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TECHNICAL MEMORANDUM REGARDING INITIAL REMEDIAL ACTION ALTERNATIVES FOR NORTH FUEL FARM JP-5 SPILL AREA NAS CECIL FIELD FL
12/1/1993
NAS CECIL FIELD

TECHNICAL MEMORANDUM
INITIAL REMEDIAL ACTION ALTERNATIVES FOR NORTH FUEL FARM, JP-5 SPILL AREA

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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DECEMBER 1993

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INITIAL REMEDIAL ACTION ALTERNATIVES
FOR NORTH FUEL FARM, JP-5 SPILL AREA
NAS CECIL FIELD, JACKSONVILLE, FL.

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EXECUTIVE SUMMARY

The Jet Fuel (JP-5) Spill Area of the Cecil Field North Fuel Farm Area (NFFA) is the site of a 1991 release of an estimated 900,000 gallons of JP-5. An initial remedial action (IRA) as defined by Chapter 17-700, Florida Administrative Code is proposed to capture the free product and treat the excessively contaminated soil (OVA response greater than 50 ppm).

The proposed actions to accomplish free product recovery and excessively contaminated soil treatment are water table depression for free product recovery and a bioventing pilot study and soil vapor extraction system for the soil. These actions will require approval by the Florida Department of Environmental Protection (FDEP) as alternative procedures. However, in addition to accomplishing the minimum requirements of an IRA, the actions will stabilize the groundwater plume migration (reducing the continuing spread of the plume), reduce the potential of excessively contaminated soil as a continuing source of groundwater contamination , and provide valuable aquifer characteristics and soil treatment data for the future NFFA remedial action plan.

INTRODUCTION

SITE BACKGROUND

The North Fuel Farm Area (NFFA) is comprised of the North Fuel Farm, Truck Stand and Jet Fuel (JP-5) Spill Area. The NFFA is located at the northeast corner of A Avenue and Loop Road at Naval Air Station (NAS) Cecil Field. This Position Paper on Alternatives for Initial Remedial Action (IRA) is limited to the immediate area of the JP-5 Spill site. Other areas of the NFFA are covered in Contamination Assessment Reports (CARs) previously submitted to and reviewed by the Florida Department of Environmental Regulation (FDER).

Releases of Jet Fuel (JP-5) have reportedly occurred throughout the period the site has been in operation. The most recent and most significant release occurred on February 9 and 10, 1991 when an estimated 900,000 gallons of JP-5 overflowed from above ground storage tank 76E. The fuel entered Sal Taylor Creek and was observed pooled around dams and ponds at seven locations along the creek.

The topic of this paper is limited to the spill area immediately adjacent to Tank 76E. The spill area is approximately 1.5 acres in size and is located off the northeast corner of the tank farm (Figure 1). Shallow soil borings have been advanced to the water table, approximately 5 feet below land surface (bls). The boring locations and their associated organic vapor analyzer readings (in ppm) are also shown on Figure 1. Free product is present in monitoring well CEF-0760-04, located at the northeast corner of the fuel farm fenced area, and in numerous soil borings located throughout the spill area (Figure 2).

REGULATORY GUIDELINES

Initial Remedial Actions conducted in the state of Florida must meet the minimum requirements of the Florida Department of Environmental Protection (formerly Florida Department of Environmental Regulation), Chapter 17-770, Florida Administrative Code (FAC). Specifically, Chapter 17-770.300 "Initial Remedial Actions" details the actions that the state of Florida allows for an initial remedial action. Examples of the Initial Remedial Action Notification Form that provide written confirmation of an IRA, and the Initial Remedial Action Report Form that summarizes the IRA can be found in "Guidelines for Assessment and Remediation of Petroleum Contaminated Soils" available from FDEP, May 1992 version. Chapter 17-770.300 states that free product recovery is required during an IRA, and removal of excessively contaminated soil is encouraged, but not required.

REMEDIAL OPTIONS

SUMMARY OF MINIMUM REGULATORY REQUIREMENTS

Chapter 17-770.300 FAC states that an IRA should consist of free product recovery (after source identification and stoppage of discharge), and optionally, treatment of excessively contaminated soils (OVA reading greater than 50 ppm for kerosene group contaminants). Free product recovery can not spread contamination into previously uncontaminated areas and excessively contaminated soil excavation with disposal at a thermal treatment facility, landfill, or landfarm can not exceed 1500 cubic yards. Approval by FDEP is required for alternative procedures such as free product recovery that involves or causes any depression of the water table and soil treatment methods such as soil vapor extraction (SVE) or bioremediation.

