WORK PLAN

Antelope Valley Pesticide Container Disposal Site

Remedial Action and Closure

Prepared for:

Bureau of Land Management
Reno, Nevada

Prepared by:

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WESTON Work Order Number: 12767.309.002.0020
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List of Acronyms and Abbreviations

BLM	Bureau of Land Management
WESTON	Weston Solutions, Inc.
Site	Antelope Valley Pesticide Container Disposal Site
ft.	feet
EPA	Environmental Protection Agency
JSA	Job Safety Analysis

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1.0 INTRODUCTION

The Bureau of Land Management (BLM) tasked Weston Solutions, Inc. (WESTON) to conduct several phases of work in support of site closure at the Antelope Valley Pesticide Container Disposal Site (site), in the Battle Mountain District, Nevada.

This Work Plan describes the various project phases in detail. The Work Plan and its appendices also define the sampling and data collection methods that will be used for this project. The Work Plan is intended to accurately reflect the planned site activities; however, site conditions and additional BLM direction may warrant modifications. All significant changes will be documented in the final report.

The site, located approximately 50 miles south of Battle Mountain, Nevada, is a 12.5 acre property that includes a rectangular 2.5 acre fenced enclosure surrounded by a perimeter soil berm/ditch. The fenced enclosure area is known to have been used for collection and disposal of empty pesticide containers beginning in 1971. The containers were reportedly rinsed clean and placed into an unlined trench located within the fenced enclosure.

This Section describes the project organization and scope of work. The site history and background are described in Section 2, the steps of project execution (mobilization, excavation, sampling, transportation, and site restoration) are outlined in Section 3, and the project schedule is provided in Section 4. This Work Plan also includes the following attachments:

- A Sampling and Analysis Plan, which describes the procedures for collection of samples and the types of laboratory analyses (Appendix A);
- A Decontamination Plan, which outlines the process used to decontaminate equipment that handles potentially contaminated materials and the protocol for collection and disposal of decontamination fluids (Appendix B);
- A Spill Prevention Plan, which outlines the procedures to minimize the potential for a spill of contaminated materials and the emergency response procedures if a spill were to occur (Appendix C);
- A Journey Management Plan, which describes the process to prevent offsite exposure to the public due to the hauling of material from the site to the disposal facility (Appendix D);
- An Environmental Protection Plan, which describes steps to minimize grading erosion, stabilize soil and encourage revegetation and restoration during and following the soil removal and regarding work (Appendix E); and,
- Copies of the Project Forms that will be used daily activities form, disposal manifest, tailgate job safety analysis (JSA), and change order form (Appendix F).

1.1 Project Organization

The following is a list of project personnel and their responsibilities:

Bob Kelso, Environmental Protection Specialist

Mr. Kelso, the contracting officer representative for the BLM, is the primary decision maker for this remedial action and is the primary contact for the WESTON Project Manager.

Jonathan Anstey, P.G., Project Manager

Mr. Anstey will be responsible for project planning, scheduling, and environmental compliance. He will serve as the direct client liaison and will assign the appropriate technical resources to each task as required.

Roy Weindorf, P.G., Site Manager

Mr. Weindorf's responsibilities include field implementation of the Work Plans, field health and safety coordinator, managing the subcontractors, and working with the BLM to make field decisions.

Project Personnel Contacts

Title/Responsibility	Name	Phone Number
BLM Contracting Officer	Robert Kelso	(775) 861-6570
WESTON Project Manager	Jonathan Anstey	(303) 729-6178 / (720) 201-6105
WESTON Field Manager	Roy Weindorf	(303) 729-6146 / (817) 379-2257

1.2 Scope of Work

The following disposal and remedial action recommendations were provided to the BLM in the *Site Characterization and Disposal Recommendations Report* (WESTON, 2009).

- To eliminate the risk of potential exposure and environmental impacts associated with the on-site burial of pesticide containers within the known disposal trench, either cap the backfilled trench with a low permeability material or remove all exposed and buried containers for off-site disposal and backfill all excavations to match the adjacent grade.
- Any liquids observed in exposed containers should be handled as hazardous waste and disposed of at a properly licensed facility.
- Close the disposal site by prohibiting further disposal of pesticide containers at the site and removal of the structure and security fence.

The selected scope of work outlined in this Work Plan includes removal and disposal of buried containers and any related contaminated materials at an off-site location (remedial action) and returning the site to post beneficial use status (closure).

2.0 BACKGROUND

2.1 Location and Description

The site is located within Antelope Valley in Lander County, Nevada at latitude 40˚ 02' 30" N and longitude 117˚ 14' 30" W (Figure 1 – Site Map). The site, as shown on the 7.5 minute Mt. Moses Quadrangle Map (United States Geological Survey, 1990), is located approximately 5.5 miles west of Route 305, which connects the Towns of Battle Mountain, Nevada and Austin, Nevada. The Town of Austin, near the interchange of Routes 305 and 50, lies approximately 47 miles south of the site. Battle Mountain, adjacent to the interchange of Route 305 and Interstate 80, lies approximately 42 miles north. The legal description of the site is NW 1/4 SE 1/4, Section 18, Township 25 N, Range 42 E, MDM. The site lies within an undeveloped area at the end of an unimproved access road approximately 0.5 miles south of the county road leading to Antelope Valley.

The site is located at the northern end of the Bridges Hills at an approximate elevation of 4,920 feet (ft.) above mean sea level. Slope at the site is from west to east (away from the Bridges Hills) at about 12%. The major topographic feature in the area is Antelope Valley, which is drained by the ephemeral Cain Creek. The main axis of Antelope Valley occurs west of the site and is bounded by the Augusta Mountains on the west, the Fish Creek Mountains on

the north and the Bridges Hills on the east. The valley narrows as it bends eastward around the Bridges Hills, opening again into the Middle Reese River Valley. Cain Creek lies approximately 0.25 miles north of the site and flows northeasterly into the Reese River, which in-turn flows northward toward Battle Mountain.

The site consists of a 12.5-acre parcel with unmarked boundary corners. A two-acre fenced enclosure is located near the presumed center of the 12.5-acre parcel. The 8 ft. high fence consists of metal poles and chain-link fencing with two strands of barbed wire on top. The 417 by 209 ft. fenced enclosure contains a small structure and one partially open disposal trench oriented approximately north-south, located approximately 35 ft. away from the western fence. The trench is approximately 119 ft. by 27 ft. by 10 ft. (with an additional 37 ft. of backfilled material on the northern end). A ramp at the south end of the trench provides access to the disposal area, and metal drums and glass containers are presently exposed at the surface.

Access to the site is through a locked gate located in the northeast corner of the fenced enclosure. The combination lock on the access gate is the property of the BLM Battle Mountain District. Lack of any rubbish other than the permitted pesticide containers indicates the area within the fenced enclosure apparently has been utilized solely for disposal of pesticide containers. The glass containers were recently left among the empty metal drums, as reported by the BLM. The gate and fence are in good condition and have posted warning signs. A one to two feet high earthen berm surrounds the fence to divert surface runoff from entering the fenced area. The structure and an attached trellis, reportedly were used for rinsing empty pesticide containers prior to disposal.

2.2 Site History

The two acre fenced enclosure is public land managed by BLM that was selected for disposal of empty pesticide/herbicide containers. An application from Lander County for a Special Land Use Permit was approved. In 1985, BLM agreed to sell the property to Lander County, but a final patent was not issued. A detailed chronology of site events prior to 1886 is available in a *Preliminary Assessment Report* (AEPCO, 1986). WESTON was retained in 1988 to conduct a site inspection prior to issuing the patent. No soil contamination was identified during the 1988 inspection. In September 1992, drums still containing fluid were repackaged to prevent leaking. The Nevada Division of Environmental Protection requested that these overpacked drums be disposed of at a hazardous waste landfill, the trench capped with 12 inches of clay, and that the BLM conduct annual groundwater monitoring for five years. The referenced drums were shipped to a hazardous waste landfill in January 1994.

In 2009 WESTON completed a follow-up environmental investigation to further characterize subsurface soil and groundwater at the pesticide disposal trench site. Subsurface soil samples collected from within the trench, adjacent to the trench and in the surrounding 2.5-acres were reported with no detections of pesticide compounds. Groundwater was not encountered during the subsurface investigation activities. A sample was collected from fluid observed within a glass container exposed in the disposal trench. The fluid was reported to contain Alpha-BHC at 88 micrograms per liter and Heptachlor Epoxide at 380 micrograms per liter. The results of the 2009 investigation and recommendations for the site closure were reported in the *Site Characterization and Disposal Recommendations Report* (WESTON, 2009)

3.0 PROJECT EXECUTION

The current site activities will include the excavation of the exposed containers and buried drums and associated soils, confirmation sampling following the excavation, sampling of the excavated soil after separation from the drums, transportation and off-site disposal of excavated drums and associated impacted media, backfilling the trench, regrading the site and reseeding of disturbed areas.

3.1 Mobilization

WESTON will mobilize to the site on 3 January 2011. Equipment mobilized to the site will included a Bobcat S300 Turbo skid steer, a Bobcat 442 track hoe, and a Remu L150 screening bucket, or similar equipment. In addition, roll-off containers will be continuously mobilized, loaded, and demobilized from the site throughout the project.

Appendix C - Spill Prevention Plan (SPP) describes the best management practices to prevent spills from contaminating storm water runoff during the implementation of the remedial action.

3.2 Excavation

Excavation activities will begin at the southern most extent of the known disposal container burial area. Exposed empty and crushed containers of various sizes will be removed using an excavator. The excavation will extend north approximately 100 feet and ten feet below ground surface until bedrock is encountered based on the findings of the investigation completed by WESTON in 2009. The excavator will remove crushed drums and other disposal debris, and then stockpile them for screening to remove excess soil. This soil will be stockpiled on plastic to prevent potential cross contaminating the surface soil. Soil shaken from the pesticide container will be added to the stockpile. The stockpiled soil will either be used as clean backfill or be disposed of off-site, based on laboratory analytical results. To minimize the length of time the potentially impacted soil is exposed to the elements (wind and precipitation), soil samples will be submitted with an expedited turn-around-time. When the excavation is completed, the area will be scanned with a magnetic locator to ensure that no metal remains in the excavation area.

The stockpiled drums will be loaded into the screening bucket (or shaker bucket) and screened until relatively free of dirt, gravel, and organic debris. When the drums are screened they will be placed, both by hand and mechanical means, into a roll-off container. Glass containers observed in the trench during the last phase of the investigation will be loaded by hand.

Soil exhibiting apparent staining from within the excavation or removed from the containers during the screening (shaker bucket) will be segregated and placed on 40-mil protective plastic. The segregated soil will then be sampled to determine presence of contaminants and waste classification. WESTON believes, based on the findings of the 2009 investigation that impacted soil if found, will be a non-regulated waste.

The chain link fence will be separated from the posts and rolled up for recycling or reuse by the BLM, if requested by the site representative. Otherwise, the fence will be disposed of as refuse. The posts and shed will be removed using the excavator and disposed of in one of the roll off containers as general refuse.

3.3 Sampling

Soil samples will be collected every 25 feet along the two side walls and the bottom of the excavation to confirm the potentially impacted soil has been removed. Additionally, one soil sample will be collected per 100 cubic yards of stockpiled soil. These samples will be collected by WESTON's on-site geologist from areas that appear to have been impacted or contain elevated PID readings. The soil samples will be collected utilizing a decontaminated hand trowel.

Appendix A – Sampling and Analysis Plan (SAP) provides technical guidance and support for the field sampling activities and describes methods and procedures that will be followed in the field sampling process. Appendix B – Decontamination Plan provides standard operating procedures that will used to prevent cross contamination of samples and the surrounding area during the implementation of the remedial action.

Soil samples will be placed into laboratory supplied sample jars. The headspace will be minimized by filling the jar as completely as possible then tightly securing the container lid. Completed labels will be affixed to sample containers prior to or immediately after sampling. The labels will include the following information:

- Sample identification, based on the sample nomenclature defined below;

- The site name;
- Analytical methods; and,
- Sample time, date, and initials of sampler.

After labeling, the sample jar will immediately be sealed in ziplock bags and placed in the designated cooler with ice. All sampling information will then be recorded in the field logbook. Finally, a chain-of-custody will be completed. Prior to relinquishing the shipping cooler, fresh ice will be added, and a the Custody Seal will be affixed to the cooler

The soil samples will be submitted to a State of Nevada certified laboratory, ALS Laboratory Group of Fort Collins, Colorado. Samples will be submitted under proper chain-of-custody for pesticide analyses including Organochlorinated Pesticides by Environmental Protection Agency (EPA) Method 8081A and Organophosphorus Pesticides by EPA Method 8141A. Soil samples will be submitted on an expedited turn-around-time.

3.4 Transportation and Disposal

US Ecology Nevada Inc. (Beatty, Nevada) has been identified as a permitted Resource Conservation and Recovery Act Subtitle C/D treatment, storage, and disposal facility. Any intact containers with stored fluids will be placed in an approved shipping container for transportation to the selected facility.

Appendix D - Journey Management Plan (JMP) describes the process that will be utilized to protect the public and the environment during the transportation of potentially impacted material on public roadways during the implementation of the remedial action.

3.5 Site Restoration

All of the excavated soil that was stockpiled, sampled, and found to be free of pesticides will be placed back into the excavated area. If additional backfill soil is needed, WESTON plans to utilize on-site soil berm material to complete the backfill of the soil excavation and existing disposal trench.

The site will be regraded to the appropriate natural site slope to prevent impeding the flow of surface water. This includes regrading of the soil excavation backfill, existing disposal trench backfill, and any remaining portions of the storm water berms/ditch surrounding the site.

WESTON has obtained a waiver from the requirement for a Construction Stormwater Permit and the Notice of Intent, which outlines the Best Management Practices to prevent contamination of the waters of the State of Nevada due to the disturbance of more than 1 acre of soil.

