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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE FLIGHT TEST CENTER (AFMC)
EDWARDS AIR FORCE BASE, CALIFORNIA

File
E-Beam
ZAP-IT
E-Beam



REPLY TO: EM
ATTN OF:

SUBJECT: Statement of Work for Site Characterization Study for Electron Beam
Remediation at Edwards AFB

TO: AFCEE/ESCR (Major R. Miller)

1. Enclosed is a copy of the Statement of Work (SOW) for Site Characterization (Treatability) Study for Electron Beam Hazardous Waste Remediation at Edwards AFB. The purpose of this effort is to conduct a Phase I site characterization study to assess the applicability of portable electron beam transformation technology to remediate subsurface depositions of TCE at Edwards AFB.
2. As we discussed at the AFIMS Conference in Denver CO, Lawrence Livermore Laboratory provided an unsolicited proposal back in February-March 1992. If it is at all possible, would you please provide comments and guidance on the SOW.
3. If you should have any questions or comments regarding this package please feel free to contact me at (805) 277-1401 or Mr Ai Duong at (805) 277-1417.

DEAN A. DUNN
Environmental Management Office

1 Atch
Electron Beam SOW

cc: EM (Bob Wood)
EM (Ai Duong)

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AQ M01-02-0281

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STATEMENT OF WORK

SITE CHARACTERIZATION (TREATABILITY) STUDY FOR ELECTRON BEAM HAZARDOUS WASTE REMEDIATION AT EDWARDS AIR FORCE BASE, CALIFORNIA (20 July 1992)

The purpose of this work effort is to conduct a Phase I site characterization study to assess the applicability of portable electron beam transformation technology to remediate subsurface hazardous waste depositions at Edwards AFB. This effort involves the development of a test plan in consultation with Edwards AFB personnel (Task 1), collection of on-site samples (Task 2), laboratory electron beam treatment of samples (Task 3), analysis of control and treated samples (Task 4) and the development of a Phase II on-site demonstration plan (Task 5).

Nature of the Problem

Site 16 at Edwards AFB was originally identified as a JP-4 spill area caused by leakage from an underground JP-4 transfer line. Preliminary remedial action was taken to prevent further site contamination.

Preparation of a Remedial Action Plan (RAP) for Site 16 was initiated in April, 1985. Field investigation was conducted as part of the RAP work which consisted of drilling bore holes, installing monitoring wells, collecting soil and water samples for chemical analysis and conducting an aquifer pumping test to determine the hydraulic characteristics of the site. The plan recommended the installation of a recovery well and fuel storage and fuel/water separation systems. After construction and start-up of the fuel recovery system, dissolved trichloroethylene (TCE) was discovered in the discharge water, and recovery operations were suspended in December 1987. Further studies showed that benzene, toluene, ethylbenzene and xylene (BTEX) were also contaminants at Site 16.

Ultra-violet (UV) oxidation was identified as a potential best available technology for remediating groundwater contamination. Concern was subsequently expressed, however, that the incomplete oxidation under UV treatment might create hazardous end-products, such as phosgene. The alternative use of electron beam treatment is thus being considered.

Electron Beam Remediation Technology

In experiments performed at the Department of Energy's Lawrence Livermore Laboratory (LLNL), electron beams (in the x-ray mode) were used to treat a variety of VOCs (TCE, CHCl₃, CCl₄, and PCE). The tests produced complete mineralization of the VOCs and chemical analyses indicated an absence of toxic final decomposition products. As a result, the electron beam destructive transformation technology can be a viable and cost effective means to remediate VOC contamination.

Similar results were achieved in a field test of the technology at LLNL's Site 300, a Superfund site, when applied to TCE contamination. There, a commercial portable electron accelerator provided by Schonberg Radiation Corporation (SRC) and a specially-designed transformation plenum were connected to an existing vapor extraction system.

Electron beam remediation is the only transportable and efficient vapor phase complete destruction technology for VOCs. Other potential remediation methods either remove VOCs from soil or water into the air (air venting), collect VOCs for containment (carbon adsorption), only partially destroy it (incineration or UV) or require excessive treatment time (bioremediation).

TASK STATEMENT

The Contractor, in conjunction with its subcontractors (SRC and SRC's service affiliate, Zapit Technology, Inc.), shall conduct the following tasks.

Task 1: Phase I Sampling and Test Plan

The Contractor shall prepare a written Phase I Sampling and Test Plan. To the extent possible, the plan should provide for the use of electron beam remediation equipment that will be similar to the equipment provided for in the Task 5 On-Site Demonstration Plan.