Free Product

The recovery of free product at the JP-5 Spill Site without depressing the water table is limited to periodic bailing or low flow, short duration pumping of a monitoring well in the spill area with a product recovery pump until free

product recovery becomes ineffective. This procedure would require a minimum of weekly visits to the site to remove the product from the monitoring wells and to collect the product in a container for proper disposal. These methods have not proven to be effective at recovering all the free product at other sites ABB-ES has been involved in.

Excessively Contaminated Soil

The excessively contaminated soil at the JP-5 Spill Site (OVA response of greater than 50 ppm, kerosene group) covers an area of approximately 1.5 acres by approximately 5 feet deep bls. The thickness of the area fluctuates with seasonal variations in the water table, varying from near surface to approximately 6 feet bls. Because of the size of the spill area and the fluctuating water table, excavation of all the contaminated soil could prove difficult to implement. Although treatment of the contaminated soil is not required by FDEP, it would be beneficial in reducing a continuing source of groundwater contamination.

PRO-ACTIVE RECOMMENDATIONS BEYOND FDEP MINIMUM REQUIREMENTS

Excessively Contaminated Soil

Treatment of the excessively contaminated soil will reduce the amount of groundwater that eventually must be treated by reducing one of the continuing sources of contamination to an acceptable level. Several options for soil treatment at the JP-5 Spill Area exist, excavation, landfarming, in-situ bioventing, and soil vapor extraction (SVE), are possible options.

Excavation and treatment at an offsite thermal facility could remediate the soil. Landfarming (tilling) of the contaminated area is another possible option for soil remediation. The depth of contamination and the fluctuating water table make these options somewhat difficult to implement and would not provide any information on soil treatment for use during the remedial action plan (RAP) development for the NFFA.

An in situ bioventing pilot study conducted on a portion (approximately 50 ft. X 100 ft.) of the contaminated soil will determine if this method provides an adequate level of remediation for the site. The pilot study would consist of a system of horizontal piping installed above the water table. Alternating pipes will pull air or push air through the site. The surface will be covered with plastic to limit short circuiting (loss of air to the atmosphere) and have a drip irrigation system with a flow rate of approximately one gallon per minute. A blower and an air compressor would be needed as well as periodic checks on the system efficiency. A more thorough description of a typical system for a site like the JP-5 Spill Area (including cost estimates) is attached as Appendix A. The information gained from this pilot study would be useful during design of the remedial system needed to treat the rest of the NFFA site.

Soil vapor extraction of the contaminated soil is a second option. SVE is a proven, effective method of remediation for petroleum product contamination in soil. However, the shallow water table at the site would present implementation problems for an SVE system. If depression of the water table is allowable an SVE pilot study could be conducted in the worst area of soil contamination. The pilot study would require the installation of vapor extraction well(s) as well as several observation wells to determine the radius of vapor influence. The area of extraction would also need to be covered with plastic to prevent short circuiting. A blower, vapor treatment such as carbon or thermal oxidizer, and associated equipment, along with operation and maintenance time would be required.

Both of these options would require FDEP approval as an alternative action for an IRA. However, the proposed pilot studies would provide useful information for the Remedial Action Plan (RAP) for the entire NFFA that will follow and the actions taken will serve to mitigate a continuing source of groundwater contamination.

Free Product Recovery Enhancement and Plume Stabilization

The recovery of free product could be enhanced by creating a water table depression with a dewatering system. A series of well points positioned across the plume would depress the water table and stabilize the contaminant plume. This would increase the quantity of free product recovered, increase the volume of soil exposed for treatment, and aid in the determination of aquifer characteristics for the design of the future remedial system. The extracted water would need to be pumped through an oil-water separator to remove the free product. The residual contaminated water would need to be treated prior to discharge/disposal. Treatment by an air stripper, and polishing by a liquid-phase granular activated carbon unit would be one possibility. Some of the treated effluent could be discharged onto the soil treatment area to assist in the soil remediation (e.g., infiltration of nutrients for the bioventing pilot test) and the remainder could be disposed through an infiltration gallery. This action would require FDEP approval as an alternative procedure for an IRA and would significantly enhance the efficiency of free product removal.