The area of disturbed soil will be reseeded with a seed mixture appropriate for the regional ecology and approved by BLM. The seed will be broadcast and harrowed for approximately 2.5 acres using an all-terrain vehicle.

Appendix E - Environmental Protection Plan (EPP) describes the measures that will be taken to restore topsoil and to minimize erosion during the implementation of the remedial action.

4.0 PROJECT EXECUTION SCHEDULE

Figure 2 - Schedule depicts the project schedule with project start and completion dates. The field work will be dependent on the weather, particularly snow and frozen ground conditions.

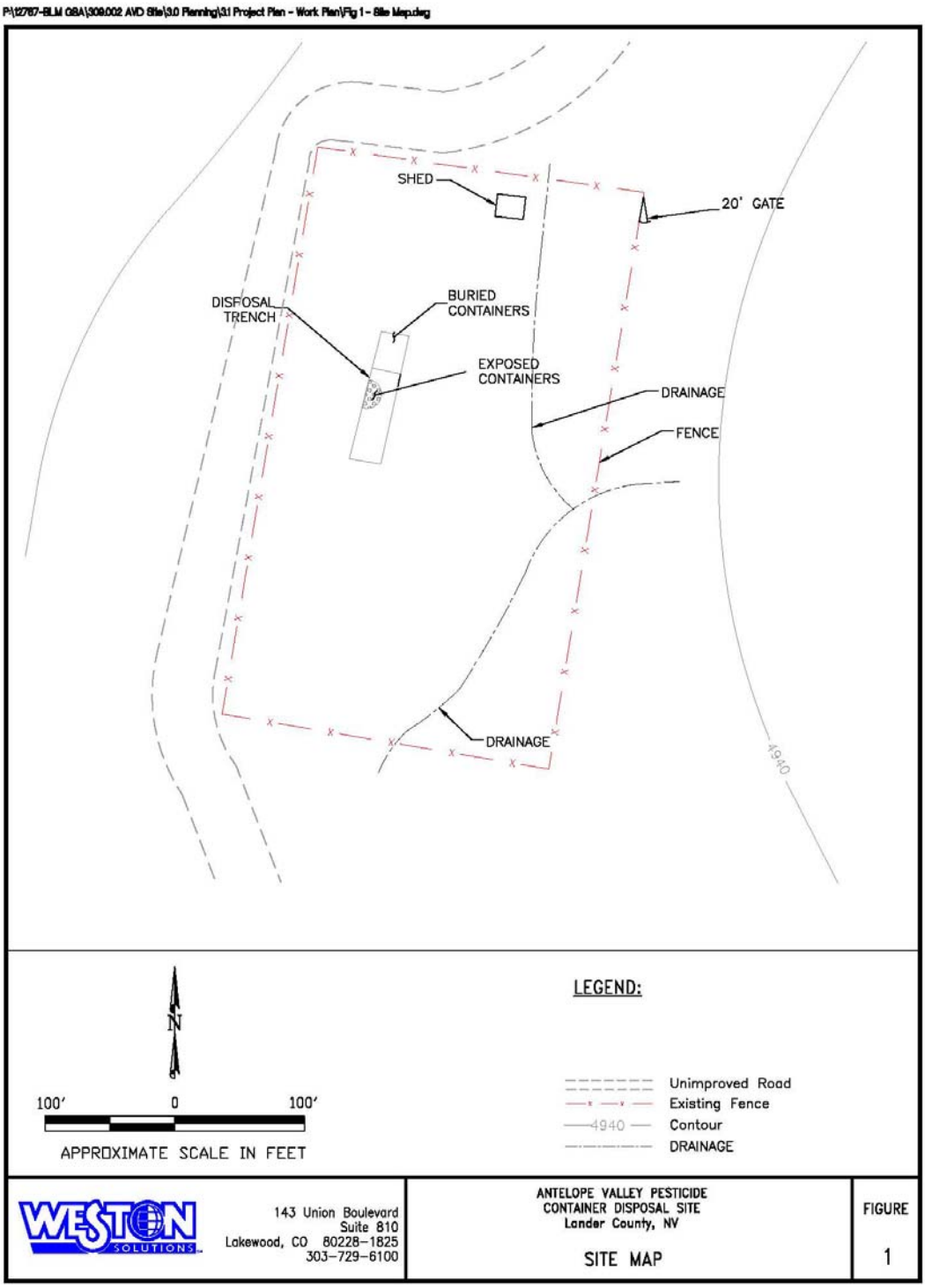

Figure 1 Site Map

Activity Description	Early Start	Early Finish	Orig Dur	Rem Dur
BLM - Antelope Valley Pesticide Disposal Site				
Kick-off Meeting	30SEP10	30SEP10	1	1
Project Procurement	01OCT10	11NOV10	30	30
Prepare Project Work Plans	01OCT10	29OCT10	21	21
BLM Review Project Work Plans	01NOV10	12NOV10	10	10
Address Comments/Finalize Project Work Plans	15NOV10	19NOV10	5	5
Submit Final Project Work Plans		19NOV10	0	0
Prepare Project Safety Plans	01OCT10	29OCT10	21	21
BLM Review Project Safety Plans	01NOV10	12NOV10	10	10
Address Comments/Finalize Project Safety Plans	15NOV10	19NOV10	5	5
Submit Final Project Safety Plans		19NOV10	0	0
Mobilization	03JAN11*	07JAN11	5	5
Container/Soil Removal Action	10JAN11	21JAN11	10	10
Backfill Excavations	24JAN11	25JAN11	2	2
Removal of Existing Fence and Shed	26JAN11	01FEB11	5	5
Regrade Site	02FEB11	03FEB11	2	2
Reseed Site	04FEB11	07FEB11	2	2
Demobilization	08FEB11	09FEB11	2	2
Prepare Draft Final Reports	10FEB11	02MAR11	15	15
BLM Review of Draft Final Reports	03MAR11	16MAR11	10	10
Address Comments/Submit Final Reports	17MAR11	23MAR11	5	5
Project Completion		23MAR11	0	0

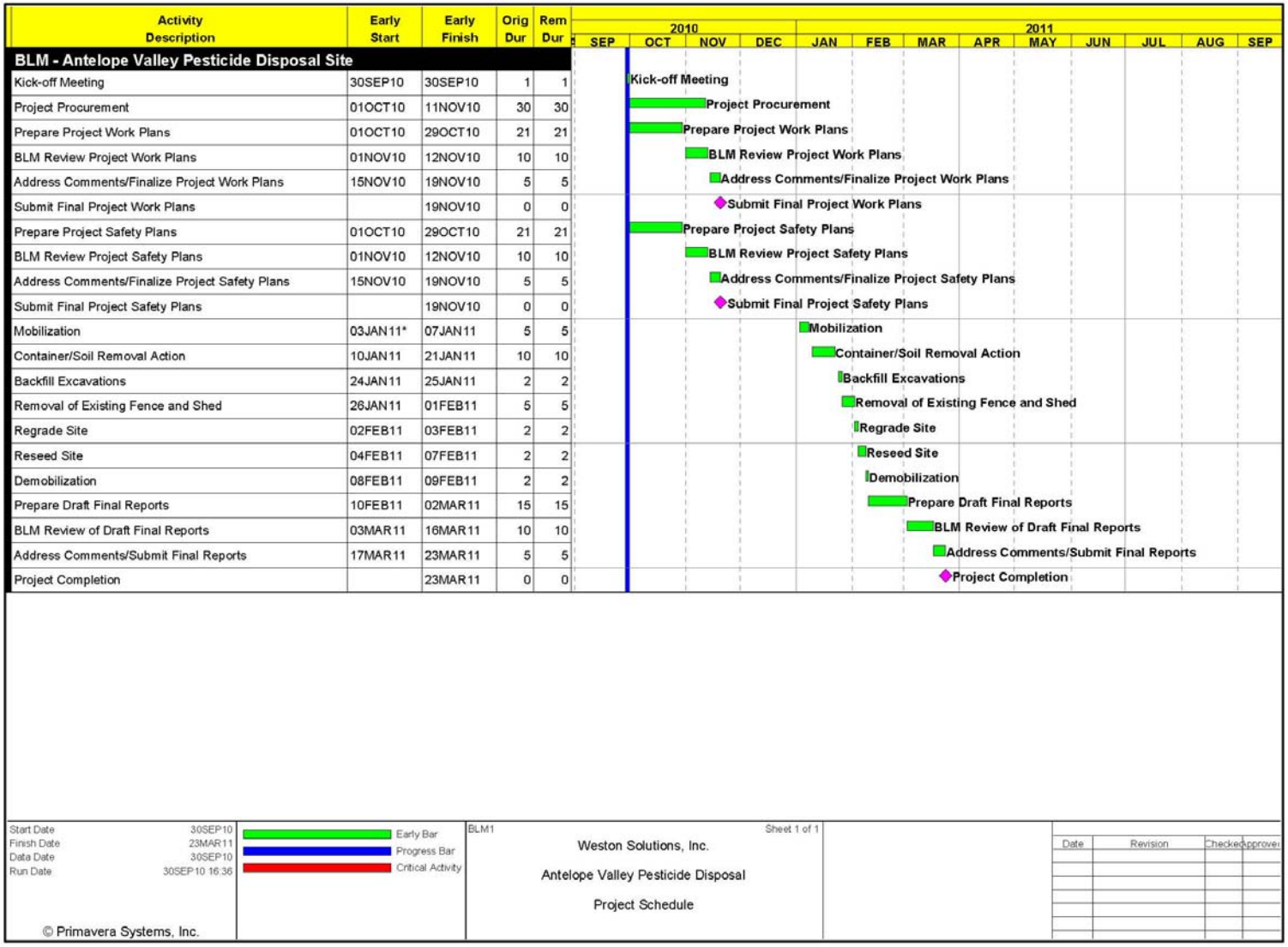

Figure 2 Project Schedule

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APPENDIX A
SAMPLING ANALYSIS PLAN

Antelope Valley Pesticide Container Disposal Site

Remedial Action and Closure

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LIST OF ACRONYMS AND ABBREVIATIONS

COC	Chain-of-Custody
EPA's	U.S. Environmental Protection Agency's
ERT	Environmental Response Team
MS/MSD	Matrix Spike/ Matrix Spike Duplicate
QA	Quality Assurance
QC	Quality Control
SAP	Sampling and Analysis Plan
SOPs	Standard Operating Procedures
WP	Work Plan

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1.0 SAMPLING OBJECTIVES

The objectives of the Remedial Action are as follows:

- Eliminate the risk of potential exposure and environmental impacts associated with the on-site burial of pesticide containers;
- Remove any liquids observed in exposed containers and dispose at a properly licensed facility; and,
- Site closure.

This Sampling and Analysis Plan (SAP) was developed, and will be implemented, to satisfy each objective noted above. The main objective of the SAP is to provide technical guidance and support for the field activities. The SAP describes all methods and procedures that will be followed in the field sampling process.

2.0 Analytical Suite

The compounds that will be analyzed for during these field activities for evaluation of soil and wastes will be the Environmental Protection Agency (EPA) SW846 analytical parameter lists for organochlorinated pesticides by EPA method 8081A and organophosphorus pesticides by EPA method 8141A.

3.0 SAMPLING METHODOLOGY

The investigation described in the Work Plan (WP) and SAP is designed to collect analytical data to confirm that no pesticides remain on-site and to facilitate site closure.

3.1 Sample Number and Media

Confirmation samples will be collected at 25 ft. intervals from both side walls and the bottom of the excavation. Current estimates show that both the open portion of the trench and the buried portion are approximately 100 ft. long. Therefore, 10 sidewall and 5 bottom samples plus 2 samples (one from each end) will be collected to confirm the absence of pesticides in the disposal trench. Confirmation soil samples will be collected following the removal of soil that appears to be impacted based on soil stating, odor or readings collected from a PID. Floor samples will be collected from locations beneath areas that exhibited signs of impacts (soil staining, odor, elevated PID readings) or the center line of the trench. Sidewall samples will be collected from locations corresponding to soil that was removed based on signs of impacts (soil staining, odor, elevated PID readings) or 1 to 2 ft. above the historic floor of the trench. In addition, to confirmation sampling, samples of any stockpiled soil will be collected to ensure that it may be used as backfill in order to close the site. One sample will be collected from every 100 cubic yards. Based on the estimated excavation 3 stockpile samples will be collected. If field conditions indicate the need additional samples will be collected in order to satisfy the objectives listed above.

3.2 Sample Nomenclature

Confirmation soil sample nomenclature is designed to describe the site location (AVDS), the sampling location (CS01 = Confirmation Soil Location 01) and the depth interval of the sample (ground surface to one foot bgs = 0001), as follows:

AVDS-CS01-0001

Stockpile samples will be identified as SP as follows:

AVDS-SP01-0001

4.0 SAMPLING Procedures

All sampling procedures are designed to conform to those specified by the EPA's Environmental Response Team (ERT). Attachment B-1 provides copies of these SOPs. The following subsections summarize the sampling methods to be utilized in each media.

4.1 Soil Sampling Program

The soil samples will be collected utilizing a decontaminated hand trowel. See Decontamination Plan (Appendix B to the WP) for Decontamination Procedures. Soil samples will be collected from 0 to 1 foot below the exposed surface. Soil will be placed into a laboratory supplied sample jar. The headspace will be minimized by filling the jar as completely as possible then tightly securing the container lid. Completed labels will be affixed to sample containers prior to or immediately after sampling. The labels will include the following information:

- Sample identification, based on the sample nomenclature defined above;
- The site name;
- Analytical methods; and,
- Sample time, date, and initials of sampler.

