Request for Applications to Demonstrate Technologies To Treat Methyl-t-Butyl Ether

Solicitation Objectives

The purpose of this Treatment Technology Application (TTA) is to solicit alternative treatment or remedial technologies that can be demonstrated at one or more selected sites in California for removing or destroying methyl-*t*-butyl ether (MTBE) and its byproducts in contaminated aquifers and drinking water. Two different loci of contamination are the focus of the demonstration: at or near the source of contamination within the aquifer and at the wellhead. Technologies treating the source must be able to handle high concentrations of MTBE (5 to > 100 mg/L) in the presence of other fuel compounds such as benzene, toluene, ethylbenzene, and xylenes (BTEX), and, potentially, non-aqueous phase liquids. Technologies treating water at the wellhead must be able to handle much lower concentrations of MTBE (10 to 500 µg/L) and, potentially, *t*-butyl alcohol (TBA), usually in the absence of other organics. The technologies will be demonstrated under controlled conditions so that proper scientific evaluations and assessments are possible. The size of demonstrations will be of such a magnitude to enable scale-up without having to make unsupported assumptions.

Solicitation Structure

This TTA consists of five (5) sections:

- Section 1: Summary of program requirements.
- Section 2: Description of host site.
- Section 3: Application requirements (general, outline, and discussion) and a description of the criteria used to evaluate applications.
- Section 4: Review and selection process.
- Section 5: Schedule.

Introduction

The U.S. Environmental Protection Agency (EPA) is engaged in an effort to demonstrate and verify the cost and performance of new environmental cleanup and drinking water treatment technologies for fuel oxygenates, particularly MTBE and its byproducts. This solicitation focuses on parties responsible for cleanup of MTBE-contaminated aquifers and drinking water and their technology needs. Specifically, its purpose is to solicit treatment technologies to treat MTBE-contaminated aquifers at the source and at the wellhead at one or more selected host sites for a period of up to one year. The objective is to demonstrate and verify field application of remediation and drinking water technologies that would render the MTBE-contaminated water safe for human consumption. The results of the evaluations will provide reliable engineering, performance, and cost information for treatment decision-makers and technology vendors.

The primary fuel oxygenate of interest nationally is methyl-*t*-butyl ether (MTBE) and its byproducts, such as *t*-butyl alcohol (TBA). MTBE and TBA are highly water soluble, not easily strippable, not readily biodegradable, and have relatively low sorption coefficients for soil or activated carbon. These contaminants are often highly mobile in the subsurface and may migrate significant distances in groundwater with relatively little retardation or biodegradation in contrast to other fuel constituents such as benzene, toluene, ethylbenzene, and xylenes (BTEX). Consequently, the highly mobile oxygenate compounds present potential risks to human health and the environment as contaminants in groundwater supplies.

Aquifers contaminated with fuels containing these oxygenates generally consist of source areas and groundwater contamination plumes that migrate downgradient from these source areas. Contaminant nature and distribution often are fundamentally different in source areas (areas within the aquifer containing the original contamination), where contaminant mass and concentrations are high and contaminants may be present as both non-aqueous phase liquids and dissolved in groundwater, than in the downgradient plume, where contaminant concentrations are significantly lower. Based on these fundamental differences, different technologies are often required for remediation of source areas within the aquifer and the downgradient plume. Thus, there is a need to study MTBE removal from both the source area using *in-situ* technologies and from groundwater that is extracted either during remediation of the downgradient plume or during production of potable water from wells. The aquifer in the source area where the original contamination occurred needs to be treated for several reasons:

- The vast majority of the contaminant mass is associated with the original source of contamination in the aquifer.
- When the source is gone, pump-and-treat systems and *in-situ* technologies work in a more timely manner.

Drinking water treatment at the wellhead is necessary because of the public need to use the water directly for human consumption or the need to meet certain concentration standards prior to discharge. *Ex-situ* treatment technologies are the most likely candidates for cost-effective use in wellhead treatment. Both source and wellhead treatment are equally important for inclusion in this research demonstration.

