.589	UG/KG
OM31P	ENDRIN	0.56	UG/KG
OM31P	ENDRIN ALDEHYDE	0.728	UG/KG
OM31P	ENDRIN KETONE	0.853	UG/KG
OM31P	GAMMA BHC (LINDANE)	0.228	UG/KG
OM31P	GAMMA-CHLORDANE	0.297	UG/KG
OM31P	HEPTACHLOR	0.273	UG/KG
OM31P	HEPTACHLOR EPOXIDE	0.248	UG/KG
OM31P	METHOXYCHLOR	17	UG/KG
OM31P	PCB-1016 (AROCHLOR 1016)	10.4	UG/KG
OM31P	PCB-1221 (AROCHLOR 1221)	10.4	UG/KG
OM31P	PCB-1232 (AROCHLOR 1232)	10.4	UG/KG
OM31P	PCB-1242 (AROCHLOR 1242)	10.4	UG/KG
OM31P	PCB-1248 (AROCHLOR 1248)	3.02	UG/KG
OM31P	PCB-1254 (AROCHLOR 1254)	3.02	UG/KG
OM31P	PCB-1260 (AROCHLOR 1260)	3.02	UG/KG
OM31P	TOXAPHENE	20.7	UG/KG
OM31V	1,1,1-TRICHLOROETHANE	2.4	UG/KG
OM31V	1,1,2,2-TETRACHLOROETHANE	3.04	UG/KG

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
OM31V	1,1,2-TRICHLOROETHANE	2.59	UG/KG
OM31V	1,1-DICHLOROETHANE	2.32	UG/KG
OM31V	1,1-DICHLOROETHENE	2.34	UG/KG
OM31V	1,2-DICHLOROETHANE	2.82	UG/KG
OM31V	1,2-DICHLOROPROPANE	2.57	UG/KG
OM31V	2-HEXANONE	3.48	UG/KG
OM31V	ACETONE	3.81	UG/KG
OM31V	BENZENE	2.4	UG/KG
OM31V	BROMODICHLOROMETHANE	2.51	UG/KG
OM31V	BROMOFORM	2.72	UG/KG
OM31V	BROMOMETHANE	4.45	UG/KG
OM31V	CARBON DISULFIDE	2.34	UG/KG
OM31V	CARBON TETRACHLORIDE	2.23	UG/KG
OM31V	CHLOROBENZENE	2.21	UG/KG
OM31V	CHLOROETHANE	2.36	UG/KG
OM31V	CHLOROFORM	2.48	UG/KG
OM31V	CHLOROMETHANE	3.13	UG/KG
OM31V	CIS-1,3-DICHLOROPROPENE	2.4	UG/KG
OM31V	DIBROMOCHLOROMETHANE	2.43	UG/KG
OM31V	ETHYLBENZENE	2.17	UG/KG
OM31V	METHYL ETHYL KETONE (2-BUTANONE)	3.6	UG/KG
OM31V	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTA	2.62	UG/KG
OM31V	METHYLENE CHLORIDE	2.08	UG/KG
OM31V	STYRENE	2.29	UG/KG
OM31V	TETRACHLOROETHYLENE(PCE)	2.25	UG/KG
OM31V	TOLUENE	2.37	UG/KG
OM31V	TOTAL 1,2-DICHLOROETHENE	2.3	UG/KG
OM31V	TRANS-1,3-DICHLOROPROPENE	2.38	UG/KG
OM31V	TRICHLOROETHYLENE (TCE)	2.24	UG/KG
OM31V	VINYL CHLORIDE	2.48	UG/KG
OM31V	XYLENES, TOTAL	7.22	UG/KG
SW8270	1,2,4-TRICHLOROBENZENE	44.9	UG/KG
SW8270	1,2-DICHLOROBENZENE	48.5	UG/KG
SW8270	1,3-DICHLOROBENZENE	50.6	UG/KG
SW8270	1,3-DIETHYL-1,3-DIPHENYL UREA	126	UG/KG
SW8270	1,4-DICHLOROBENZENE	53	UG/KG
SW8270	2,2'-OXYBIS(1-CHLORO)PROPANE	69	UG/KG
SW8270	2,4,5-TRICHLOROPHENOL	33.2	UG/KG
SW8270	2,4,6-TRICHLOROPHENOL	133	UG/KG
SW8270	2,4-DICHLOROPHENOL	122	UG/KG
SW8270	2,4-DIMETHYLPHENOL	101	UG/KG
SW8270	2,4-DINITROPHENOL	154	UG/KG
SW8270	2,4-DINITROTOLUENE	35.8	UG/KG
SW8270	2,6-DINITROTOLUENE	37.7	UG/KG
SW8270	2-CHLOROBENZALDEHYDE	122	UG/KG
SW8270	2-CHLOROBENZOIC ACID	1390	UG/KG
SW8270	2-CHLORONAPHTHALENE	54.3	UG/KG
SW8270	2-CHLOROPHENOL	97.7	UG/KG