After labeling, the sample jar will immediately be sealed in ziplock bags and placed in the designated cooler with ice. All sampling information will then be recorded in the field logbook. Finally, a chain-of-custody (COC) will be completed. Prior to relinquishing the shipping cooler, fresh ice will be added, and a the Custody Seal will be affixed to the cooler

4.2 Waste Sampling Program

Grab samples will be collected from any containers found to have liquid remaining in them. Each grab sample will be immediately transferred to an appropriate laboratory supplied container, properly labeled, and placed in a cooler and maintained at 4°C. Chain-of-custody forms will be completed for each sample with laboratory analysis specified for as listed in Section 2.

4.3 Quality Assurance/ Quality Control (QA/QC) Samples

As part of the sampling program for soils, QA/QC samples will be collected. The QA/QC samples will consist of Matrix Spike (MS)/ MS Duplicate (MSD), and blind duplicates. Blind duplicates will be collected on a frequency of one blind duplicate for every 10 samples or parts thereof collected. For example, if 23 soil samples are collected, then three blind duplicates will be collected. MS/MSD samples will be requested for every 20 samples or parts thereof.

5.0 STANDARD OPERATING Procedures (SOP)

The following list of SOPs provided by the EPA ERT will be used to standardize sampling activities at the site. Each SOP is also provided in this section.

SOP-T03	SOP Field Reporting and Documentation
SOP-T15	SOP For Field Measurements
SOP-T16	SOP For Soil and Waste Sampling
SOP-T18	SOP For Sample Containers, Preservation, and Holding Times
SOP-T19	SOP For Sample Classification, Storage, Packaging, and Shipment
SOP-T22	SOP For Sample Control and Custody Procedures

STANDARD OPERATING PROCEDURE (SOP)
FOR FIELD REPORTING AND DOCUMENTATION
(SOP-T3)

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STANDARD OPERATING PROCEDURE

FOR FIELD REPORTING AND DOCUMENTATION

(SOP-T3)

1.0 SCOPE OF PROCEDURE

1.1 Purpose of Procedure

Standard Operating Procedure-T3 (SOP-T3) describes the requirements for reporting of procedures, acquired data, and observations during field operations as described in the Work Plan, Sampling and Analysis Plan, or other specifications to provide documentation of the work. Date collected using the SOPs will be used in conjunction with previously collected site data. Therefore, to the extent practical, the procedures presented herein shall be comparable to those used previously, especially with respect to sample collection, handling, and laboratory analyses.

1.2 Scope Covered by SOP-T3

- General Documentation Requirements and Considerations
- Standard Field Documents and Their Use
- Field Document Control System

1.3 Related Procedures and Documents

- Geologic Logging and Material Classification Procedures (SOP-T4)
- Borehole Grouting Procedures (SOP-T5)
- Groundwater Monitoring Well Installation (SOP-T7)
- Site Media Sampling Procedures (SOP-T12, T13, and T16)
- Field Measurements (SOP-T15)
- Sample Classification, Storage, Packaging, and Shipment (SOP-T19)
- Equipment Decontamination (SOP-T20)
- Sample Control and Custody Procedures (SOP-T22)
- Equipment Calibration and Maintenance (SOP-T23)
- Handling of Investigation - Generated Materials (SOP-T24)
- Work Plan, Sampling and Analysis Plan (SAP), and Quality Assurance Project Plan

1.4 Work Specifications

Field reporting and documentation as described herein shall be conducted for all activities as so specified in the Work Plan, Sampling and Analysis Plan, or other parent document referencing this SOP. In the event there is a conflict in specifications presented herein with those presented in the parent document referencing this SOP, then the specifications in the parent document will be followed to the extent they are different.

1.5 Definitions of Standards

Definitions of terms and adopted standards shall be in accordance with an attachment to this SOP, if so provided. Otherwise, it is intended that they be consistent with those used or implied in the Work Plan, Sampling and Analysis Plan, or other parent document referencing this SOP.

2.0 EXECUTION

2.1 General Requirements and Considerations

Documentation should be recorded and maintained for all planned activities and other significant occurrences at the site during field operations.

Where possible, organized documentation should be completed on appropriate forms designed to prompt the user for all standard information for planned activities. Significant data collected and observances made that may be required as legal evidence should be recorded in original form in a bound field logbook, and may be transcribed to a form or duplicated on a form. In any case, the bound logbook record will take official precedence over transcribed or duplicate form records, if the same data (whether conflicting or agreeing) is contained in both. All written entries made in the field log book will be made using indelible ink. Documentation should be kept for the following planned field activities and occurrences:

- All planned and revised sampling activities and sample data
- Field testing and analysis results
- Labeling and chain-of-custody procedures
- Drilling, well installation, grouting and well development activities
- Hydrogeologic testing

- Air monitoring
- Decontamination of personnel and equipment
- Packaging and shipping of samples
- Calibration and maintenance procedures
- Exposure incidents and accidents (see Health and Safety Plan for requirements)
- Field audits and corrective action

All methods of documentation should be consistent with the requirements of SOPs for obtaining samples, calibration of equipment, preparing samples for analysis, and tracking of samples and documents. In the event this or other SOPs differ, the requirements of the QAPP will take precedence.

All recordings of field procedures, observations, and data should be signed, dated, and legible, and the field documents should be protected against contamination (soiling and smudging) to the extent possible.

Photocopies should be made periodically of all field forms and log books and maintained in a duplicate file. Copies should be stamped, clearly marking the copy as a copy.

2.2 Standard Field Documents and Their Use

2.2.1 Field Logbook

Logbooks will provide the documentary evidence for procedures as performed by field personnel. Each entry should be legible and contain accurate and complete field documentation of specific activities. The logbook should contain only facts and observations. Each logbook page should be numbered, dated, and signed by all personnel making entries on that page. Under no circumstances will pages be removed from the logbook. General information that should be documented in the field logbook(s) includes, but is not limited to the following:

- The objective(s) of the days' activities.
- Identification of drilling/sampling teams, major equipment used, procedures followed, and weather conditions.
- Notation of time and chronological summary of field activities and events.

- Signatures of individuals making entries.

Specific information that should be documented in the field logbook includes, but is not limited to:

- Sampling data, descriptions, references, and labeling described for specific activities presented in the SOPs for sampling and chain-of-custody procedures.
- Sample identification, analyses ordered, number of containers shipped, laboratory destination, and chain-of-custody records sent.
- Results of measurements and calibration of field instruments used.
- Documentation of proper borehole grouting and equipment decontamination.
- Photography information and descriptions.
- Detailed description of health and safety related activities at the site, including use of personal protective equipment and air monitoring data.
- Project field logbooks should generally not contain personnel records or data which is not relevant to the work being performed at the site.

2.2.2 Field Drilling/Sampling/Installation Forms

Documentation of drilling, sampling, and well installation, along with other types of field activities, may be kept on activity-specific forms as a more comprehensive means of recording data from those activities.

Forms used should reflect the specific data required in the Work Plan, SAP, or SOP addressing that specific activity. The information collected on forms should generally duplicate data recorded in the field logbook, but should allow for more detail to be entered. Such activity-specific forms should be suitable as back-up to the Daily Activity Report (see Section 2.2.8).

2.2.3 Calibration/Maintenance Records

Documentation of calibration and maintenance of individual field instruments should be kept in the field book for each time the calibration or maintenance is performed. Calibration and maintenance records may be documented on special forms but should be referenced in the field

book. A calibration log should be maintained in a hard-bound log book as long-term record of calibrations for that project. Data and information to be recorded in the calibration and maintenance record and calibration logbook are specified in SOP-T23, Calibration and Maintenance of Field Instruments.

2.2.4 Sample Labels

Self-adhesive sample labels shall be affixed to each sample container, providing the information required as specified in SOP-T22, Sample Control and Custody Procedures. In cases where field samples will be packaged in shipping containers to satisfy DOT requirements as outlined in SOP-T19, a duplicate label will also be placed on the outer container along with any other DOT required information as specified in SOP-T19.

2.2.5 Chain-of-Custody Forms and Custody Seals

A chain-of-custody form shall accompany each batch of samples transported from the site. Forms will contain the minimum information specified in SOP-T22. If samples within a given shipment are to be separated at some point before their final disposition, then separate chain-of-custody forms will be provided for each separate group of samples. A custody seal shall be placed over the lid and body of the sample container, including one over any other package or container required to ship the sample. The custody seal shall be used in accordance with SOP-T22.

2.2.6 Decontamination Records

Decontamination records shall be kept on forms or within the field log book to document observations that verify proper personnel and equipment decontamination procedures are followed. Personnel decontamination procedures are presented in the Health and Safety Plan. Equipment decontamination procedures are presented in SOP-T20.

2.2.7 Visitor's Log

A log will be maintained at the site to record names of people visiting the site. Dates and times of arrivals and departures of visitors and the nature of their activities will be recorded. It should be noted by the site manager whether the visitor remained in the clean zone of the site or not. Unauthorized persons will not be permitted onsite during any field activities. Unauthorized visitors should be reported to the project manager for proper action.

2.2.8 Daily Activity Report

A summary of daily field activities should be kept to report the progress of field operations for that day. Information that should be summarized includes, but is not limited to, the following:

- Sampling locations worked
- Drilling footage planned/completed
- Drilling rig or major equipment work hours
- Number of samples planned/taken at each location
- Location and status of monitoring well installations
- Summary of other field activities
- Summary of supplies and water used
- Identification of problems, downtime and corrective action taken
- Summary of weather and weather impacts
- Personnel and visitors recorded on-site that day
- Change in the work scope or methodology initiated in the field

Copies of field forms and logbooks may be attached to the Daily Activity Report for submittal to the Project Manager.

2.2.9 Photographs

Photographs may be used during site investigation to identify topographic features and to document site structures. Information concerning each photograph must be entered into the logbook immediately after the photograph has been taken, including a photograph identification, a description of the object being photographed, the time taken, and the geographic direction in

which the photograph was taken. If photographs of samples are taken, then the photographs should be in color with the samples placed on a back board on which the following is indicated:

- Project name and number
- Sample location and depth
- Date and time of sample
- Length and orientation (top/bottom) of sample

2.2.10 Other Field Documentation

Other field documentation may be generated at the site for purposes of quality assurance. Such documentation includes audit reports and corrective action notices.

2.3 Document Control System

2.3.1 Project Files

Project files including all non-draft records, documents, and information relating to the performance of the work at the site and the removal of waste materials from the site may be maintained at the site. These files can include sampling analyses, chain-of-custody records, manifests, contracts, trucking logs, bill of lading, receipts, records pertaining to traffic routing, destination of waste materials, and volume and chemical nature of such materials, correspondence, and other final documents produced. A filing system should be used for maintaining project documents in a complete, organized manner so the status of these records can be easily attainable. Each file entry should be given a unique sequential reference number with these kept on an official file docket or inventory form.

2.3.2 Serialization

Logbooks, chain-of-custody forms, and other data records will be serialized before being used in the field. Serialization can assist in controlling and tracing documents until they are placed into the project file.

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STANDARD OPERATING PROCEDURE (SOP)
FOR FIELD MEASUREMENTS
(SOP-T15)

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STANDARD OPERATING PROCEDURE

FOR FIELD MEASUREMENTS

(SOP-T15)

1.0 SCOPE OF PROCEDURE

1.1 Purpose of Procedure

Standard Operating Procedure-T15 (SOP-T15) describes the minimum acceptable requirements for procedures to obtain measurement of specific field parameters as described in the Work Plan, Sampling and Analysis Plan, or as otherwise specified.

1.2 Scope Covered by SOP-T15

- General Sampling Requirements
- Measurement Procedures

1.3 Related Procedures and Documents

- Field Reporting and Documentation (SOP-T3)
- Air Monitoring (SOP-T12)
- Equipment Decontamination (SOP-T20)
- Calibration and Maintenance of Field Instruments (SOP-T23)
- Handling of Investigation - Generated Materials
- Work Plan or Sampling and Analysis Plan (SAP)

1.4 Work Specifications

Field measurements as described herein shall be conducted for all sampling activities as specified in the Work Plan, SAP, or other document referencing this SOP. In the event there is a conflict in specs presented herein with those presented in the parent document referencing this SOP, then specifications in the parent document will be followed to the extent they are different.

1.5 Definitions of Standards

Definitions of terms and adopted standards shall be in accordance with an attachment to this SOP, if so provided. Otherwise, it is intended that they be consistent with those used or implied in the Work Plan, SAP, or other parent document referencing this SOP.

1.6 Health and Safety Considerations

This procedure may involve exposure to impacted groundwater via routes of dermal contact and inhalation. Accordingly, personnel should follow the precaution procedures and use the appropriate personal protective equipment described in the approved Health and Safety Plan.

2.0 EXECUTION

2.1 General Requirements and Considerations

Field methods to be utilized may include measurements of the following:

- Temperature, pH, and oxidation - reduction potential (ORP)
- Specific conductance
- Dissolved oxygen

The site geologist or engineer is responsible for implementing the techniques correctly, for obtaining samples required and for recording the field data and observations.

Field measurement devices shall be calibrated in accordance with the manufacturer's procedures or as specified in SOP-T23, as appropriate.

All equipment covered by this method shall be decontaminated after use in the field in a manner such that contamination of the equipment is minimized. Specific decontamination procedures are described in SOP-T20.

2.2 Procedure

2.2.1 Temperature/pH/ORP

Temperature, pH, and oxidation/reduction potential (ORP) can be measured using one instrument with different probes, although separate instruments could be used as well. The instrument shall be calibrated in accordance with the manufacturer's instructions and SOP-T23. Measurements shall be reported to the nearest 0.1^{o}C for temperature, to the nearest 0.01 unit for pH and to the nearest millivolt for ORP. All calibration and measurements shall be recorded in the field logbook.

2.2.2 Specific Conductance

The specific conductance of the sample shall be measured using a self-contained conductivity meter. The instrument shall be calibrated in accordance with the manufacturer's instructions and SOP-T23. Conductance shall be reported to the nearest ten units for readings under 1000 umho/cm and to the nearest 100 units for readings over 1000 umho/cm. Also temperature shall be measured for correction of the conductance value to 25^{o}C. All calibrations and measurements shall be recorded in the field logbook.