SECTION 1. PROGRAM REQUIREMENTS

The California selected host site responsibilities include providing power, site access, and physical support for the process (paving, concrete pad, containment, etc.). Proper disposal of waste generated during the demonstration is also the responsibility of the site applicant. EPA will provide support for specific tasks in the demonstration including test plan preparation, rigorous sampling and analysis, and report writing. The technology supplier's responsibilities include provision and installation of the technology, daily operation and maintenance, troubleshooting, and system shutdown at the end of the demonstration.

The funding mechanism will be in the form of a Cooperative Research and Development Agreement (CRDA). Funds are not exchanged between EPA and the technology supplier. Prior to the demonstration, a no-funds agreement is signed by the technology supplier(s) and EPA to define the areas of responsibility. The application developed in response to this TTA will be the

basis for the agreement with EPA and must, therefore, contain sufficient details about the proposed technology and the actual treatment it provides.

SECTION 2. DESCRIPTION OF HOST SITE

The Naval Construction Battalion Center (CBC) Port Hueneme, California has been selected as a host site for both source zone and wellhead treatment technology demonstration and evaluation for MTBE-impacted groundwater. The CBC Environmental Office and the Advanced Fuel Hydrocarbon Remediation National Environmental Technology Test Site (NETTS) will co-host the projects on-site. CBC Port Hueneme is located approximately 70 miles northwest of Los Angeles.

General Information

The Naval Exchange (NEX) Service Station site on CBC Port Hueneme is available for *in-situ* and *ex-situ* processes to treat MTBE in groundwater. Based on NEX Gasoline Station inventory records, approximately 4,000 gallons of leaded gasoline and 6,800 gallons of premium unleaded gasoline, for a total of 10,800 gallons, containing the additive MTBE were released from product delivery lines into the subsurface between September 1984 and March 1985. The area considered as the source area is comprised of a 9-acre MTBE plume with the BTEX compounds (benzene, toluene, ethylbenzene, and isomers of xylene) extending more than 1,200 feet from the release site (Figure 1). The MTBE dissolved plume extends another 36 acres. The plume is, for the most part, under open hardstands (parade ground, parking lots, and storage areas).

Hydrogeology

The geology at the site consists of unconsolidated sands, silts, and clays with minor amounts of gravel and fill material. A shallow semi-perched aquifer is the uppermost groundwater unit. It is contained within the first three depositional soil units, which consist of an upper silty sand unit, an underlying fine- to coarse-grained sand unit, and a basal clay unit. The NEX plume is confined within the aquifer and is within 22 feet of the ground surface.

In general, groundwater within this aquifer flows southwest with gradients ranging from approximately 0.001 to 0.003. Transmissivity values range from 19,000 to 45,000 gal/day/ft. Groundwater flow velocity ranges from 230 to 330 ft/year, assuming a porosity of 35 percent. Unconfined water table conditions typically characterize the aquifer, with upper water levels ranging from 8 to 10 feet below ground surface (bgs) with about 1- to 2-foot seasonal variation.

For ex-situ treatment technologies, contaminated groundwater can be delivered to the technology system at up to 10 gpm.

Contaminant Distribution

Groundwater contamination is limited to the upper horizon of the shallow aquifer flowing beneath the NEX Service Station. The area immediately downgradient of the NEX Service Station, where aquifer contamination consists of nonaqueous-phase liquids as well as contaminated groundwater, is being considered for demonstration of source treatment

technologies. Demonstration of drinking-water treatment technologies is being considered for areas of the dissolved plume downgradient of the contaminant source where the contaminants of concern are MTBE and, potentially, TBA. In Figure 1 and Table 1, monitoring well CBC-10 is representative of the source area concentrations of MTBE and BTEX contaminants in groundwater. Monitoring wells CBC-25, CBC-46, CBC-49, and CBC-51 represent the dissolved plume MTBE data at various distances from the source materials. The distribution of TBA appears to be more variable than that of MTBE. Concentrations of TBA in recent groundwater samples have ranged as high as approximately 3 mg/l. In Figure 1, monitoring wells CBC-10 and CBC-25 are representative of the source area concentrations of MTBE and BTEX contaminants in groundwater. Monitoring wells CBC-46, CBC-49, and CBC-51 represent the dissolved plume MTBE data. Table 1 indicates recent MTBE and BTEX concentration data in both the source and dissolved plume areas.