Soil Vapor Extraction and In Situ Air Sparging

Additional pilot studies to determine the most effective method of site cleanup could also include soil vapor extraction (SVE) in combination with in situ air sparging (IAS). Although SVE is a proven method of extracting vapor from contaminated soil, IAS is a relatively new process for in-situ remediation of dissolved volatile organic compounds. Both methods would require the installation of minimal equipment, well points, an air compressor for the IAS, and a blower and vapor phase treatment for the SVE. A schematic of a SVE/IAS system is shown in Figure 3 reproduced from the Fall 1993 edition of "Ground Water Monitoring & Remediation".

The shallow water table presents some problems for a SVE/IAS pilot study. However, by determining the optimum time of the year for a pilot study (lowest naturally occurring water levels) it could be conducted in the following manner: operate the SVE system for 12-to-24 hours, operate the SVE/IAS system for 12-to-24 hours, and finally operate the IAS system for 12-to-24 hours. This multiple stage pilot test would allow comparison of the efficiency of each system individually and in combination. This pilot study would provide important information for design of a complete remedial system for the NFFA and the action taken will serve to mitigate a continuing source of contamination, and enhance free product recovery efforts.

LEVEL OF EFFORT AND APPROXIMATE COST COMPARISON

Table 1 lists the various remedial options, their required level of effort to implement and an approximate cost to implement.

RECOMMENDATIONS

The IRA options that will accomplish the goals of free product recovery and contamination source reduction at the JP-5 Spill Area are the use of a ground water depression system for free product capture and plume stabilization, and the implementation of both bioventing and SVE pilot studies. Additionally, the use of IAS concurrently with the SVE pilot study would provide an initial action for groundwater treatment and would provide data that will be significant in designing the remedial system for the NFFA. The most passive approach of simply bailing the free product will recover some free product but at a much slower rate, without the benefits of gathering aquifer characteristics data, without accomplishing any contaminant source reduction in the soil, and without the benefits of plume stabilization.

TABLE 1
IRA Remedial Option Comparison
JP–5 Spill Area
NAS Cecil Field

REMEDIAL ACTION	LEVEL OF EFFORT	APPROXIMATE COST	SOURCE REMOVAL EFFECTIVENESS
FREE PRODUCT RECOVERY			
Monitoring Well Bailing	LOW	$5,000	LOW
Intermittent Low Volume Pumping	MEDIUM	$7,500	MEDIUM
Dewatering	HIGH	$160,000	HIGH
SVE/IAS Pilot Study	HIGH	$20,000	LOW
EXCESSIVELY CONTAMINATED SOIL			
Excavation & Thermal Treatment	HIGH	>$250,000	HIGH
Bioventing Pilot Study	MEDIUM	$70,000	LOW
SVE Pilot Study	MEDIUM	$10,000	LOW
SVE/IAS Pilot Study	HIGH	$20,000	LOW
IN–SITU LANDFARMING	LOW		LOW