2.2.3 Dissolved Oxygen

Dissolved oxygen (DO) content of water samples shall be measured using a membrane electrode DO meter. The meter shall be calibrated in accordance with the manufacturer's instructions and SOP-T23. DO content shall be reported to the nearest 0.1 mg/L. All calibrations and measurements shall be recorded in the field logbook.

3.0 REFERENCES

American Water Works Association, "Standard Methods of Examination of Water and Wastewater", sixteenth edition, 1985.

U.S. Environmental Protection Agency, "Compendium of Superfund Field Operations Methods," EPA/540/P-87/001, December, 1987.

U.S. Environmental Protection Agency, "RCRA Groundwater Monitoring Technical Enforcement Guidance Document," September, 1986.

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STANDARD OPERATING PROCEDURE (SOP)
FOR SOIL AND WASTE SAMPLING
(SOP-T16)

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LIST OF ATTACHMENTS

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STANDARD OPERATING PROCEDURE
FOR SOIL AND WASTE SAMPLING
(SOP-T16)

1.0 SCOPE OF PROCEDURE

1.1 Purpose of Procedure

Standard Operating Procedure-T16 (SOP-T16) describes the minimum acceptable requirements for obtaining surface, subsurface soil, sediment, and waste samples as stated in the Work Plan, Sampling and Analysis Plan, or as otherwise specified for the purpose of chemical and physical analysis to evaluate surface and subsurface soil conditions. Soil sampling with the soil probe rig is discussed in SOP-T17.

1.2 Scope Covered by SOP-T16

- General Requirements
- Selection of Borehole Advancement Methods
- Sampling Equipment and Methods
- Sampling Procedures
- Decontamination
- Activity Reports to Agencies

1.3 Related Procedures and Documents

- Air Quality Monitoring (SOP-T12)
- Sample Classification, Storage, Packaging, and Shipment (SOP-T19)
- Equipment Decontamination (SOP-T20)
- Quality Assurance Samples (SOP-T21)
- Labeling and Chain-of-Custody (SOP-T22)
- Field Documentation (SOP-T3)
- Sampling and Analysis Plan (SAP)
- Handling of Investigation - Generated Materials (SOP-T24)
- Applicable State Regulations

1.4 Work Specifications

Soil, sediment, and waste sampling as described herein will be conducted at the frequency and locations which are specified in the Work Plan, SAP, or other document referencing this SOP. In the event there is a conflict in specifications presented herein with those presented in the parent document referencing this SOP, then the specifications in the parent document will be followed to the extent they are different. Unless otherwise justified, all borehole installation procedures are to follow the applicable state regulations.

1.5 Definitions of Standards

Definitions of terms and adopted standards are in accordance with an attachment to this SOP, if so provided.

1.6 Health and Safety Considerations

This procedure potentially involves exposure to impacted soils or wastes via routes of dermal contact and inhalation. Accordingly, sampling personnel shall follow the precaution procedures and use the appropriate personal protective equipment described in the approved Site Health and Safety Plan.

2.0 EXECUTION

2.1 Borehole Advancement

2.1.1 General

Boreholes used to obtain subsurface soil and rock may be drilled with multiple objectives, including to: 1) provide geological data on subsurface conditions; namely stratigraphy, occurrence of groundwater, and depth to bedrock; 2) obtain representative disturbed or undisturbed samples for identification and laboratory testing; 3) provide holes for geophysical logging and downhole hydraulic testing; and, 4) install piezometers and monitoring wells. Prior to drilling, the following steps shall be taken:

- Check for buried utilities at all planned drilling locations. For reasons of safety and liability, no drill hole will be advanced if this step has not been completed.
- Prepare and implement an approved Health and Safety Plan, adhering to all of its provisions for protection of the field crew.
- Make provisions for disposal of all cuttings and discharge water in accordance with SOP-T24.
- A technician; a hydrogeologist or engineer was present (on-site) during drilling.

2.2 Sampling Equipment and Methods

2.2.1 Unconsolidated Soils

2.2.1.2 Continuous Tube Sampling System

The primary sampling methodology that will be used in unconsolidated soils will be a continuous tube sampling system. This sampling method typically uses a 5.5 foot steel split-barrel sampling tube that is 3.5 inches or 4.0 inches in diameter. The continuous sampler has a threaded cutting shoe which mounts on the base of the sample tube and a threaded retrieval head which mounts onto the top of the sample tube. A sample retainer can be used in sandy or gravelly soils to improve recovery. The continuous sampler is mounted within the lead hollow-stem auger flight and is adjusted so the cutting head or shoe is even with the auger cutting bits or extends to as much as 0.5 feet below the bit.

The continuous sampler is mounted on a drilling rod and does not rotate as the auger is rotated and hydraulically pushed into the subsurface. No drilling fluids are used during sampling with the continuous tube system. The hollow-stem augers are advanced in 5-foot increments. Once the augers have been advanced over a 5-foot interval, the continuous sampler is removed from the borehole (augers remain in position) and the sampling barrel is split open to expose the 5-foot long sample. A properly decontaminated sampler is used for each sample interval. Once the sample is exposed it is measured and described by the on-site hydrogeologist. Samples may be retained and submitted for chemical or physical tests.

2.2.2 Drilling Methods

Hollow-Stem Auger

Hollow-stem augers will be used to advance borings at sites as noted in the Work Plan or SAP. The augers were hydraulically pushed and rotated in 5-foot intervals with sampling occurring by lowering equipment through the center of the augers.

Hand Auger

Hand augered boring methods will be used for shallow borings (generally five feet or less). In this method, the auger will be hand rotated into the ground in six-inch intervals. The auger is then removed from the borehole and the soil removed from the bucket. The auger is cleaned and then reinserted into the borehole and hand rotated until another six-inches of soil has been removed. A stainless steel hand auger will be used at all times.

2.3 Sampling Procedures

The sampling procedures common to undisturbed sampling and disturbed sampling are described in this section. Specific requirements for selecting sample intervals or criteria for selecting sampling intervals will be specified on the SAP or Work Plan utilizing this SOP. A summary of the procedures are listed below:

- Sampler Preparation
- Drilling Fluid Composition
- Sample Interval
- Sample Identification
- Extruding Sample from Tubes
- Sample Collection and Management

Sampler Preparation

All samplers will be thoroughly clean, free of dents and nicks. The sample tubes will not be lubricated. Any defects in the thin-wall tube or cutting head, split-spoon sampler, or continuous-tube sampler constitute reasons for the sampling system to be discarded or replaced. All sample equipment will be decontaminated in accordance with SOP-T20.

Sample Interval

All borings will be sampled continuously to the designated target depth unless specific sample intervals of interest were previously determined in the Work Plan or SAP.

Sample and Drill Hole Identification

Each sample will be identified by drill hole number and by consecutive sample number. The consecutive sample number should correspond to the sample numbers recorded on the borehole logs.

Sample Collection and Management

The primary sampling methodology that will be used in unconsolidated or poorly consolidated soils will be a split-barrel sampling system. This sampling system will be used to collect all samples except the sample for geotechnical testing and samples collected during monitoring well installation. This sampling method uses a 5 foot steel split-barrel sampler that is 3.5 inches in diameter. The sampler has a threaded cutting shoe which mounts on the base of the sample tube and a threaded retrieval head which mounts onto the top of the sample tube. A sample retainer can be used in sandy or gravelly soils to improve recovery. The sampler is mounted within the lead hollow-stem auger flight and is adjusted so the cutting head or shoe is even with the auger cutting bits or extends to as much as 0.5 feet below the bit. The sampler is mounted on a drilling rod and does not rotate as the auger is rotated and hydraulically pushed into the subsurface. The hollow-stem augers are advanced in 5-foot increments. Once the augers have been advanced over a 5-foot interval, the sample is removed from the borehole (augers remain in position) and the sampling barrel is split open to expose the 5-foot long sample. A properly decontaminated sampler will be used for each sample interval. Once the sample is exposed, it will be measured and described by the on-site geologist or hydrogeologist. Samples may be retained or split for chemical or physical tests.

The following procedures will be used in collection of samples with the split-barrel sampler:

1. Break apart and decontaminate the split-barrel sampler using procedures described in SOP-T20.
2. Reassemble the sampler in a “designated clean area”.

3. Attach the sampler to the drilling rods and lower the sampler onto the center portion of the augers until the bottom of the augers is reached.
4. Measure the augers to pre-determine the sampling interval (usually 5 feet) and mark the augers with chalk to indicate when the interval has fully been sampled.
5. Slowly begin auger drilling to the pre-determined sample depth. Upon reaching the required depth, terminate the auger drilling, and remove sampler and rods from the auger. The sampler will not come in contact with the ground. If necessary, designate a "clean area" to rest the sampler on when removing the drill rods from the sampler.
6. Remove the sampler to the sample handling area and split open the sampler exposing the soil core.
7. Measure the sample recovery and record on the Soil Boring Log Form.
8. Remove the core from the sampler by placing it on clean aluminum foil that has been spread out on the sampling table. Ensure the orientation of the sample is noted (i.e., top of core or bottom of core).
9. Using a stainless steel knife, shave the outer surface of the soil core. This shaved soil will be discarded and not used in the sample collection.
10. The geologist will then describe the lithology and record the description on the Soil Boring Record.
11. The core will then be split lengthwise with a stainless steel knife (down the center), thus dividing the core in half.
12. The PID will then be used to immediately determine the levels of ionizable hydrocarbon vapors along the length of the core by passing the PID probe end down along the core. This data will be recorded on the Soil Boring Log Form.
13. Samples will be collected as described in the Site Specific Work Plan or SAP referencing this SOP.
14. A composite soil sample, if collected for analysis, will be collected from the exposed soil sample by compositing equal amounts from the specified sample interval. This sample will be placed in clean laboratory containers and submitted to the laboratory for analysis.
15. Fill all laboratory containers (4 ounce wide mount glass jars with TeflonJ lined lids) leaving no headspace in the sample container. Samples for volatile organic analyses (SW-8240) will be collected first, followed by total petroleum hydrocarbon samples, and finally metal samples. The sample container will be labeled in accordance with SOP-T19, and then immediately placed in an ice-filled cooler.
16. All samples will be prepared for shipment according to procedures described in SOP-T19.

Soil Packaging and Handling

All samples for the chemical tests will be placed in clean laboratory supplied glass jars and properly labeled. All samples that are analyzed will have a chain-of-custody form completed.

Soil Sample Description and Logging

Immediately upon retrieval, all recovered samples will be scanned for the presence of volatile organic compounds utilizing portable air monitoring photoionization instruments such as an organic vapor analyzer (OVA) or an OVM.

All recovered samples will be described and logged by the site hydrogeologist at the drill rig, in accordance with SOP-T4.

Borehole Abandonment

Borehole grouting procedures are described in SOP-T5.

3.0 DOCUMENTATION

Record sample data and field observations in accordance with requirements specified in SOP-T22 for labeling and custody control.

Specified procedures for describing the samples and logging the subsurface sampling are presented in SOP-T4.

An example Boring Record suitable for use in surface soil, subsurface soil, and sediment sampling is provided as Attachment T16-1. It provides documentation regarding the following activities that are generally associated with a soil sampling event:

- Project and field activity identification information
- Drilling data
- Field personnel
- Dates of activity
- Sample descriptions
- Log of subsurface sampling
- Site or location description
- Vapor readings

4.0 REFERENCES

ASTM Standards on Groundwater and Vadose Zone Investigations, 2nd Edition, American Society for Testing and Materials, Philadelphia, PA, 1994.

Driscoll, Fletcher G., Groundwater and Wells, Second Edition, St. Paul, Minnesota, 1986.

U. S. EPA, "Compendium of Superfund Field Operations Methods", Publication EPA/540/P-87/001, December 1987.

STANDARD OPERATING PROCEDURE (SOP)
FOR SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES
(SOP-T18)

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STANDARD OPERATING PROCEDURE
FOR SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES
(SOP-T18)

1.0 SCOPE OF PROCEDURE

1.1 Purpose of Procedure

Standard Operating Procedure-T18 (SOP-T18) describes the requirements for preparation of sample containers, preservation of samples, and sample holding times as specified in the Work Plan, Sampling and Analysis Plan, or as otherwise specified to ensure that accurate and valid chemical analyses may be performed.

1.2 Scope Covered by SOP-T18

- General Requirements
- Types of Containers
- Cleaning Procedures for Sample Containers
- Preservation Procedures for Samples
- Holding Times for Samples

1.3 Related Procedures and Documents

- Sampling and Analysis Plan (SAP)
- Quality Assurance Project Plan (QAPP)
- Field Reporting and Documentation (SOP-T3)
- Field Quality Assurance Samples (SOP-T21)
- Sample Classification, Storage, Package, and Shipment (SOP-T19)

1.4 Work Specifications

Procedures for sample containers, preservation of samples, and sample holding times as described herein shall be conducted as specified in the Work Plan, Sampling and Analysis Plan, or other parent document referencing this SOP. In the event there is a conflict in specifications presented herein with those presented in the parent document referencing this SOP, then the specifications in the parent document will be followed to the extent they are different. Further, if an analytical

method change occurs (e.g., EPA SW 846 or equivalent), the new procedures will supercede the protocols presented herein.

1.5 Definitions of Standards

Definitions of terms and adopted standards shall be in accordance with an attachment to this SOP, if so provided. Otherwise, it is intended that they be consistent with those used of implied in the Work Plan, SAP, or other parent document referencing this SOP.

1.6 Health and Safety Considerations

This procedures may involve exposure to impacted sample waters or soils via routes of dermal contact and inhalation. Accordingly, personnel should follow the precautions procedures, and use the appropriate personal protective equipment described in the approved Health and Safety Plan.

