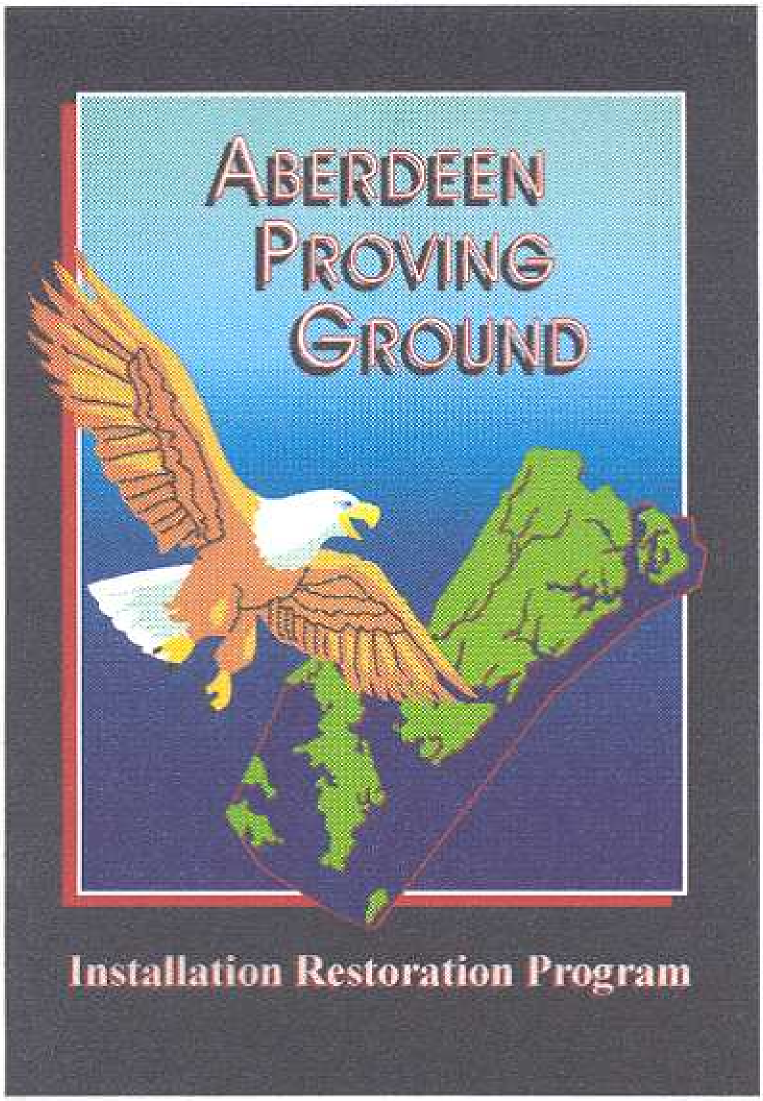

J-FIELD STUDY AREA

Work Plan for Work Assignment NO. 0-034
J-Field Phytoremediation

July 7, 1999

Aberdeen Proving Ground, Maryland

WORK PLAN

FOR

WORK ASSIGNMENT NO. 0-034

J-FIELD PHYTOREMEDIATION

JULY 7, 1999

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WORK PLAN
J-FIELD PHYTOREMEDIATION

Prepared for
U.S. ENVIRONMENTAL PROTECTION AGENCY

Date: JULY 7, 1999
Contract No: 68-C-99-223
Assignment No.: 0-034

Approval:

REAC Program Manager ____________________ Date: ____________

REAC Task Lead ____________________ Date: ____________

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Work Assignment Number:	034
Work Assignment Title:	J-Field Phytoremediation
Work Assignment Manager:	Harry Compton
Lockheed Martin REAC Task Leader:	Ray Lewis
Duration:	10/0
Contract Number	68-C99-223
Site ID:	034

Purpose

The purpose of this project is to provide technical support to the U.S. Environmental Protection Agency/Environmental Response Team Center (U.S. EPA/ERTC) in the form of sampling, monitoring, and analysis at the J-Field Phytoremediation site at the Aberdeen Proving Grounds in Edgewood, MD. Sample matrices include trees, groundwater, and soil.

Background

Site Background

J-Field is located at the tip of Gunpowder Neck, Edgewood Area of Aberdeen Proving Ground (APG) in Harford County, Maryland. The Toxic Pits area of J-Field was once the disposal site for chemical warfare agents, munitions, and industrial chemicals. The Toxic Pits area consists of two parallel disposal pits that are approximately 10 feet deep by 15 feet wide by 200 feet long. Remnants of other pits extend into the marsh area to the east. The pits were used for open-pit burning and detonation from 1940 through the 1970's.