The Sampling and Test Plan shall also include a Health and Safety Plan focusing on the procedures to be followed during the removal of groundwater samples from site 16. The Health and Safety Plan must be in accordance with 29CFR1910.120.

In consultation with Edwards AFB personnel, the plan shall identify the type, location and number of on-site contamination samples to be taken for subsequent treatment and laboratory tests. The plan also shall: identify procedures for subjecting non-control samples to electron beam treatment; identify the types of laboratory analyses to be performed; and describe the

sampling, packaging and transportation procedures that must be followed to insure sample integrity.

Provisions shall be made in the test plan for preserving a specified number of samples for a second round of electron beam treatment in the event chemical analyses identify unexpected and unacceptable levels of toxic reactive products. The second round of testing may involve increasing electron beam dosage levels and/or adding promoters to the samples to facilitate complete mineralization.

Task 2: Draw On-Site Samples

The Contractor shall design and construct the sample containers. The containers shall be chemically inert to the reaction products of electron beam treatment.

Currently, There is no hardware at site 16 capable of pumping and vaporizing groundwater. The contractor shall be responsible for setting up the pumps and collecting groundwater samples from the highest TCE concentration well at site 16 and air stripping off-site. All permits with Federal, State, and Local Agencies for transporting hazardous material shall be the responsibility of the contractor.

The contractor shall be responsible for properly disposing of end products as the result of Electron Beam Treatment, and any remaining samples in liquid or vaporized states.

Consistent with the procedures identified in the Task 1 sampling and test plan, the Contractor, in coordination with Edwards AFB personnel, shall collect samples from the specified site(s). The collected samples shall be packaged in a manner consistent with preserving sample integrity. All samples will receive appropriate identification and chain of custody documentation.

Task 3: Electron Beam Treatment

The Contractor shall apply electron beam treatment to non-control samples consistent with the Task 1 sampling and test plan procedures. The treatment generally will be performed on sets of samples at specified electron beam dosage levels (e.g., 100, 200, 300, 400, 500 and 1,000 kR plus an unexposed control sample).

Task 4: Sample Analysis Report

The control and treated samples shall be analyzed by the Contractor consistent with the Task 1 sampling and test plan. At least two sample set shall be analyzed by an EPA-certified laboratory. The intent of the testing shall be to ascertain the

presence or absence of hazardous products in control and treated samples.

The Contractor shall prepare a report documenting the results of the sample treatment and analyses.

Task 5: Phase II On-Site Demonstration Plan

The Contractor shall prepare a draft and final electron beam remediation Phase II On-Site Demonstration Plan based on the results of the Task 4 sample analyses, site inspections and discussions with Base personnel. The plan shall contain:

- a. Summary of the results of the Phase I effort, including sampling and test procedures and analysis results.
- b. Identification of site(s) where the remediation demonstration shall take place.
- c. Description of the hardware installation and operation.
- d. Description of measurement, monitoring and chemical analyses to be conducted during the demonstration.
- e. Description of in-progress reports documenting the test results, future actions, problem areas (if any) and actions to resolve any problems.
- f. Milestone schedule.
- g. Detailed Phase II benefit to cost analysis.
- h. Phase II estimated cost, separately identifying equipment, support and G&A or other handling fees.

The plan also shall contain a conceptual framework for potential electron beam remediation of non-subsurface VOC contamination. Examples shall include air stripping and electron beam treatment of released TCE vapors from existing carbon adsorption collection canisters. An order of magnitude preliminary cost/benefit analysis of electron beam versus traditional carbon regeneration/disposal methods shall be included in the conceptual framework.

The Contractor shall present an oral briefing on a draft demonstration plan to Base personnel. The final, written plan shall incorporate Air Force verbal comments provided during the briefing to Base personnel on the draft plan.

SCHEDULE

<u>Task</u>	<u>Description</u>	<u>Date</u>
Task 1	Phase I Sampling & Test Plan	30 days ACA ¹
Task 2	Draw On-Site Samples	45 days ACA
Task 3	Electron Beam Treatment	75 days ACA
Task 4	Sample Analysis Report	100 days ACA
Task 5	Draft Demonstration Plan	
	Briefing	100 days ACA
Task 5	Final Demonstration Plan	120 days ACA

DELIVERABLES

Copies of each task deliverable shall be submitted to the following:

Mr. Bob Wood (10 copies)
HQ AFFTC/EM
Edwards AFB, CA 93523

Mr. Dean Dunn (3 copies)
HQ AFFTC/EM
Edwards AFB, CA 93523

¹ ACA = After Contract Award.