2.0 EXECUTION

2.1 General Requirements and Considerations

Sample containers and preservation methods should be selected and used such that accurate and valid chemical and physical analyses may be performed, and materials or procedures that might cause overt disturbance, contamination, oxidation or other chemical decomposition or reaction of the sample should be avoided. This SOP only addresses containers and preservation of chemical analytical samples. Sample preservation methods should adequately meet the requirement of the chain-of-custody and sample security presented in SOP-T22 or as otherwise established in the Work Plan, Sampling and Analysis Plan, or Quality Assurance Project Plan (QAPP). Use of containers and preservation procedures should be consistent with the analytical procedures to be used by the analytical laboratory. Preservation is generally limited to pH control, addition of chemicals, and refrigeration. These techniques are intended to retard biological action, retard hydrolysis of chemical compounds, keep metals in solution, and reduce volatility of constituents.

Refrigeration to maintain the sample temperature near $4^{o}C$ is the minimum amount of preservation that should be performed for environmental samples. Samples should not be frozen

and dry ice should not be used as the cooling agent (due to shipping restrictions). Chemical preservatives may be added to sample bottles in advance, generally by the testing laboratory or by field personnel.

The sample volumes required for analysis vary widely depending on laboratory capabilities. The volumes prescribed herein are conservative numbers; however, the laboratory should be consulted as to the quantity required.

2.2 Container Types

Containers in which samples of soil or water are collected should be constructed of materials that remain inert with respect to the suspected contaminants. They should have screw-type lids to assure adequate sealing of the bottles. Teflon inserts should be placed inside the lids of glass containers to prevent sample reaction with the lid and improve the quality of the seal. Sample containers should generally be supplied by the laboratory which is contracted to perform the analyses. In these cases, sample bottles should be cleaned by the laboratory prior to shipment to the field. If this procedure has been followed, each bottle should be clearly labeled as to the type of parameter for analysis. If laboratory prepared bottles are unavailable, the cleaning procedures described in Section 2.3 may be used to decontaminate sample containers.

2.2.1 Documentation of Containers and Preservatives Used

A list of containers and preservatives used to collect aqueous or solid samples shall be recorded in the field log book.

2.3 Cleaning Procedures for Sample Containers

All sample containers used for laboratory analysis will be supplied by the analytical laboratory and accompanied by a certification of cleaning procedure. These procedures will be equivalent to, or more stringent than the following:

"Protocol A" is used for general chemistry analysis, metals, and analysis of extractable organics. Protocol A consists of the following steps:

- Wash containers, closures and Teflon liner in hot tap water with laboratory ade non-phosphate detergent.
- Rinse three times with tap water
- Rinse with 1:1 nitric acid
- Rinse three times with deionized water
- Rinse with pesticide grade methylene chloride
- Oven dry at 125^{o}C. Allow to cool.
- Remove containers, closures, and Teflon liners from oven
- Place Teflon liners in closures and place closures on container.

Attendant to wear gloves and containers are not to be removed from preparation room until sealed.

"Protocol B" is used for organic analysis and analysis of purgeable (volatile) organics. The cleaning procedures are:

- Wash containers, septa, and closures in hot water with laboratory grade non-phosphate detergent.
- Rinse three times with tap water.
- Rinse three times with deionized water.
- Oven dry containers, septa, and closures at 125^{o}C
- Remove containers, septa, and closures at 125^{o}C
- Place liners in closures, Teflon side down, and place on containers.

Attendant to wear gloves and containers are not to be removed from preparation room until sealed.

"Protocol C" is used for the same analysis as Protocol A excluding phenols, oil and grease, and total organic carbon. These cleaning procedures are:

- Wash containers, closures, Teflon liners in hot tap water with laboratory grade non-phosphate detergent.

- Rinse three times with tap water.
- Rinse with 1:1 nitric acid.
- Rinse three times with deionized water
- Air dry in contaminant-free environment.
- Place liners in closures and place closures on containers. Attendant to wear gloves and containers are not to be removed from preparation room until sealed.

2.4 Container and Preservation Requirements for Environmental Samples

Containers, preservatives, and holding times specific to an individual project should be provided in the site-specific Work Plan or SAP.

2.4.1 Water Samples

Organics

Water samples for organics should be collected in glass bottles equipped with Teflon-lined screw caps. Water supply and other samples suspected of also containing residual chlorine should have 0.008 percent $NA_2S_2O_3$ (sodium thiosulfate) added. These water samples should be preserved by cooling with ice below 4^oC.

Regulatory or other considerations may require that duplicate samples be collected for purgeable (volatile organics). Samples for purgeables should be collected in 40 ml glass vials (purge vials) equipped with Teflon-backed silicon septum screw caps and filled to the top. Samples for extractables should be collected in one-gallon or four one-liter glass bottles with Teflon-lined caps.

Metals

Water samples for organics analyses should be collected in one-liter high-density polyethylene bottles with solid polyethylene or polyethylene-lines caps. Bakelite caps should be avoided. The bottles are cleaned with dilute nitric acid and washed well with distilled or deionized water. The

samples should be preserved with nitric acid to below pH 2. Nitric acid concentration should not exceed 0.15 percent if the sample is to be shipped via air cargo.

Sulfide

Water samples for sulfide analysis should be collected in 500 ml polyethylene bottles, with a 0.04 percent zinc acetate added.

2.4.2 Soil or Sediment Samples

Soil or sediment samples should be collected in wide-mouth glass jars equipped with Teflon-lined screw caps. Samples should be preserved by cooling with ice or refrigeration at 4^{o}C.

3.0 HOLDING TIMES

The USEPA has established holding times for various analyses related to environmental samples. For analytical data to be correct and/or accurate, all analyses should be performed within the maximum holding times outlined in Table T18-1. Table T18-1 provides a list of required holding times as found in USEPA SW-846 for aqueous samples and for solid samples such as soils. All environmental samples shall be analyzed within the holding times specified in this table.

4.0 REFERENCES

Heritage Environmental Services, Inc., Comprehensive Quality Assurance Plan, May, 1994.

U.S. EPA, "Methods for Evaluation of Water and Wastes," EPA-600/4-79-020.

U.S. EPA, "RCRA Groundwater Monitoring Technical Enforcement Guidance Document," September, 1986.

U.S. EPA, "Test Methods for Evaluating Solid Waste, "publication SW-846, 1986 (Third Edition).

U.S. EPA, "User's Guide to the Contact Laboratory Program," December 1988, 9240.01.

STANDARD OPERATING PROCEDURE (SOP) FOR SAMPLE CLASSIFICATION, STORAGE, PACKAGING, AND SHIPMENT (SOP-T19)

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STANDARD OPERATING PROCEDURE
FOR SAMPLE CLASSIFICATION, STORAGE, PACKING AND SHIPMENT
(SOP-T19)

1.0 SCOPE OF PROCEDURE

1.1 Purpose of Procedure

Standard Operating Procedure-T19 (SOP-T19) describes the requirements for sample classification, storage, packaging, and shipment as described in the Work Plan, Sampling and Analysis Plan or as otherwise specified for the purpose of ensuring proper handling of samples.

1.2 Scope Covered by SOP-T19

- General Requirements
- Sample Classification Categories
- Sample Storage Requirements
- Sample Packaging Procedures
- Sample Shipping Requirements

1.3 Related Procedures and Documents

- Field Reporting and Documentation (SOP-T3)
- Sample Containers, Preservation, and Holding Times (SOP-T18)
- Sampling and Analysis Plan (SAP)
- Quality Assurance Project Plan (QAPP)

1.4 Work Specifications

Procedures for classification, storage, packaging, and shipment of samples as described herein shall be conducted as specified in the Work Plan, SAP, or other document referencing this SOP. In the event there is a conflict in specifications presented herein with those presented in the parent document referencing this SOP, then the specifications in the parent document will be followed to the extent they are different.

1.5 Definitions of Standards

Definitions of terms and adopted standards shall be in accordance with an attachment to this SOP, if so provided. Otherwise, it is intended that they be consistent with those used of implied in the Work Plan, Field Sampling Plan, or other parent document referencing this SOP.

1.6 Health and Safety Considerations

These procedures may involve exposure to impacted sample waters or soils via routes of dermal contact and inhalation. Accordingly, sampling personnel should follow the precautions, procedures and use the appropriate personal protective equipment described in the approved Site Health and Safety Plan.

2.0 EXECUTION

2.1 General Requirements and Considerations

Classification of samples shall be made on the basis of the suspected level of contaminant concentration which determines subsequent packaging and labeling requirements, shipping procedures and laboratory handling of samples.

Contamination concentrations must be assessed early in the planning stage of an investigation because of their effect upon field operations. Sample classification must be considered in the development of the Health and Safety Plan and Field Sampling Plan. The procedures and materials used for sample packaging must adequately protect the sample container from accidental breakage and should be sufficient to prevent any leaks or spills.

Sample labels for proper sample identification are discussed in the SOP for the appropriate sampling technique and in SOP-T22. The correct labels which must be applied to sample containers and shipping containers to conform with U. S. Department of Transportation (DOT) shipping regulations are included in this SOP.

Samples classified as hazardous can be shipped only by means specified in the DOT regulations as discussed herein.

2.2 Sample Classification

2.2.1 Environmental Samples

Environmental samples are those which contain less than 10 ppm of any one contaminant. Samples collected off-site are considered "environmental" unless information to the contrary exists. On-site samples may be classed as "environmental" by the Project Manager based on knowledge of the site and the nature of the sample.

Initially, concentrations of constituents are estimated based on knowledge of contaminant sources and the contaminant transport mechanisms and their effects on contaminant concentrations. It is, therefore, necessary to be conservative in the estimate of contaminant concentration. Sample classification can be downgraded for subsequent samples if data exists to support that decision.

2.2.2 Hazardous Samples

Two categories of hazardous samples are defined as follows:

1. Medium concentration - samples expected to contain greater than 10 ppm and up to 15 percent (150,000 ppm) concentration of any one contaminant.
2. High concentration - samples expected to contain greater than 15 percent of any one contaminant.

"Hazardous Samples" include soil or water samples that may be highly contaminated, sludge or waste pile samples of concentrated wastes, and any sample from a closed drum or container.

2.3 Sample Storage

Samples should be stored in a manner consistent with the requirement for sample preservation so as to maintain the quality of the sample. Samples preserved by cooling should be stored in such a

way as to maintain the acceptable range of temperature for the duration of the holding time. Samples should not be stored on-site for extended periods of time and should be protected from environmental extremes. Shipment to the laboratory should be completed as soon as possible and well within any holding time limits specified for particular analyses (Refer to QAPP) to allow initiation of analyses within the holding time limits. If temporary storage is necessary, samples should remain in an area that has been designated as the "sample storage area" which must be locked and secured to maintain sample integrity and chain-of-custody requirements. Separate containers must be used to store low, medium, and high concentration samples.

Samples shall not be stored in refrigerators or other areas where food or drink may also be stored and vice versa.

2.4 Environmental Sample Packaging

2.4.1 Regulatory Considerations

DOT regulations do not consider environmental samples hazardous. In addition, DOT has stated that dilute solutions of chemical preservatives are not subject to Hazardous Materials Regulations as long as the concentrations do not exceed specified values.

In accordance with 49 CFR 173.24(a), the following is required for all packages:

> "Each package used for shipping hazardous materials... shall be so designed and constructed, and its contents so limited, that under conditions normally incident to transportation:
>
> (1) there will be no significant release of the hazardous materials to the environment;
>
> (2) the effectiveness of the packaging will not be substantially reduced; and
>
> (3) there will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of heat or pressure, or through an explosion, significantly reduce the effectiveness of the packaging."

In accordance with 49 CFR 173.6(a), the following is required for all shipment by air:

> "Each package...shall be so designed and constructed, and its contents so limited, that under conditions normally incident to transportation:
>
> (1) there will be no significant release of ... materials to the environment.
>
> (2) Inner containers that are breakable (such as earthenware, glass, or brittle plastic) must be packaged to prevent breakage and leakage under conditions normally incident to transportation. These completed packages must be capable of withstanding a 4-foot drop on solid concrete in the position most likely to cause damage. Cushioning and absorbent materials must not react dangerously with the contents...
>
> (3) For any packaging with a capacity of 110 gallons or less containing liquids, sufficient outage (ullage) must be provided to prevent liquid contents from completely filling the packaging at 130E F. The primary packaging (which may include composite packaging), for which retention of the liquid is the basic function, must be capable of withstanding, without leakage, an internal absolute pressure of not less than 26 pounds per square inch or no less than the sum of the absolute vapor pressure of the contents at 130E F (55E C) and the atmospheric pressure at sea level, whichever is greater.
>
> (4) Stoppers, corks, or other such friction-type closures must be held securely, tightly and effectively in place with wire, tape, or other positive means. Each screw-type closure on any inside plastic packaging must be secured to prevent the closure from loosening due to vibration or substantial changes in temperature...."

2.4.2 Shipping Containers

All sample containers should be placed inside a strong shipping container capable of withstanding a 4-foot drop on solid concrete in the position most likely to cause damage. A metal or plastic picnic cooler (ice chest) with a hard plastic liner withstands this test. The drainage hole at the bottom of the cooler must be taped shut so that the contents from broken containers or water from ice bags will not escape. The shipping container should be taped shut to form an adequate seal around the lid to prevent any leakage in the event that the cooler is turned over.

The shipping container should be marked "THIS END UP" with arrows indicating the proper upward position of the container affixed to all four sides. To prevent cross-contamination, the shipping container must be adequately cleaned between shipments.

2.4.3 Ice

Ice should be placed into a plastic bag (minimum 2-mil thick) and that bag sealed tightly. The amount of ice used will depend on the available space in the cooler but 10 pounds per 20 quarts of cooler volume should be the minimum to assure sufficient cooling. Dry ice (CO_2) generally should not be used.