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
SW8270	2-METHYL-3-NITROANILINE	185	UG/KG
SW8270	2-METHYL-5-NITROANILINE	118	UG/KG
SW8270	2-METHYLNAPHTHALENE	101	UG/KG
SW8270	2-METHYLPHENOL (O-CRESOL)	83.6	UG/KG
SW8270	2-NITROANILINE	156	UG/KG
SW8270	2-NITRODIPHENYLAMINE	162	UG/KG
SW8270	2-NITROPHENOL	102	UG/KG
SW8270	3,3'-DICHLOROBENZIDINE	132	UG/KG
SW8270	3,5-DINITROANILINE	142	UG/KG
SW8270	3-CHLOROBENZALDEHYDE	75	UG/KG
SW8270	3-NITROANILINE	94.7	UG/KG
SW8270	4,6-DINITRO-2-METHYLPHENOL	155	UG/KG
SW8270	4-BROMOPHENYL PHENYL ETHER	60.2	UG/KG
SW8270	4-CHLORO-3-METHYLPHENOL	119	UG/KG
SW8270	4-CHLOROANILINE	125	UG/KG
SW8270	4-CHLOROBENZALDEHYDE	88.6	UG/KG
SW8270	4-CHLOROPHENYL PHENYL ETHER	33.9	UG/KG
SW8270	4-METHYLPHENOL (P-CRESOL)	129	UG/KG
SW8270	4-NITROANILINE	144	UG/KG
SW8270	4-NITROPHENOL	145	UG/KG
SW8270	ACENAPHTHENE	52.7	UG/KG
SW8270	ACENAPHTHYLENE	55.3	UG/KG
SW8270	ANILINE	68.9	UG/KG
SW8270	ANTHRACENE	41.7	UG/KG
SW8270	BENZO(A)ANTHRACENE	48.8	UG/KG
SW8270	BENZO(A)PYRENE	44.5	UG/KG
SW8270	BENZO(B)FLUORANTHENE	73.3	UG/KG
SW8270	BENZO(G,H,I)PERYLENE	66.8	UG/KG
SW8270	BENZO(K)FLUORANTHENE	47.6	UG/KG
SW8270	BENZOIC ACID	211	UG/KG
SW8270	BENZYL ALCOHOL	223	UG/KG
SW8270	BENZYL BUTYL PHTHALATE	45.7	UG/KG
SW8270	BIS(2-CHLOROETHOXY) METHANE	47.3	UG/KG
SW8270	BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL	41.9	UG/KG
SW8270	BIS(2-ETHYLHEXYL) PHTHALATE	121	UG/KG
SW8270	CARBAZOLE	72.7	UG/KG
SW8270	CHRYSENE	46.8	UG/KG
SW8270	DI-N-BUTYL PHTHALATE	71.5	UG/KG
SW8270	DI-N-OCTYLPHTHALATE	74.8	UG/KG
SW8270	DI-N-PROPYL ADIPATE	120	UG/KG
SW8270	DIBENZ(A,H)ANTHRACENE	73.9	UG/KG
SW8270	DIBENZOFURAN	60.2	UG/KG
SW8270	DIETHYL PHTHALATE	31.6	UG/KG
SW8270	DIMETHYL PHTHALATE	39	UG/KG
SW8270	FLUORANTHENE	90.9	UG/KG
SW8270	FLUORENE	39.9	UG/KG
SW8270	HEXACHLOROBENZENE	51	UG/KG
SW8270	HEXACHLOROBUTADIENE	44.7	UG/KG