During open burning, wood was first placed in one of the pits and the agents, munitions, and chemicals were placed on top. The pit was then flooded with fuel oil and ignited. After the first burn, a reburn of any remaining material was performed in the adjacent pit. Any remaining debris was then pushed into the marsh. Metals were recovered from the pushout area for recycling. The pits and surrounding land have been disturbed by the activities that took place on J-Field. The area to the northeast of the pits appears to be the main pushout area for the pits.

The types of materials handled at these pits included:

High explosives
Nerve agents
Mustard agents
Smoke materials
Solvents

The contaminants of concern in the groundwater adjacent to the toxic pits are:

1,1,2,2-tetrachloroethane (1122)
1,1,1,2-tetrachloroethane (1112)
1,1,2-trichloroethane (TCA)
trans-1,2-dichloroethene (t-DCE)
cis-1,2-dichloroethene (c-DCE)
trichloroethene (TCE)
tetrachloroethene (PCE)

General Assumption

This work plan will provide for the following:

- Monitoring of transpiration gases from the study trees
- Monitoring of all relevant environmental factors during the sampling event including: solar radiaition, wind, relative humidity, and precipitation
- Ground water sampling and vadose zone sampling (lysimeters)
- Plant tissue analysis
- Tree monitoring in the form of sap flow and tree diameter measurements
- Soil flux monitoring of contaminants of concern
- Comparison of current soil "health" (nematodes, fungal biomass, and other microbial inhabitants) to with past data
- General maintenance of the phytoremediation study area
- Preparation of reports for presentation at a phytoremediation conference

TECHNICAL APPROACH

Tasks

1) Full scale sampling effort to begin on July 12th
2) Trip report for July sampling event approximately 2 weeks after analytical data is recieved
3) Presentation of materials for Phytoremediation Conference - date to be determined
4) Final Report covering all of the information gathered during the 1999 growing season

Monitor Well/Lysimeter Sampling

Monitoring of the wells and lysimeters will include obtaining one round of samples per year to determine groundwater contaminant concentrations. Groundwater sampling for VOCs and TAL metals will be conducted on wells JF-53, JF-63, JF-73, JF-83, JF-183, JF-173, JF-203, JFP 1 through 5, and P-2 through 4. This data will be used to assess the effectiveness of the remediation project. Permanent water elevation monitors located at well JF-63, 53, 73 and 83 will record changes in groundwater levels. Additional groundwater level monitors may be installed.

Groundwater sampling of monitor wells will be performed in accordance with APG protocols which include a low flow sample collection method. Any measurements will be recorded either on Well Purge Forms or on the datacollectors associated with the low flow devices. Prior to purging, water depth will be recorded for each individual well. Each well will be purged prior to sampling using adjustable submersible pumps in accordance with the acceptable purge/sampling devices listed in the APG SOP. Initially, after removing three liters of water from the well while purging, a sample will be collected for pH, temperature, turbidity, conductivity and dissolved oxygen. These stabilization measurements will be collected in realtime using a flow through water quality parameter instrument. These measurements will be used to determine if conditions in the well have stabilized. Stabilization is achieved when three successive readings are within $\pm$0.1 for pH, $\pm$3% for conductivity and $\pm$10% for turbidity and dissolved oxygen (DO). Turbidity and DO are typically the last parameters to stabilize. If turbidity samples do not approach the range of natural groundwater (10 NTU), both filtered and unfiltered samples may be collected for metals analysis. A sample will be collected when the water quality has stabilized, the well has been purged dry and recovered, or three well volumes have been purged, whichever comes first. Lysimeters will be sampled in accordance with the TIMCO lysimeter manual.

Modeling

Software programs, such as Geosoft and Surfer, will be utilized to model groundwater contamination and water level data. Color, two-dimensional plots will be produced on a yearly basis. These plots will allow future data, when modeled, to be compared so that a fluctuation in contaminant concentration and/or groundwater levels can be determined.

Maintenance

Any trees which have died during the year may be removed and replanted by hand with new trees. Replanting of the trees will be performed during late fall or winter.

The trees should require only minimal maintenance during the year. This maintenance includes pruning, spraying for insects, fertilizing, and preventing deer damage.

Phytoremediation Monitoring

Plant Growth Measurements and Visual Observations

Plant growth will be measured annually at the end of each growing season (October). Measures of plant growth will include diameter at breast height (DBH) (1.4 meters above ground level) using tree girth diameter tape. Total height will be measured with a telescoping tree measuring pole. Observations of plant health will be conducted quarterly. Evidence of insect damage, chlorosis, wilting, and other visual symptoms of poor health will be recorded quarterly. Vegetation growing between the trees will be clipped annually to reduce competition with the trees.