2.4.4 Glass Containers

The lid of the container should be tightened to assure an adequate seal and taped to prevent loosening during transit. The container may be placed into a clear plastic bag which has a minimum thickness of 2-mil (many sandwich and freezer bags are suitable) and this bag taped tightly shut. They should be wrapped and cushioned in an inert packing material such as styrofoam, closed-cell foam packing material, or an absorbent material such as vermiculite.

2.4.5 Plastic Containers

Plastic containers do not require individual cushioning material, but should be packed to prevent movement during transport. Caps should be tightly screwed on an taped to prevent loosening during transit. These bottles may also be placed into a 2-mil-thick, plastic bag and the bag sealed.

2.5 Hazardous Sample Packaging

2.5.1 Regulatory Considerations

Hazardous samples are classified as ORM-E (Other Regulated Material - Series E) substances by the DOT. They are treated as a flammable liquid or solid and must be packaged accordingly to conform with DOT requirements.

If a sample is known to contain a material identified in the DOT Hazardous Materials Table (49 CFR 172.101), packaging and shipment should conform to the specific requirements for that substance.

If the nature of the sample is unknown, the materials should be prepared for shipment in accordance with DOT regulations for packaging and labeling the ORM-E hazard class.

2.5.2 Shipping Containers for Unanalyzed Waste Excluding Closed Container Samples

The procedures in this section should be applied to unanalyzed waste samples except those which come from closed containers whose contents are presumed to warrant a more careful packaging as described in Section 2.5.3.

Each sample container, properly labeled with sample information, should be placed into a 4-mil minimum thickness polyethylene bag, one sample per bag, and the bag sealed tightly with tape. This sealed container is placed into a metal can or overpack (such as a 1-gallon paint can) with incombustible, absorbent cushioning material, such as vermiculite or earth. Only one bag should be placed inside each can. The can lid should be closed tightly and sealed using tape or other positive means. Each metal can must bear the following labels and markings:

1. Testing laboratory name and address and a return address.
2. "Flammable Liquid, N.O.S." or "Flammable Solid, N.O.S."

The abbreviation, "N.O.S." means "Not Otherwise Specified."

The following labels must be placed next to one another and near the "Flammable Liquid, N.O.S." marking:

1. "Cargo Aircraft Only" and

2. "Flammable Liquid" or "Flammable Solid" and "Dangerous When Wet".

More than one can may be placed in a shipping container surrounded with incombustible packaging material for stability. The outside of the shipping container must bear the following markings and labels:

1. All of the labels described above for the sample cans; and
2. "Laboratory Samples," and
3. "This End Up" on the container top with upward pointing arrows on all four sides.

Using the word "flammable" does not convey the certain knowledge that a sample is, in fact, flammable or how flammable, but is intended to prescribe the class of packaging in order to comply with DOT regulations.

2.5.3 Shipping Containers for Unanalyzed Waste from Closed Containers

The Project Manager should make a judgment as to the hazard class of all samples from closed containers based upon available data. The following procedures provide typical worst-case methods for packaging of materials classed by the DOT as "Poison A"; this type of "reasonable doubt" practice is provided for in the regulation (49 CFR 172.402 h). Unless reliable data exclude the possibility of the presence of "Poison A" substances (as defined in 49 CFR 173.326), sample containers of unanalyzed waste from tanks or drums (solid, liquid or gas) must be packaged in a DOT Spec. 3A1800 or 3AA1800 metal compressed gas cylinder. The sample container is first labeled with required sample information. Then, using a string of flexible wire attached to the neck of the sample container, it is lowered into a metal cylinder which has been partially filled with incombustible, absorbent, packaging material. Allow enough cushioning material between the bottom and sides of the sample container and metal cylinder to prevent breakage. After the sample container is completely covered with cushioning material, the string or wire is dropped into the cylinder. The cylinder valve assembly and protector are replaced. The following markings must be placed on the tag wired to the cylinder valve protector or a label affixed to the cylinder itself:

1. "Poisonous Liquid, N.O.S." and

2. Laboratory name and address and return address

The following label must be placed on the cylinder, regardless of the location of all other markings:

1. "Poisonous Gas," (the "Poisonous Liquid" label is not acceptable here, even if the sample is a liquid).

One or more cylinders may be placed into the same shipping container. The shipping container must bear the following markings:

1. All of the labels described above for the metal cylinders, and
2. "Laboratory Sample" and "Inside Packages Comply with Prescribed Specifications" should be marked on top of the container.
3. "This Side Up" marking should be placed on the top of the container with upward pointing arrows on all four sides.

2.6 Shipping of Samples

2.6.1 Environmental Samples

Environmental samples may be shipped by commercial common-carrier, bus, by rental vehicle or air-cargo service to the testing laboratory. Samples should be received by the laboratory within twenty-four (24) hours after sampling or sooner, if necessary, to allow initiation of analyses within prescribed holding times.

2.6.2 Hazardous Samples

Hazardous samples, excluding those from closed containers, may be shipped by common carrier, air-cargo, or other more protective means suitable for closed container shipments as described below.

Carrier-provided bills of lading and certification for restricted articles will be completed and signed. Standard industry forms will be used if carrier does not provide them. One form may be

used for multiple shipping containers. The following information should be entered on the shipping papers:

1. "Flammable Liquid (or Solid), N.O.S."
2. "Net Weight" by item or "Net Volume" by item
3. "Cargo Aircraft Only"
4. "Limited Quantity"
5. "Laboratory Samples"

Shipping containers with unanalyzed wastes from drums or tanks should be entered as "Poisonous Liquid, N.O.S." on the first line above.

Unanalyzed samples taken from closed containers may not be transported by commercial air cargo or common carrier aircraft or by rental, non-government aircraft. Federal regulations require shipment by common, public or commercial "ground" carrier, or governmental aircraft.

3.0 REFERENCES

Code of Federal Regulations, Title 49 (Transportation), Hazardous Materials Tables and Hazardous Materials Communications Regulations: 49 CFR, Part 172, Office of the Federal Register, Material Archives and Records Service, General Services Administration, 1989.

Code of Federal Regulations, Title 49 (Transportation), Shippers - General Requirements for Shipments and Packages: 49 CFR, Part 173, Office of the Federal Register, National Archives and Records Service, General Services Administration, 1989.

U.S. EPA National Enforcement Investigations Center, "Enforcement Considerations for Evaluation of Uncontrolled Hazardous Waste Disposal Sites by Contractors," Draft, dated April, 1980.

U.S. EPA, "EPA Technical Methods for Investigating Sites Containing Hazardous Substances," Technical Monograph No. 22, Draft, dated June, 1981.

U.S. EPA, "RCRA Ground-water Technical Enforcement Guidance Document," September 1986.

U.S. EPA, "User's Guide to the Contract Laboratory Program,: December 1988, 9240.01

TABLE T19-1

STANDARD PRESERVATIVE SOLUTIONS
EXEMPTED* FROM DOT HAZARDOUS WASTE REGULATION

Preservative	Quantity of Preservative Per Liter of Sample	Maximum Weight of Preservative (%)
HCl	2 ml of 1:1**	0.04
$HgCl_2$	40 mg	0.004
HNO_3	3 ml of 1:1	0.15
H_2SO_4	2 ml of 36 N	0.35
NaOH	2 ml of 10 N	0.08
H_3PO_4	Sufficient to yield pH range between 2 and 4	

Notes:

* U.S. EPA, NEIC, "Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors", Draft, dated April, 1980; Appendix D: Letter of Understanding Provided EPA by DOT for Environmental Samples.

** Ratios are volume of acid to distilled water.

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STANDARD OPERATING PROCEDURE (SOP)
FOR SAMPLE CONTROL AND CUSTODY PROCEDURES
(SOP-T22)

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STANDARD OPERATING PROCEDURE
FOR SAMPLE CONTROL AND CUSTODY PROCEDURES
(SOP-T22)

1.0 SCOPE OF PROCEDURE

1.1 Purpose of Procedure

Standard Operating Procedure-T22 (SOP-T22) describes the procedures for controlling sample identification and custody in order to maintain the quality of samples during collection, transportation, and storage for analysis.

1.2 Scope Covered by SOP-T22

- Sample Identification Labels or Tags
- Transfer of Sample Custody and Shipment
- Chain-of-Custody Forms
- Custody Seals
- Calibration/Maintenance Documentation

1.3 Related Procedures and Documents

- Field Reporting and Documentation (SOP-T3)
- Sample Containers, Preservation, and Holding Times (SOP-T18)
- Sample Classification, Storage, Packaging, and Shipment (SOP-T19)
- Sampling and Analysis Plan (SAP)

1.4 Work Specifications

Sample control and custody procedures shall be conducted as described herein for all sampling activities associated with the site as specified in the Work Plan or SAP referencing this SOP. In the event there is a conflict in the specifications presented herein with those presented in the parent document referencing this SOP, then the specifications in the parent document will be followed to the extent they are different.

1.5 Definitions of Standards

Definitions of terms and adopted standards shall be in accordance with an attachment to this SOP, if so provided. Otherwise, it is intended that they be consistent with those used or implied in the Work Plan, or other parent document referencing this SOP.

2.0 EXECUTION

2.1 General Requirements and Considerations

Sample control and custody shall be followed, without exception, by all persons involved in sampling and documentation activities at the site within the program outlined or specified in the project Work Plan or SAP.

Samples may be defined as any physical evidence collected for environmental measuring and monitoring and includes portions of site media and non-media evidence such as remote-sensing imagery and photographs.

Sample identification documents must be prepared to maintain sample identification and chain-of-custody. The following are sample identification documents:

- Sample identification labels or tags
- Chain-of-custody records
- Custody seals
- Field logbook

The above documents are discussed in this SOP. Other documents, including sample traffic reports, receipts for sample forms, analytical request forms, and shipment records may also be required for specific laboratories.

2.2 Sample Identification Labels or Tags

2.2.1 Label Forms

Sample labels or tags shall be provided by the Project Manager or the sample personnel in a form appropriate for the sampling activity. Labels may be preprinted with spaces for the appropriate sample identification and information requirements or may be blank tags with lines provided for uniform recording. The label shall be of the type material that ink will write, but not be so overly absorbent that ink will run. Labels should be self-adhesive on glass and polyethylene containers. Examples of labels are provided in Attachment 1060-1.

The following sample information should be contained on each sample label or tag and kept tabulated in the field logbook.

- Project identification number or code
- Date and time of the sample collection
- Sample station identification (boring number, well number, other number or code, etc.)
- Preservative(s) used
- Laboratory analysis or code referencing the analysis.
- Serial number (if required)

2.2.2 Labeling Procedure

Following collection of the sample and placement into the appropriate container, wipe excess soil, waste, or water off of container. Affix adhesive label or tag to container. Fill out label or tag information as prescribed above using indelible ink. If a mistake is made, neatly mark through the mistake and write in the correction, initializing the correction. If the label is too smudged or damaged to neatly correct, void it by writing "VOID" across it and initialize it, then affix a new label onto the container, partially covering the voided label. Cover over the label or tape with clear plastic adhesive tape to protect the label and prevent it from being subsequently written upon.

Serialized sample labels, if used, require additional procedures and restrictions that are discussed in the Work Plan or SAP incorporating this SOP.

For custody control, sample labels or tags should be considered to be in an individual's possession until it is filled out, attached to the sample, and transferred to another individual along with the corresponding chain-of-custody form.

2.3 Chain-of-Custody Record

2.3.1 Definition of Custody

A sample is under custody if one or more of the following criteria are met:

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

Because samples collected during an investigation could be used as evidence in litigation, possession of the samples must be traceable from the time each is collected until it is introduced as evidence in legal proceedings. To document sample possession, chain-of-custody procedures and documentation are discussed below.

2.3.2 Chain-of-Custody Documentation and Forms

Chain-of-Custody documents are initiated by the sampling personnel in the field with the notation of sampling data and sample identification during the sampling activity. This data is collected in the field logbook generally in a tabulated form along with the description of the sample and sampling procedure, and includes the following:

- Sample station identification
- Sample identification
- Date and time sample was taken
- Number and type of container used
- Whether sample was grab or composite
- Preservation method used
- Analysis requested
- Name of sampling personnel involved

- Contact names and telephone numbers
- Shipping method

Each sample sent off-site will be recorded on a chain-of-custody form by the sampler or a field sample custodian at the site. The form should be filled out after returning the sample from the sampling locations and after decontamination. An example Chain-of-Custody form is attached. Chain-of-Custody forms will be serialized so they can be documented in the field log book and traced back to the analytical laboratory.

The chain-of-custody form should be filled out by the sampler or the field sample custodian on behalf of the sampler. The information indicated on the chain-of-custody form should be reconciled with that in the field logbook used by the sample personnel. The chain-of-custody form should be signed by the sampling personnel.

2.3.3 Custody Seals

When samples are shipped to the laboratory, they must be placed in padlocked containers or containers sealed with custody seals. Some custody seals are serially numbered. These numbers must appear in a cross-reference matrix of the field document and on the chain-of-custody report. Other types of custody seals include unnumbered seals and evidence tape.

When samples are shipped, two or more seals are to be placed on each shipping container (such as a cooler), with at least one at the back, located in a manner that would indicate if the container were opened in transit. Wide, clear tape should be placed over the seals to ensure that seals are not accidentally broken during shipment. Nylon packing tape may be used providing that it does not completely cover the custody seal. Completely covering the seal with this type of tape may allow the label to be peeled off. Alternatively, evidence tape may be substituted for custody seals.

If samples are subject to interim storage before shipment, custody seals or evidence tape may be placed over the lid of the jar or across the opening of the storage box. Custody during shipment

should be the same as described above. Evidence tape may also be used to seal the plastic bags or metal cans that are used to contain samples in the cooler or shipping container. Sealing individual sample containers assures that sample integrity will not be compromised if the outer container seals are accidentally broken.

2.3.4 Field Custody Procedures

Only enough of the sample should be collected to provide a good representation of the medium being sampled. To the extent possible, the quantity and types of samples and the sample locations should be determined before the actual field work. As few people as possible should handle the samples.