TABLE 3-4: SUMMARY OF PHASE I ANALYTICAL METHODS

Crushed Drum Removal Work Plan
J-3 Range
Camp Edwards, Massachusetts

LAB METHOD	ANALYTE	MDL	UNITS
SW8270	HEXACHLOROCYCLOPENTADIENE	172	UG/KG
SW8270	HEXACHLOROETHANE	59.5	UG/KG
SW8270	INDENO(1,2,3-C,D)PYRENE	70.9	UG/KG
SW8270	ISOPHORONE	62.6	UG/KG
SW8270	N-NITROSODI-N-PROPYLAMINE	84.1	UG/KG
SW8270	N-NITROSODIMETHYLAMINE	61.9	UG/KG
SW8270	N-NITROSODIPHENYLAMINE	185	UG/KG
SW8270	NAPHTHALENE	46.4	UG/KG
SW8270	NITROBENZENE	91.3	UG/KG
SW8270	PENTACHLOROPHENOL	92	UG/KG
SW8270	PHENANTHRENE	42.6	UG/KG
SW8270	PHENOL	150	UG/KG
SW8270	PYRENE	43.2	UG/KG
TOC	TOTAL ORGANIC CARBON	0.104	MG/KG
SW8270	DI-N-PROPYL ADIPATE	0.795	UG/L
SW8270	DIBENZ(A,H)ANTHRACENE	0.75	UG/L
SW8270	DIBENZOFURAN	1.34	UG/L
SW8270	DIETHYL PHTHALATE	0.46	UG/L
SW8270	DIMETHYL PHTHALATE	1.74	UG/L
SW8270	FLUORANTHENE	0.98	UG/L
SW8270	FLUORENE	0.53	UG/L
SW8270	HEXACHLOROBENZENE	0.83	UG/L
SW8270	HEXACHLOROBUTADIENE	0.76	UG/L
SW8270	HEXACHLOROCYCLOPENTADIENE	2.4	UG/L
SW8270	HEXACHLOROETHANE	1.36	UG/L
SW8270	INDENO(1,2,3-C,D)PYRENE	0.65	UG/L
SW8270	ISOPHORONE	1.78	UG/L
SW8270	N-NITROSODI-N-PROPYLAMINE	1.46	UG/L
SW8270	N-NITROSODIMETHYLAMINE	1.11	UG/L
SW8270	N-NITROSODIPHENYLAMINE	2.66	UG/L
SW8270	NAPHTHALENE	0.6	UG/L
SW8270	NITROBENZENE	1.11	UG/L
SW8270	PENTACHLOROPHENOL	2.39	UG/L
SW8270	PHENANTHRENE	0.7	UG/L
SW8270	PHENOL	1.12	UG/L
SW8270	PYRENE	0.89	UG/L
TOC	TOTAL ORGANIC CARBON	0.3563	MG/L

Table 3-5
Summary of Disposal Characterization Analytical Methods
Crushed Drum Removal Work Plan
J-3 Range

Parameter	Method
TCLP Metals	1311/6000
Volatile Organic Compounds	8260B
Semi-volatile Organic Compounds	8270
TCLP Pesticides	1311/8081
TCLP Herbicides	1311/8151
TPH by GC	8100M
PCBs	8080
Ignitability/Flashpoint	1010
Corrosivity/pH	9045
Reactive Sulfide	7.3.4.1
Reactive Cyanide	7.3.1.2
Free Liquids/Paint Filter	9095