Weather Monitoring

Weather parameter data will be collected from various sources. Parameters such as daily precipitation, wind speed/direction, solar radiation, and temperature will be recorded throughout the term of the monitoring program. Weather and solar radiation data will be correlated with measures of transpiration.

Plant Tissue Sampling

Plant tissue samples (roots, shoots, leaves) will be collected from selected trees. Sample quantities will be determined by analytical methodology. Sampling will be conducted during the mid-growing season sampling event to assess seasonal variability in the translocation of contaminants in plant tissues.

Soil-Flux Sampling / OP-FTIR

Soil flux samples will be taken from previously monitored sampling locations during both day and nighttime periods to measure emissions from the site. Additional monitoring of mass emissions of parent compounds from the plantation area will be conducted using OP-FTIR during the mid-growing season sampling event.

Plant Transpiration Measurements

Two methods of determining sap flow rates will be used. The heat balance technique, which has been used during previous monitoring events, uses the Dynamax Flow32™ Sap Flow System to measure the transpiration rate in grams water/hour/tree (Devitt *et al.* 1993, Gutierrez *et al.* 1994). This method is non-invasive and does not injure the tree. The second method, Thermal Dissipation Sap Velocity (TDSV), uses small probes inserted into holes drilled in the tree trunk to measure sap flow rates. Transpiration rates will be recorded on eight trees or more over a one week period using the two sampling methods. This information will be correlated with measures of VOCs in transpiration gas and with meteorological data in order to estimate the quantity of VOCs being emitted from the trees over the course of the season.

Transpiration Gas Sampling

Transpiration gas will be measured on trees using the following method. A Tedlar bag will be placed over a three foot section of the end of a branch. The bag will be sealed around the stem using clay and a mechanical fastener. A cold trap attached to the system will remove condensate from the Tedlar bag enclosure. Air will be circulated through the enclosure and cold trap so that transpiration rates will not be substantially reduced in the affected branch due to increased relative humidity within the enclosure.

Transpiration gases and condensate from the enclosure will be sampled and analyzed for VOCs. Mean transpiration rates and mean contaminant concentrations in transpired gases and condensate will be used to estimate the quantity of transpired water and contaminants for the entire planting area.

Soil Community Analysis

A soil community analysis will be conducted to examine the functioning and health of the soil community. Nematode populations, fungal composition, microbial biomass, and the impact of leaf degradation on the soil community may be analyzed to determine if compounds in the trees are negatively affecting the soil community.

Surficial Aquifer Sampling

A geoprobe or similar machinery may be used to install additional microwells. These wells will be screened at selected intervals so that discreet water samples can be collected in the upper portion of the surficial aquifer. The concentration of contaminants in these samples will be used to determine if a contaminant gradient exists in the vicinity of the tree root zone. These additional wells will be installed at or near the leading edge of the ground water plume.

Tree Excavation

If necessary, trees, as selected by ERTC/REAC, will be excavated to evaluate the structure and extensiveness of the root system. This information will be used in determining future water, soil, and rhizosphere sampling locations.

DYNAMAX Phytoremediation Analysis

DYNAMAX, the company the sap flow equipment was purchased from, will be on site the week of July 12 for data analysis and technical training.

Technical Conference

A paper will be prepared and presented at a relevant technology conference (e.g., In Situ and On-

Site Bioremediation, April 19-22, 1999). The paper will be titled *Evaluating and Monitoring Phytoremediation as a CERCLA Remedial Option.*

Monitoring Guidance

Once the phytoremediation monitoring plan is optimized for J-Field, the most useful and strategic monitoring methods will be incorporated into a monitoring guidance. The purpose of this guidance is to provide succinct and consistent monitoring and analytical methods for use on future phytoremediation sites.

Soil Sampling

Any soil sampling or boring will require a mag sweep for UXO (unexploded ordnance) avoidance unless the boring will be located within 1.5 ft of a tree, an area which has already been cleared for UXO. An EOD contractor to REAC will provide this service. This will ensure that no unexploded ordnance or munitions are present where sampling and/or boring is being performed. Soil samples may be collected from the root zone of the trees for chemical analysis. Any samples to be taken off base will be cleared of chemical agents through the CTF lab and Scitech Services of APG.

Standard Operating Procedures

UXO avoidance will be performed according to procedures set forth in the Site Health and Safety Plan before any intrusive activities are performed. ERTC/REAC and APG SOPs will be utilized. The more stringent of the two SOPs will be utilized. Any discrepancies to these SOPs will be noted in a field logbook.