Field samplers are personally responsible for the care and custody of the samples collected by their teams until the samples are transferred or dispatched properly. A person should be designated to receive the samples from the field samplers after decontamination; this person maintains custody until the samples are dispatched. The site manager should determine whether proper custody procedures were followed during the field work and decides if additional samples are required to make up for any deficiencies.

Samples shall be accompanied by a chain-of-custody form or record. When transferring samples, the individuals relinquishing and receiving them should sign, date and note the time on the form. This form documents sample custody transfer from the sampler, often through another person, to the analyst at the laboratory.

Samples are packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate chain-of-custody record accompanying each shipment. Shipping containers are padlocked or sealed with custody seals for shipment to the laboratory. The method for shipment, courier name(s), and other pertinent information such as the laboratory name should be entered in the "Remarks" section of the chain-of-custody record.

When samples are split with an owner, operator, or government agency, the event is noted in the "Remarks" section of the chain-of-custody record. The note indicates with whom the samples are being split. The person relinquishing the samples to the facility or agency requests the signature of the receiving party on a receipt-for-samples form, thereby acknowledging receipt of the samples. If a representative is unavailable or refuses to sign, this situation is noted in the "Remarks" section of the chain-of-custody record. The samples shall be secured if no one is present to receive them.

All shipments are accompanied by a chain-of-custody record identifying their contents. The original form accompanies the shipment; the copies are retained by the sampler.

If nonhazardous samples are sent by mail, the package is registered, and the return receipt is requested. Note: Hazardous materials shall not be sent by mail. If samples are sent by common carrier, a bill of lading is used. Air freight shipments should be sent prepaid. Freight bills, postal service receipts, and bills of lading should be retained as part of the permanent documentation of the chain-of-custody records.

2.4 Field Logbook

A bound field logbook must be maintained by the sampling team leader to provide daily records of significant events, observations, and measurements during field investigations. All entries are to be signed and dated. Observations or measurements that are taken in an area where contamination of the field notebooks may occur may be recorded in a separate bound and numbered logbook before being transferred to the project logbook. The original records are retained, and the delayed entry is noted as such.

Field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during projects and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence. The field notebook entries should be factual, detailed, and objective.

2.4.1 Corrections to Documentation

Unless restricted by weather conditions, all original data recorded in field logbooks and on sample identification labels, chain-of-custody forms, and custody seals forms are written in waterproof ink. Accountable serialized documents are not to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on an accountable document assigned to one person, that individual may make corrections simply by crossing out the error and entering the correction information. The erroneous information should not be obliterated. Any error discovered on an accountable document should be corrected by the person who made the entry. All corrections must be initialed and dated.

For all photographs taken, a photographic log should be kept; the log records date, time, subject, frame and roll number, and photographer. For "instant photos", the date, time, subject, and photographer are recorded directly on the developed picture. The serial number of the camera and lens are recorded in the project notebook. The photographer should review the photographs or slides when they return from developing and compare them to the log, to assure that the log and photographs match. It can be particularly useful to photograph the labeled sample jars before packing them into shipping containers. A clear photograph of the sample jar, showing the label, any evidence tape sealing the jar, and the color and amount of sample, can be most useful in reconciling any later discrepancies.

3.0 REFERENCES

U. S. EPA, "A Compendium of Superfund Field Operations Methods", publication EPA/540/P-87?001, December, 1987.

U. S. EPA, "RCRA Ground-water Technical Enforcement Guidance Document, September 1986.

APPENDIX B
DECONTAMINATION PLAN

Antelope Valley Pesticide Container Disposal Site

Remedial Action and Closure

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STANDARD OPERATING PROCEDURE (SOP)
FOR EQUIPMENT DECONTAMINATION
(SOP-T20)

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STANDARD OPERATING PROCEDURE (SOP)
FOR EQUIPMENT DECONTAMINATION
(SOP-T20)

1.0 EXECUTION

Until proven otherwise, personnel should assume that all equipment exiting the area of potential contamination are contaminated and, therefore, decontamination procedures must be implemented. Procedures for decontamination of equipment as well as personal protective clothing and safety equipment are described in this plan.

1.1 Site Facilities and Supplies

1.1.1 Site Selection

The equipment decontamination site will be in an area where contaminants can be controlled and at the boundary of a "clean" zone. The location will also be selected to prevent equipment from being exposed to additional or other contamination. This area will be conspicuously marked as 'off-limits' to all personnel not involved with the decontamination process.

1.1.2 Decontamination Pad

The decontamination area will be made of mounded soil to create a curb and will be covered with plastic sheeting. Soil will be swept, collected, and added to the onsite soil stockpiles.

1.1.3 Water Supply

It is not expected that water will be necessary for large equipment decontamination. However, small volumes will be used in sampling equipment decontamination.

1.1.4 Cleaning Equipment and Supplies

Should water spray be needed a garden sprayers may be utilized for final rinsing or cleaning. A decontamination solution, of alconox, a low sudsing detergent, and water, will be used as necessary to adequately clean equipment

Miscellaneous items typically required for decontamination efforts include some of the following:

- Brushes - to remove heavy muds, dust, etc.;
- Paper Towels - to dry off equipment;
- Buckets - to store possibly contaminated water or items;
- Plastic sheeting - to wrap decontaminated equipment, tools, etc., after cleaning.

1.1.5 Personnel Protection

Personnel involved in the decontamination process can be exposed to significant concentrations of various contaminants. The level of protection for decontamination personnel is addressed in the health and safety plan. It is expected that work will proceed in level D.

1.3 Vehicle Decontamination Procedures

1. Low to Moderate Contaminant Concentration:
   a. Brush to remove mud or dirt,
   b. If mud or dirt remains water wash with a mixture of detergent and potable water (using garden sprayer) and brush,
   c. Air dry.

2. High Contaminant Concentration (only to be used if liquids are incounteredor higher contamination is suspected:
   a. Steam rinse with potable water to remove mud or dirt,
   b. Steam wash with a mixture of detergent and potable water or other type of decontamination solution,
   c. Steam rinse with clean, potable water, and
   d. Air dry.

Generally, decontamination can be limited to the portion of the equipment which come in direct contact with possible contaminants.

1.4 Sampling Equipment Decontamination Procedures

All sampling equipment which may contribute to the potential contamination of a sample must be thoroughly decontaminated prior to its initial use, unless specific documentation exists that the sampling equipment has been decontaminated.

Generally, sampling equipment can be cleaned by hand. The following procedure is given as a the sequence which will be utilized:

- Scrub with potable water to remove mud and residue,
- Scrub with a non-phosphate detergent-potable water solution or other decontamination solutions using a hard bristle brush,
- Rinse with clean potable water,
- Air dry, and
- Package and seal equipment in plastic bags or other appropriate containers to prevent recontamination.

Use of high pressure seam or hot water washing may be substituted for hand scrubbing if it effectively removes contaminants and soil and can be done safely without burning or contaminating the personnel.

2.0 REFERENCES

Felter, C.W., Jr., "Potential Sources of Contamination in Groundwater Monitoring," Groundwater Monitoring Review, Spring, 1983.

Morely, R.L., "Monitoring Well Basics - Equipment Decontamination, Groundwater Age," April, 1985.

U.S. EPA, "Technical Methods for Investigating Sites Containing Hazardous Substances," Technical Monograph No. 23, draft, June, 1981.

U.S. EPA, (Region VII) and Union Pacific Railroad, "Hazardous Materials First Responder Course."

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APPENDIX C
SPILL PREVENTION PLAN

Antelope Valley Pesticide Container Disposal Site

Remedial Action and Closure

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1.0 Purpose

Weston Solutions, Inc. (WESTON) has developed this Spill Prevention Plan (SPP) to describe the best management practices to prevent spills from contaminating storm water runoff during the implementation of the Remedial Action and Closure project at the Bureau of Land Management's (BLM's) Antelope Valley Pesticide Disposal Site (site).

This document provides a brief summary of the site conditions with respect to petroleum fuel storage, and the spill prevention and response actions that will be put in place during the implementation of the remedial action.

2.0 Background

The site, located approximately 50 miles south of Battle Mountain, Nevada, is a 12.5 acre property that includes a rectangular 2.3 acre fenced enclosure surrounded by a perimeter soil berm. The fenced enclosure area is known to have been used for collection and disposal of empty pesticide containers beginning in 1971. The containers were reportedly rinsed clean and placed into an unlined trench located within the fenced enclosure.

There are no petroleum storage tanks currently on site. During the implementation of the remedial action, there may be a temporary petroleum storage tank on site to refuel earth work equipment. The temporary storage tank(s) will be required to be below a total of 1,320-gallon capacity; therefore, no Spill Prevention, Control and Countermeasure (SPCC) Plan will be required.

3.0 Spill Prevention and Response

The most likely scenario for a spill at the site during the implementation of the remedial action will be during the transfer of fuel from the temporary on-site storage tank to the equipment. Although the volume of fuel that could be spilled during this scenario is below the reportable limit, WESTON's goal is to not spill any fuel on the site. To prevent fuel spilling and/or dripping, the personnel fueling the equipment will do so with absorbent pads on hand to soak up potential spilling/dripping.

A separate spill scenario is a leak from the temporary fuel tank. This tank will be inspected daily for leaks. If a leak is observed, the leak will be stopped and the tank will be put out of service and removed from the site as soon as possible. Any impacted soil will be handled by the tank owner/operator at their expense and in a timely manner to prevent migration of the fuel.

If a fuel spill of greater than 25-gallons occurs on the site, the spill will be reported to the Nevada Department of Environmental Protection within 24-hours of the spill.

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APPENDIX D
JOURNEY MANAGEMENT PLAN

Antelope Valley Pesticide Container Disposal Site

Remedial Action and Closure

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1.0 PURPOSE

Weston Solutions, Inc. (WESTON) has developed this Journey Management Plan (JMP) to describe the process to protect the public and the environment during the transportation of potentially impacted material on public roadways during the implementation of the Remedial Action and Closure project at the Bureau of Land Management's (BLM's) Antelope Valley Pesticide Disposal Site (site).

This document provides a brief summary of the site conditions, the procedures the verify vehicles are free of exposed material prior to leaving the site, the hauling route from the site to the disposal facility, and a contingency plan for potential spills of impacted material while in route to the disposal facility.

2.0 BACKGROUND

The site, located approximately 50 miles south of Battle Mountain, Nevada, is a 12.5 acre property that includes a rectangular 2.3 acre fenced enclosure surrounded by a perimeter soil berm. The fenced enclosure area is known to have been used for collection and disposal of empty pesticide containers beginning in 1971. The containers were reportedly rinsed clean and placed into an unlined trench located within the fenced enclosure.

Analytical results of soil samples collected during the site investigation indicated no significant soil impacts existed in the known trench disposal area or within the surface water drainages at the time. Based on the EM-31 geophysical survey, the volume of buried material (soil and crushed containers) within the known disposal trench is approximately 10,000 cubic ft. or 370 cubic yards.

WESTON anticipates the disposal material to include the following:

- Crushed, rinsed containers (primarily metal drums, with limited glass); and
- Soil, if determined based on analytical results to exceed the U.S. Environmental Protection Agency's (EPA) Region 9 Regional Screening Levels (RSLs) for pesticides for industrial property use.

The facility identified for the disposal of the impacted material is located in Las Vegas, Nevada. The route of transportation is described in Section 5 and depicted on Figure 1.

3.0 INSPECTION

Hauling containers will be properly prepared prior to loading the disposal material to minimize the potential for a release or spill during the transportation of impacted material from the site to the disposal facility. Prior to arrival at the site, each container will be verified to be free of material.

Prior to departing the site, an inspection of each vehicle and container will be conducted simultaneously by the driver and WESTON's Site Manager. The Equipment/Truck Inspection Checklist (Attachment 1 and included in the Health and Safety Plan [HASP] in FLD 57 – Motor Vehicle Safety) will be completed during the inspection. The inspection will verify that the vehicle is in safe and roadworthy condition, which includes but is not limited to tires are properly inflated and in good condition, and lights, alarms, instruments and mechanical equipment are in working condition. Additionally, the drives will comply with WESTON's off-road guidance while accessing the site and departing the site (See FLD 11 - Off-Road Travel).

The inspection will also focus on the spill and release prevention. All noticeable soil and/or debris that are not within the container will be removed prior to passing the inspection. The container cover will be inspected to ensure that impacted materials will be held within the container during transportation to the disposal facility.

Driver is properly licensed to drive the vehicle and haul impacted material in the State of Nevada. The driver understands and will comply with all applicable Department of Transportation rules and regulations regarding the

transportation of impacted material, the traffic laws of the State of Nevada, and the maximum hour for driving the specific vehicle. Each driver will review and comply with WESTON's Motor Vehicle Safety field operating standard outline in FLD 57. If necessary, proper placading will be placed on the vehicle.

During the inspection, the Site Manager will verify the driver appears to be in condition to handle the vehicle and does not appear to be under the influence of drugs or medications. Prior to departing the site, the Site Manager will outline WESTON's stop work authority and the proper implementation of that authority during the hauling of impacted waste material. See Section 7 for the contingency plan that should be outlined for each driver prior to departing the site.

4.0 TRANSPORTATION ROUTE

The route from the site to the disposal facility, U.S Ecology south of Beatty, Nevada, is depicted on page 1 of Figure 1. The route directions are summarized on page 2 of Figure 1. The map and the route description will be provided to each of the drivers for their review prior to leaving the site and use during the hauling. The travel time is approximately 4 hours 39 minute and the travel distance is approximately 263 miles.

Reverse the directions for the return trip to the site. Note that the shortest and easiest return trip from the disposal facility to the contractor's vehicle storage area may not the reverse of the route provided.