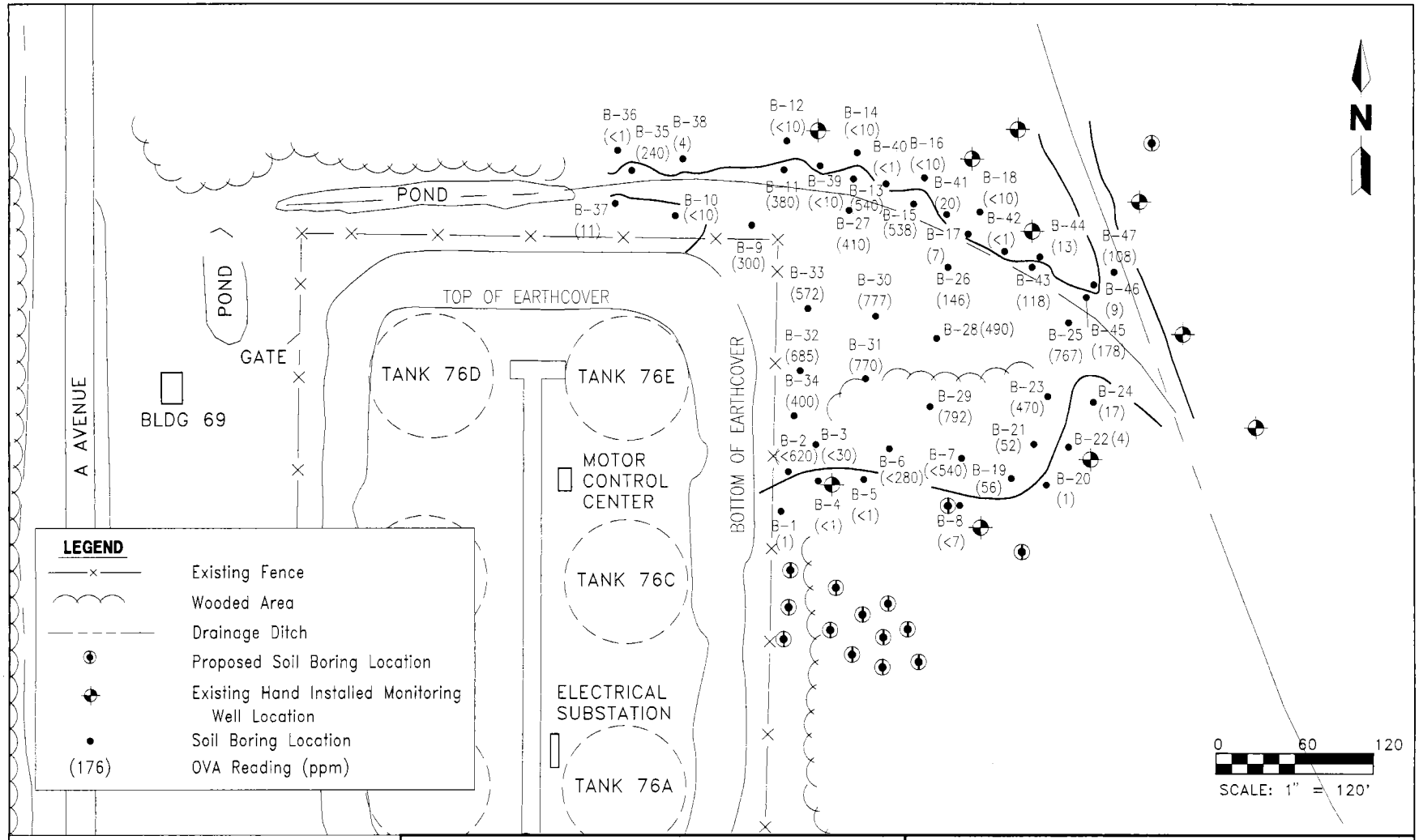


FIGURE 4-5
PROPOSED SOIL BORING LOCATION AT JP-5 SPILL SITE

CONTAMINATION ASSESSMENT PLAN, NORTH FUEL FARM AREA

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

BACMED.DWG/MAH/10-25-93

FIGURE 1 Proposed Soil Boring Location at JP-5 Spill Site

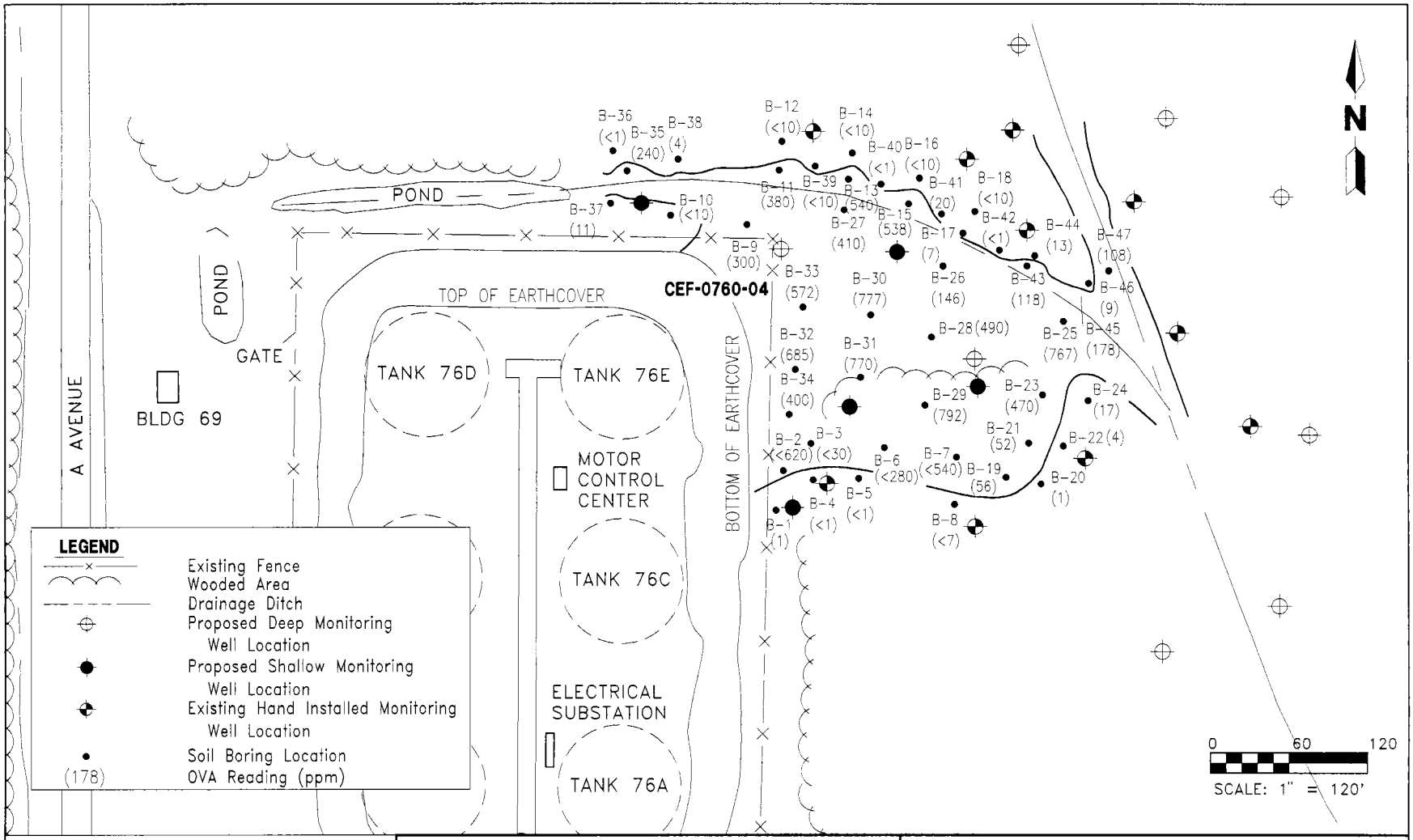


FIGURE 4-6
PROPOSED MONITORING WELL LOCATION AT JP-5 SPILL SITE

CONTAMINATION ASSESSMENT PLAN, NORTH FUEL FARM AREA

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

BACMED.DWG/MAH/10-22-93

FIGURE 2 Proposed Monitoring well Location at JP-5 Spill Site

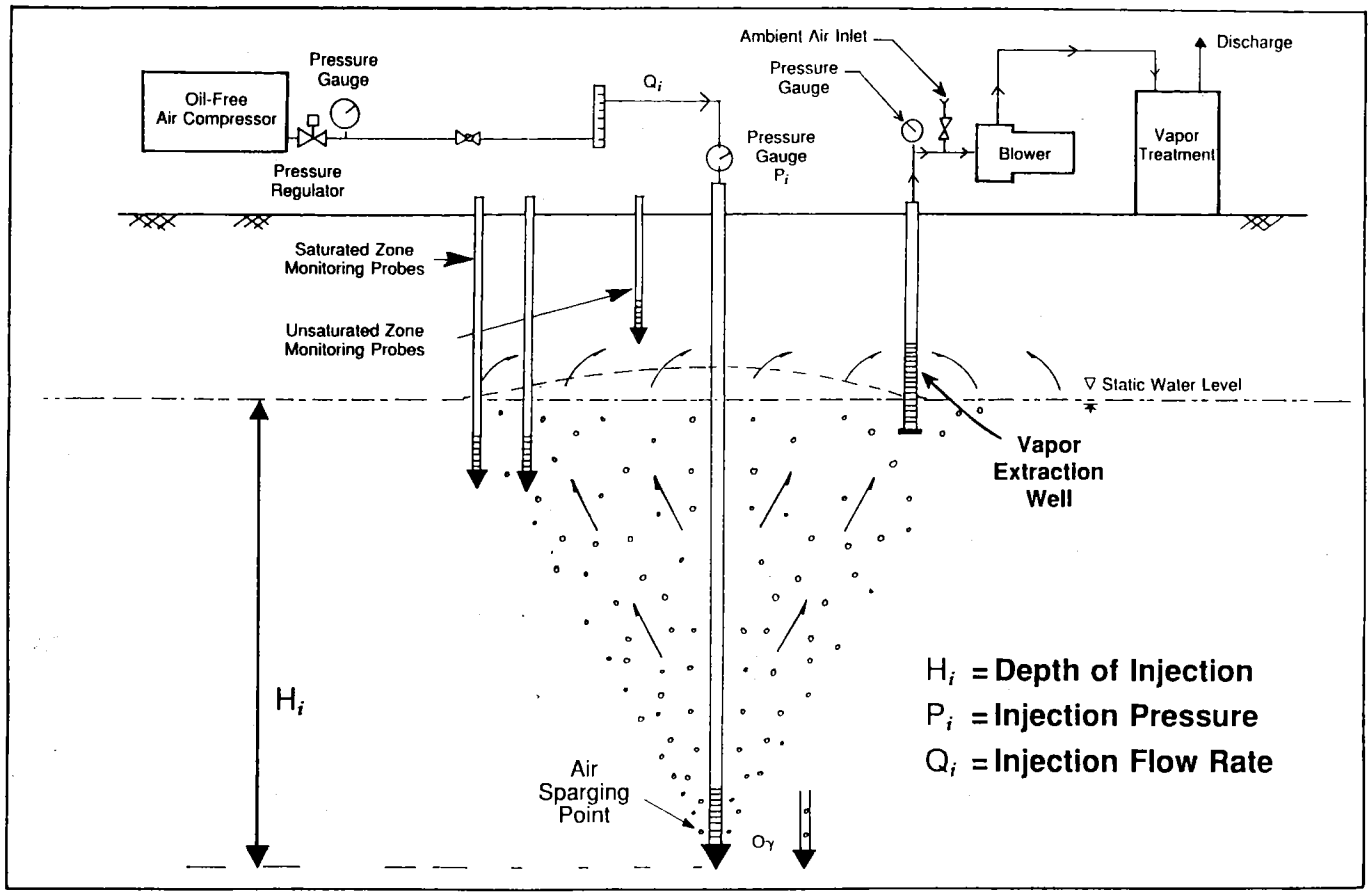


FIGURE 3
FIGURE REPRODUCED FROM GROUND WATER MONITORING & REMEDIATION
FALL 1993, VOLUME 13 NO. 4

APPENDIX A

Cecil Field Bioventing

Introduction

Bioventing is a vadose zone remediation process in which biological degradation of organic compounds occurs in-situ. The principle behind bioventing is to improve soil environmental conditions to promote biological degradation of organic compounds by the naturally-occurring soil microorganisms. Often the natural population of soil microorganisms has the ability to degrade the compounds of interest, but is limited by inadequate environmental conditions such as the shortage of moisture, nutrients or electron acceptors (e.g. oxygen). Soil environmental conditions that can be improved by bioventing include oxygen, nutrient, and moisture conditions.