Sample Documentation

Sample documentation will be completed as per the following Standard Operating Procedures (SOPs):

- ERTC/REAC SOP #2002, *Sample Documentation*
- ERTC/REAC SOP #4005, *Chain of Custody Procedures*
- ERTC/REAC SOP #4021, *Preparation of Final Reports*

Sample Packaging and Shipment

Sample packaging and shipment will be conducted in accordance with the following SOP:

- ERTC/REAC SOP #2004, *Sample Packaging and Shipment*

Sampling Techniques

- ERTC/REAC SOP #2007, *Groundwater Well Sampling*
- ERTC/REAC SOP #2012, *Soil Sampling*
- ERTC/REAC SOP #2001, *General Field Sampling Guidelines*
- ERTC/REAC SOP #2003, *Sample Storage, Preservation, and Handling*
- ERTC/REAC SOP #2013, *Surface Water Sampling*
- ERTC/REAC SOP #2041, *Operation of the Hydrolab Surveyor II Water Quality Management System*
- ERTC/REAC SOP #2016, *Sediment Sampling*

- ERTC/REAC SOP #2043, *Water Level Measurement*
- APG SOP # 013, *Collection of Monitoring Well Samples*

Other ERTC/REAC SOPs will be followed where appropriate for the various phases of the project.

Equipment Decontamination

The following equipment decontamination procedure will be employed prior and subsequent to boring holes and/or for large equipment:

- physical removal
- high pressure nonphosphate detergent wash
- potable water rinse

The following sample equipment decontamination procedure will be employed prior to collection of environmental samples with nondedicated sampling equipment:

- physical removal
- nonphosphate detergent wash
- deionized water rinse
- 10% nitric acid wash
- deionized water rinse
- acetone wash
- deionized water rinse
- air dry

The REAC Task Leader will maintain contact with the U.S. EPA/ERTC Work Assignment Manager to provide information on the technical and financial progress of this project. This communication will commence with the issuance of the work assignment and project scoping meeting. Activities under this project will be reported in status or trip reports and other deliverables (e.g., analytical reports, final reports) identified in this work plan. Activities will also be summarized in appropriate format for inclusion in REAC Monthly and Annual Reports.

Lockheed personnel performing work under this work assignment have received the REAC Conflict of Interest Plan and been informed of their obligation to report personal conflicts of interest. Each employee has agreed to this policy by signing a statement related to conflict of interest responsibilities. In addition, Lockheed will conduct searches of corporate conflict of interest data bases in reference to this work assignment. Any actual or potential conflict of interest associated with this work assignment will be brought to the attention of the Contract and Project Officers. Lastly, Lockheed recognizes the continuing obligation to identify and report any actual or potential conflicts of interest arising at any time during performance of this work assignment.

STAFFING PLAN AND SCHEDULE

Staffing Plan

The REAC Task Leader/Quality Control (QC) Coordinator (Ray Lewis) is the primary REAC point of contact with the U.S. EPA/ERTC Work Assignment Manager. The Task Leader is responsible for the development and completion of the WP, project team organization, and supervision of all project tasks, including reporting and deliverables. In addition, the QC Coordinator is responsible for ensuring field adherence to the WP and recording any deviations from the WP.

The following REAC personnel will work on this project:

Personnel	Responsibility
Ray Lewis	Task Leader
Dale Haroski	Biologist
Mike Chilek	Geologist
Larry Kaelin	Senior Chemist
Mike Gemelli	Meteorologist
Anthony Stegner	Geoprobe Operator

The REAC Quality Assurance (QA) Officer is **Joe Lockheed**, the Health and Safety Officer is **Butch Marrietta**, the Operations Section Leader is Leah Street, and the Analytical Section Leader is Dennis Miller. These individuals are responsible for auditing and guiding the project team, reviewing/auditing the deliverables and proposing corrective action, if necessary, for nonconformity to the workplan or health and safety plan (HASP).

While not specifically identified, activities such as video documentation, photo documentation, computer graphics and support, statistics, word processing, report preparation and purchasing support may be required in order to accomplish the objectives of this project.

The estimated costs (including labor, travel, materials and equipment, and subcontractor) to complete this project are depicted in the attached cost summary sheet.

It is anticipated that the following trips will be made in support of this project:

- Number of Trips from Edison to APG, MD 1
- Number of Days/trip 8
- Number of Personnel 10
- Per Diem $93
- Other Relevant Costs (tolls, truck rental, gas) $3000

Schedule of Activities

The work assignment for this project was received on 15 June 1999. The workplan was initiated at that time. The overall project is expected to close out with the issuance of a final technical memo on 30 Oct 2000.

The following deliverables will be provided under this project:

ITEM	DATE
Work Plan	7 July 1999
Trip Report	2 weeks after analytical data is recieved
Presentation Materials	To be determined
Final Report	30 Oct 2000