5.0 TRANSPORTER COMMUNICATION

Each driver will contact WESTON's Site Manager, at the number provided prior to leaving the site, upon safe arrival at the disposal facility, again prior to leaving the disposal facility on the return trip and finally upon arrival at the hauling contractor's vehicle storage area. The time and date of these calls will be documented in the field log book by the Site Manager.

6.0 MANIFEST DOCUMENTATION

If necessary, based on the material being hauled, the driver will be responsible for the waste manifest documentation from the time of leaving the site until the vehicle is safely returned to the contractor's vehicle storage area. Following the arrival at the final destination, the waste manifest documentation will be provided to the contractor's supervisor for submittal to WESTON.

7.0 SPILL CONTINGENCY

In the unlikely event of a spill or release of impacted material from within the transportation container, the driver will follow the steps outlined on Attachment 2, which will be provided to the driver to be kept in the vehicle during the duration of the trip.

Google maps

Directions to US-95 S
263 mi – about **4 hours 39 mins**
Route from the BLM - Anteloope Valley Pesticide Disposal Site to the US Ecology disposal facility south of Beatty, NV.

FIGURE 1 – TRANSPORTATION ROUTE (Page 1 of 2)

Unknown road

1. Head **north** toward **Antelope Valley Rd** About 1 min		go 0.3 mi total 0.3 mi
2. Turn **right** at **Antelope Valley Rd** About 14 mins		go 5.5 mi total 5.8 mi
3. Turn **right** at **NV-305 S** About 43 mins		go 41.9 mi total 47.7 mi
4. Turn **left** at **US-50 E** About 21 mins		go 12.7 mi total 60.4 mi
5. Turn **right** at **NV-376 S** About 1 hour 33 mins		go 99.9 mi total 160 mi
6. Turn **right** at **US-6 W** About 8 mins		go 5.4 mi total 166 mi
7. Turn **left** at **US-95 S/Erie St** Continue to follow US-95 S About 1 hour 31 mins		go 93.0 mi total 259 mi
8. Turn **left** at **US-95 S/S 2nd St** Continue to follow US-95 S About 7 mins		go 4.3 mi total 263 mi

US-95 S

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2010 Google

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

FIGURE 1 – TRANSPORTATION ROUTE (Page 2 of 2)

ATTACHMENT 1 - EQUIPMENT/TRUCKING INSPECTION CHECKLIST

This inspection form is to be filled out at the start of the work shift by the Equipment/Truck Operator to ensure that the equipment/truck is safe to operate and is free from apparent damage which could cause failure while in use. Once completed, this form is to be given to the Site Manager to be kept on file on-site. In all cases, consult the manufacturer's data to ensure compliance with all safety inspection criteria which may not be indicated below.

MAKE/DESCRIPTION_____

MODEL/SERIAL_____

Inspection Item	OK	Not OK	N/A	Comment And Actions Taken
Brakes				
Brake Lights				
Reverse Signal Alarm				
Horn				
Tires				
Steering				
Seat Belts				
Operating Controls				
Fire Extinguisher				
Lights				
Defroster				
Mirrors				
Instruments				
Coupling Devices				
Windshield/Window Glass				
Windshield Wiper				
Mud Flaps/Rock Guards				
Exhaust System				
Hitches & Safety Cables				
Hydraulic Lines/Air Hoses				
Engine Oil Level				
Roll-Over Protection/ Emergency Equipment				

Odometer: _____ Hour Meter: _____ Fuel Level: _____

Inspector Name/Signature: _____

Date: _____

ATTACHMENT 2 – CONTINGENCY FORM

This form is to be kept in each transportation vehicle to be used as guidance in case of an emergency.

IN CASE OF AN IMMEDIATE EMERGENCY, CONTACT 911.

Then talk to the following personnel as soon as the conditions are safe enough to allow for a conversation.

Name	Company	Title	Office	Cellular
Jonathan Anstey	WESTON	Project Manager	(303) 729-6178	(720) 201-6105
Roy Weindorf	WESTON	Site Manager	(303) 729-6146	(817) 319-2257
Mike Stuart	WESTON	Health & Safety	(505) 837-6566	(505) 259-7613

Provide the following information:

- Your name and company
- Date and time of the emergency
- Location of the emergency
- Parties involved
- Injuries or hazardous conditions
- Detailed description of events leading up to the emergency
- Detailed description of the emergency
- Description of action taken following the emergency

APPENDIX E
ENVIRONMENTAL PROTECTION PLAN

Antelope Valley Pesticide Container Disposal Site

Remedial Action and Closure

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1.0 Purpose

Weston Solutions, Inc. (WESTON) has developed this Environmental Protection Plan (EPP) to describe the measures to be taken to restore topsoil and to minimize erosion during the implementation of the Remedial Action and Closure project at the Bureau of Land Management's (BLM's) Antelope Valley Pesticide Disposal Site (site).

This document provides a brief summary of the site conditions, the proposed soil disturbing activities, and the erosion and sediment control measures that will be used to reduce the impacts to the environment during the remedial action.

2.0 Background

The site, located approximately 50 miles south of Battle Mountain, Nevada, is a 12.5 acre property that includes a rectangular 2.3 acre fenced enclosure surrounded by a perimeter soil ditch. The region is arid, receiving an average of between 6 and 16 inches of precipitation annually. Strong winds are common within the Antelope Valley, primarily from the southwest. The sparse vegetation on site consists of shadscale, low sage, rabbit brush and bud sage with an understory of squirreltail, cheatgrass and Indian ricegrass. The surface soil and near surface soil types are characterized with weak expressions of soil development, and appear to be aridisol or mineral soils of arid climates. The site does not contain any perennial waters, wetlands or floodplains. A storm water system has not been identified during the previous work at the site, and is not anticipated based on the remote location.

During the investigation phase of activities at the site, the surface conditions were evaluated. The surface soil type was observed to ranging from clay to sand. The slope over the site is approximately a 12% grade, which is considered moderate (8' horizontal run : 1' vertical rise = 0.125 slope or 12.5% grade).

The fenced enclosure area is known to have been used for collection and disposal of empty pesticide containers beginning in 1971. The containers were reportedly rinsed clean and placed into an unlined trench located within the fenced enclosure.

Analytical results of soil samples collected during the site investigation indicated no significant soil impacts existed in the known trench disposal area or within the surface water drainages at the time. Based on the EM-31 geophysical survey, the volume of buried material (soil and crushed containers) within the known disposal trench is approximately 10,000 cubic ft. or 370 cubic yards.

3.0 Soil Disturbing Activities

The remedial action at the site consists of soil disturbing activities that will exceed one-acre of disturbance (approximately 2.7 acres of surface soil will be disturbed) including excavation, grading and backfilling. WESTON will minimize soil erosion and resulting sedimentation in general by stabilizing disturbed soil by encouraging revegetation. The dry drainages on-site and at the access point to the site will be protected to the extent possible to maintain the integrity of the surface water flow. This document describes the mitigation measures and best management practices that will be put in place to protect the environment during the removal action.

3.1 Soil Excavation

Soil will be removed from the backfilled portion of the disposal trench to expose the buried pesticide containers. The excavation activities are not anticipated to encountered groundwater based on the soil boring completed during the investigation phase of work at the site (no dewatering is anticipated). This soil will be stockpiled on plastic to prevent potential cross contaminating the surface soil. Soil will be shaken from the pesticide container and added to the stockpile. The stockpiled soil will either be used as clean backfill or be disposed of off-site, based on laboratory analytical results.

3.2 Grading

To prevent surface water from pooling on the site in the future, the surface soil will be regraded to nearly flat with an eastward slop similar to the current 12% grade. The ditches surrounding the site will be filled and the site will have a general eastern slope, similar to the surrounding area.

3.3 Backfilling

Backfill material will be collected from on-site sources, including the excavated soil if deemed clean by laboratory soil samples analysis, and the general grading of the site.

4.0 Erosion and Sediment Control Measures

Erosion control measures will be put in place to minimize soil erosion and sediment transport and deposition during and following the soil disturbing activities. Because more than one-acre (approximately 2.7-acres) WESTON applies for a Construction Stormwater Permit - Notice of Intent (NOI) from the Nevada Department of Environmental Protection. Based on the length of time for the soil disturbing activities (approximately one month), the time of year the soil disturbing activities will be conducted (January – February 2011), and the arid environment at the site, the site activities qualified for Waiver Certification from National Pollution Discharge Elimination System (NPDES) Strom Water Permit (see Attachment 1). The U.S. Environmental Protection Agency (EPA) calculated an Erosion Index Value of zero based on the site specific and soils disturbing data.

The following best management practices (BMPs) will be implemented to reduce the impact to the surrounding area due to the soil disturbing activities.

- The soil excavation will be backfilled to grade. Stockpiled soil will not be left as a mound; it will be used as excavation backfill or disposed of off-site.
- To prevent surface water from flowing onto the disturbed soil, the current ditch on the uphill side (east) of the site will be left in place. This ditch will act as a diversion to reduce the volume of water from the uphill drainage area from entering the site, which will reduce the erosion of the disturbed soil during and following the soil disturbing activities.
- Prior to departing the site, the limited vehicles will be manually cleared of the bulk of soil adhered to the vehicle to prevent depositing soil on the public road. Note that the access to the site is from Antelope Valley Road, which is not paved and primarily dirt. Therefore a gravel entrance/exit pad would not be effective.
- The dry drainage on the downhill (western) boundary of the site will be protected from sediment by not disturbing the soil in the vicinity of the drainage.
- The area of disturbed soil will be reseeded with a seed mixture appropriate for the regional ecology and approved by BLM. The seed will be broadcast and harrowed for approximately 2.5 acres using an all-terrain vehicle within 14-days of completion of the soil disturbing activities. The reseeding stabilization will protect the slope of the site from gullies.

The storm water erosion and sediment controls will be inspected every week and after each rainfall event of half an inch or more. Repairs and replacements will be made for controls that are determined to no longer be effective to their purpose. Inspections and repairs/replacements will be documented in the field log book.

5.0 Monitoring and Maintenance

WESTON will not conduct any monitoring or maintenance of the site following the reseeding activities.

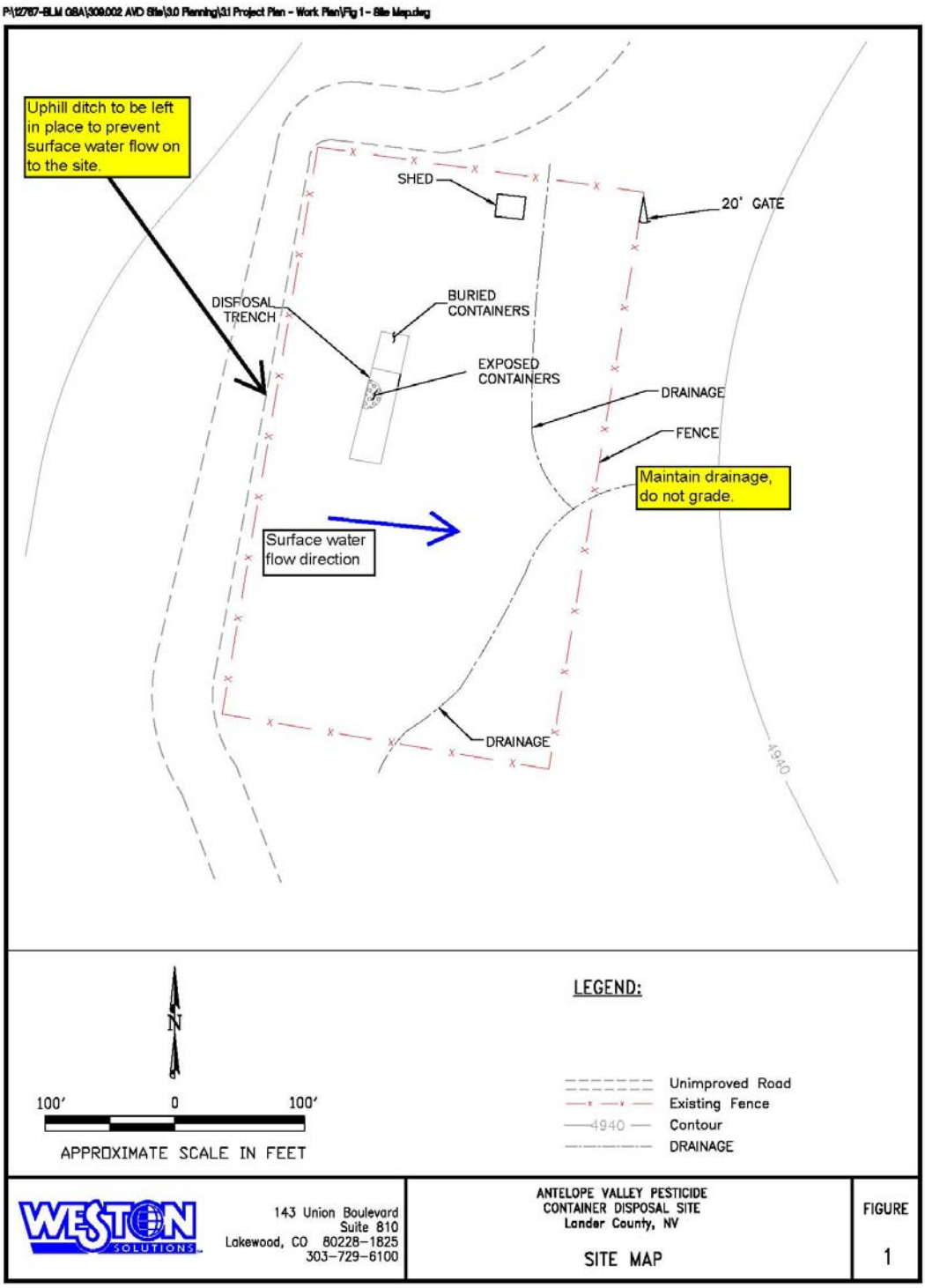

Figure 1 Site Map

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