TABLE 3-6
CONTAINERS, SAMPLE VOLUMES, PRESERVATION,
AND HOLD TIME REQUIREMENTS

SAMPLING AND ANALYSIS PLAN
 CRUSHED DRUM REMOVAL
 J-3 RANGE
 CAMP EDWARDS, MASSACHUSETTS

Medium/Parameter	Container	Preservative
Water Samples		
TCL VOA (OLC02.1)	3 40-mL glass vials with Teflon™ septums	HCl, Ice to 4 ° C
EBD (504.1)	3 40-mL glass vials with Teflon™ septums	Sodium Thiosulfate, Ice to 4 ° C
MTBE (8021)	3 40-mL glass vials with Teflon™ septums	HCl, Ice to 4 ° C
SVOA (8270)	2 1-liter amber glass bottles	Ice to 4 ° C
EPH + Targets (MADEP)	2 1-liter amber glass bottles	HCl, Ice to 4 ° C
Pesticides/PCBs (OLM02.1)	2 1-liter amber glass bottles	Ice to 4 ° C
Herbicides (8151)	2 1-liter amber glass bottles	Ice to 4 ° C
TAL Metals (ILM04.0)	1 500mL poly bottle	HNO ₃ , Ice to 4 ° C
Perchlorate (314.0)	1 500mL poly bottle	Ice to 4 ° C
Cyanide (ILM04.0)	1 250mL poly bottle	NaOH and ascorbic acid, Ice to 4 ° C
Phosphate-Phosphorous (365.2), Nitrate/Nitrite (353.2)	1 250mL poly bottle	H ₂ SO ₄ , Ice to 4 ° C
Ammonia (350.2)	1 1-liter poly bottle	H ₂ SO ₄ , Ice to 4 ° C
TOC (415.1)	2 40mL clear glass vials	H ₂ SO ₄ , Ice to 4 ° C
Chloride/Sulfate (300.0), Alkalinity (310.1)	1 500mL poly bottle	Ice to 4 ° C
Gross Alpha (900)	1 1-liter amber glass bottle	HNO ₃ , Ice to 4 ° C
Tritium (906)	1 250mL glass bottle	Ice to 4 ° C
Explosives (8330M)	2 1-liter amber glass bottles with Teflon™-lined lid, headspace	Ice to 4 ° C
Soil and Wipe Samples		
Explosives (8330M), TOC (Lloyd Kahn)	1 4oz glass jar with Teflon™-lined lid	Ice to 4 ° C
SVOCs (8270), EPH + Target PAHs (MADEP), Pesticides/PCBs (OLM03.2), Herbicides (8151)	1 16oz. Wide-mouth amber glass	Ice to 4 ° C
TCL VOA (OLM03.2)	3 40-mL glass vials with Teflon™ septums	2 Na ₂ S ₂ , 1 MeOH, Ice to 4 ° C
EBD/MTBE (8260)	3 40-mL glass vials with Teflon™ septums	2 Na ₂ S ₂ , 1 MeOH, Ice to 4 ° C

(Continued)

TABLE 3-6
CONTAINERS, SAMPLE VOLUMES, PRESERVATION,
AND HOLD TIME REQUIREMENTS

SAMPLING AND ANALYSIS PLAN
CRUSHED DRUM REMOVAL
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

Medium/Parameter	Container	Preservative
TAL Metals +Ti, Cn (ILM04.0), Phosphate/phosphorous (365.2), Nitrite/nitrate (353.2), Ammonia (350.2)	1 8oz. Wide-mouth amber glass	Ice to 4 ° C
Uranium Isotopes (E908)	1 4oz glass jar	Ice to 4 ° C
Gamma Spectroscopy, Uranium and Thorium Isotopes (Alpha Spectroscopy)	1 16oz glass jar	Ice to 4 ° C
Disposal Characterization (Soil/Sediment)		
TCLP Metals, TCLP Herbicides, TCLP Pesticides (1311/6000, 8081, 8151)	1 8oz. Wide-mouth amber glass	Ice to 4 ° C
VOCs (8260)	1 2oz. Glass jar	Ice to 4 ° C
SVOCs (8270), TPH (8015), PCBs (8082), Ignitability (1010), Corrosivity (9045), Reactivity (7.3), Paintfilter (9095)	1 16oz. Wide-mouth amber glass	Ice to 4 ° C