A bioventing system closely resembles a soil vapor extraction (SVE) system, however it is operated differently. Similar to a SVE system, the primary equipment for a bioventing system includes a series of vertical or horizontal wells for the injection/removal of air and a vacuum blower. The operation of the vent wells is different for each system however, based on the objective of the technology. The objective of a bioventing system is to promote biological degradation of organic compounds in the soil. Therefore, the vent wells of a bioventing system are operated at a level to only deliver oxygen through the soil without removing large amounts of VOCs (as occurs with a SVE system). Most (>80%) of the vapors that are extracted from the soil during bioventing operation are returned to the soil to provide greater opportunity for biodegradation. The remaining vapors are treated and discharged.

Nutrients and proper moisture conditions which are also needed for bioremediation using bioventing, are supplied to the soil through a series of injection wells or trenches. Groundwater or potable water can be amended with nutrients to provide the moisture and nutrients for biological degradation of organic compounds.

Bioventing Operation at Cecil Field

The proposed bioventing system for Cecil Field JP-5 contamination is presented in Figure 1. This bioventing system consists of horizontal vapor injection wells, a vacuum blower, and a nutrient delivery system to bioremediate a 100-ft by 50-ft test area. Three (3) 50-foot long vapor injection trenches spaced 33-feet apart would be used to draw air through the soil in the treatment area. Each would contain 2-inch slotted PVC piping placed approximately 4 feet below ground surface (above the groundwater table). A polyethylene tarp would be placed over the ground surface to promote effective movement of air through the contaminated vadose zone and prevent short-circuiting.

The nutrient delivery system consists of pumps, irrigation hose, and nutrient feed equipment. A pump would deliver either potable or treated groundwater through a series of drip irrigation hoses spaced approximately three (3) feet apart across the bioventing test area. Nutrient feed equipment would include a water holding tank, mixer and metering pump to deliver concentrated nutrient media into the irrigation influent water line.

During operation, the venting system and irrigation systems would operate independently. Air would be injected through alternating sets of vapor wells for a specified period of time (approximately 30 minutes), shut off for approximately four (4) hours, then started up again. This mode of vapor well operation would occur continuously throughout the bioventing treatment period. The irrigation system would be operated approximately once per week (or on an as-needed basis), whereby approximately 500 - 1000 gallons of nutrient-amended water would be added to the treatment soil per week.

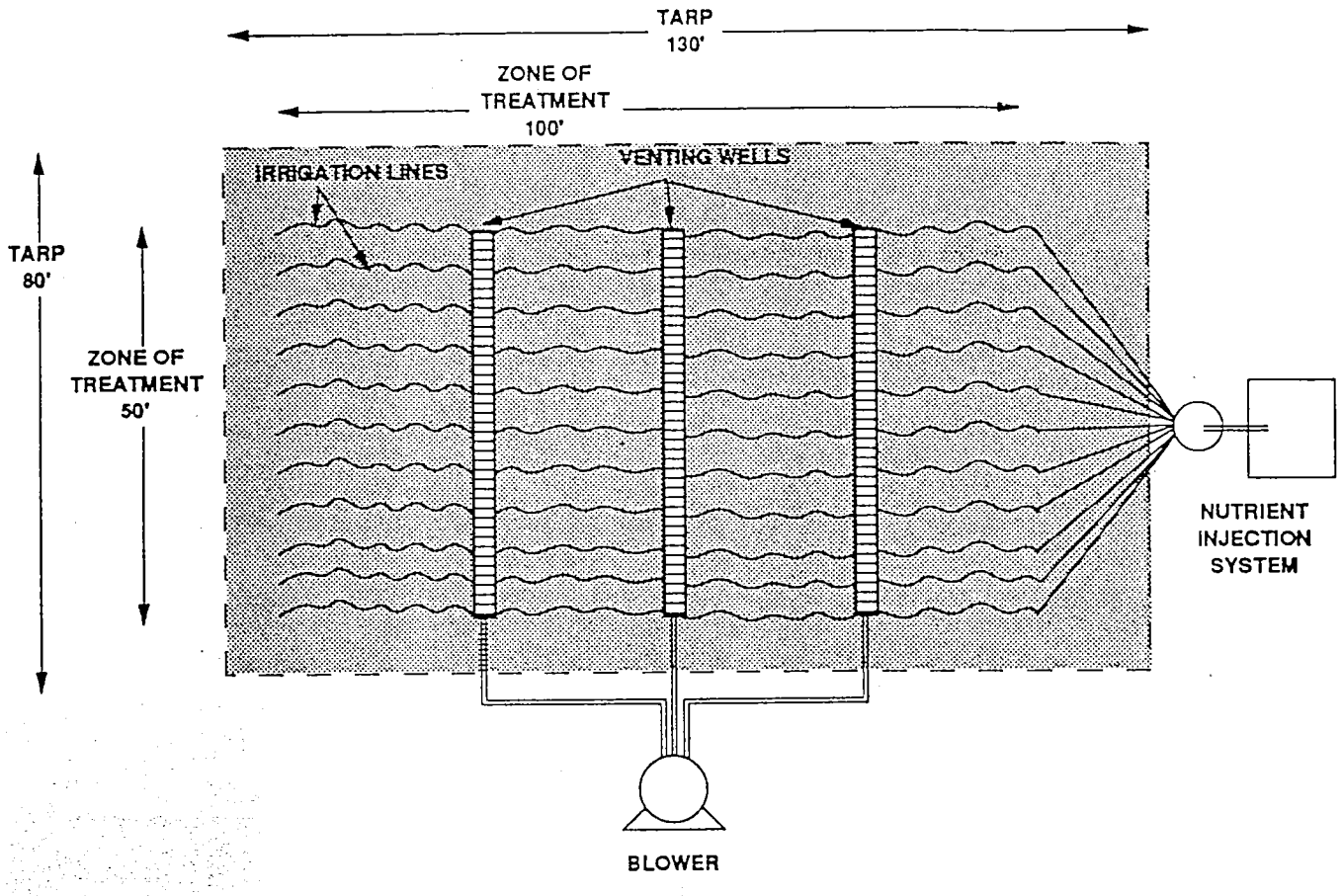
The bioventing test system would operate for approximately six (6) months. System effectiveness would be measured though a series of tests including: soil TRPH concentration measurements, respirometry measurements, and soil bacteria enumerations.

Costs

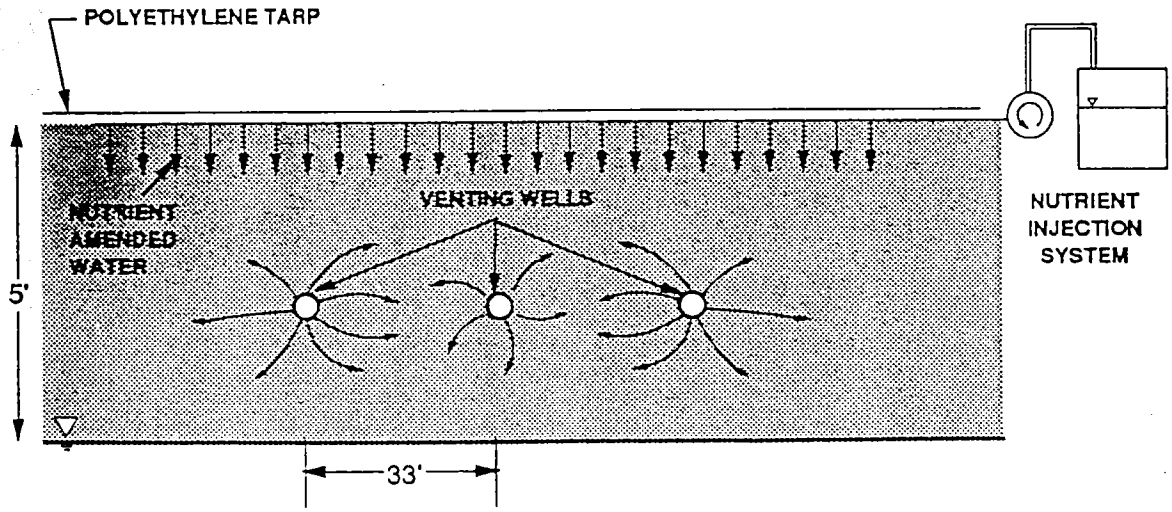
Costs for the bioventing system are presented in Table 1. Assumptions made for the installation of such a system are as follows.

Assumptions

- Potable or clean groundwater is available for nutrient delivery
- Water from the water source has sufficient pressure to be delivered to the bioventing test area
- The water table will be depressed by pumping to a level of 5 feet below ground surface
- Electricity is available
- All stumps will be cleared from the bioventing area (or trench paths)



PLAN VIEW



SECTION VIEW

ABB Environmental Services, Inc.

FIGURE 1
BIOVENTING SYSTEM

Cecil Field NFFA

Cost Estimate for In–Situ Bioventing (JP–5 Spill Area)

ITEM	Unit	Unit Cost	Quantity	Total Cost
I. Initial Design				
Engineering Design/Procurement (P2)	Hr.	$75	40	$3,000
Sr. Engineering (P3)	Hr.	$100	24	$2,400
Sr. Technical Review	Hr.	$125	8	$1,000
Drafting	Hr.	$50	16	$800
Clerical	Hr.	$45	16	$720
II. Air Flow System				
50' Trenches with 2" Slotted PVC (Installed)	lf	$50	150	$7,500
Blower/Skid/Controls	LS	$5,000	1	$5,000
Piping/Fittings/Valves/Flowmeters	LS	$2,000	1	$2,000
Permalon X–150 PE Tarp (130' x 80')	sf	$0.22	10400	$2,288
Installation/Setup Labor (ABB 2 x40/hr)	Hr.	$75	80	$6,000
III. Nutrient Injection System				
Irrigation Hose	lf	$0.80	1800	$1,440
Nutrient Feed Pump/Tank/Mixer/Valves	LS	$3,000	1	$3,000
Equipment Shed	LS	$1,200	1	$1,200
IV. Monitoring Equipment				
Tensiometer	ea	$85	8	$680
Soil Gas Monitoring Probe	LS	$85	8	$680
V. Operation and Monitoring (6–mo)				
O & M Labor (6 hr/wk)	Hr	$55	156	$8,580
Nutrients/pH Control	LS	$1,000	1	$1,000
Monitoring Tests				
Nutrient	ea	$80	12	$960
Bacteria Enumerations	ea	$100	12	$1,200
TRPH	ea	$130	24	$3,120
Respirometry Tests (2)	LS	$1,700	2	$3,400
		Subtotal Cost:		**$55,968**
		+20% Contingency:		**$11,194**
		Total Estimated Cost:		**$67,162**