Table 1. MTBE and BTEX Concentrations in the source and dissolved plume areas (µg/L)

	Mar-99	**Jun-99**	**Dec-99**
CBC-10			
MTBE *			8600
Benzene			200
Toluene			63
Ethylbenzene			610
Xylenes (Total)			1800
CBC-25			
MTBE *	3300.00		
Benzene	BQL		
Toluene	0.74		
Ethylbenzene	0.50		
Xylenes (Total)	1.40		
CBC-46			
MTBE *		3700	
Benzene		BQL	
Toluene		BQL	
Ethylbenzene		BQL	
Xylenes (Total)		BQL	
CBC-49			
MTBE *		950	1800
Benzene		BQL	
Toluene		BQL	
Ethylbenzene		BQL	
Xylenes (Total)		BQL	
CBC-51			
MTBE *		320	670
Benzene		BQL	
Toluene		BQL	
Ethylbenzene		BQL	
Xylenes (Total)		BQL	

Table 2 presents a summary of groundwater chemistry data from monitoring well CBC-10, which is 130 feet down-gradient from the release site. The aquifer in the NEX plume area is considered to be anaerobic with dissolved oxygen concentrations generally < 1 mg/l.

Table 2. Monitoring Well CBC-10 groundwater chemistry (May 1999)

COMPOUND	RESULT	UNITS	PQL	METHOD	ANALYZED
Alkalinity (CaCO3)	420.00	mg/L	10.00	310.1	05/24/99
Bicarbonate (CaCO3)	420.00	mg/L	10.00	310.0	05/24/99
Carbonate (CaCO3)	BQL	mg/L	10.00	310.1	05/24/99
Hydroxide	BQL	mg/L	10.00	310.0	05/24/99
PH	7.60	S. U.	----	150.1	05/21/99
Total hardness	890.00	mg/L	10.00	130.2	05/24/99
Chloride	100.00	mg/L	50.00	300.0	05/21/99
Fluoride	0.85	mg/L	0.10	340.1	05/21/99
Nitrate as N	BQL	mg/L	0.10	300.0	05/21/99
Sulfate	810.00	mg/L	50.00	300.0	05/21/99
Conductivity	2610.00	µMHOs/cm	2.00	120.1	05/21/99
T.D.S.	1750.00	mg/L	40.00	160.1	05/24/99
MBAS Surfactants	BQL	mg/L	0.10	425.1	05/21/99
Odor	BQL	T.O.N	1.00	140.1	05/21/99
Turbidity	13.00	NTUs	0.10	180.1	05/21/99
Calcium	310.00	mg/L	2.00	200.7	05/24/99
Copper	0.08	mg/L	0.03	200.7	05/24/99
Iron	1.86	mg/L	0.05	200.7	05/24/99
Magnesium	87.00	mg/L	1.00	200.7	05/24/99
Manganese	0.48	mg/L	0.10	200.7	05/24/99
Potassium	5.00	mg/L	4.00	200.7	05/24/99
Sodium	190.00	mg/L	4.00	200.7	05/24/99
Zinc	0.11	mg/L	0.06	200.7	05/24/99

T.D.S.: Total Dissolved Solids
PQL: Practical Quantitation Limit
BQL: Below Practical Quantitation Limit

Regulatory Factors

The NETTS staff works closely with the CBC Environmental Office staff and the technology demonstrators to prepare and submit concurrence documents and permit requests.

The lead agency with regulatory oversight authority for the underground storage tank remediation sites on CBC Port Hueneme is the Los Angeles Regional Water Quality Control Board (RWQCB). This oversight authority includes ongoing monitoring activities on the NEX Service Station plume as well as all remediation activities at the site, including technology demonstrations.

An air permit issued by the Ventura County Air Pollution Control District is required for all project equipment that would release fugitive reactive organic compounds, nitrogen oxides, particulate matter, sulfur oxides, and carbon monoxide emissions.

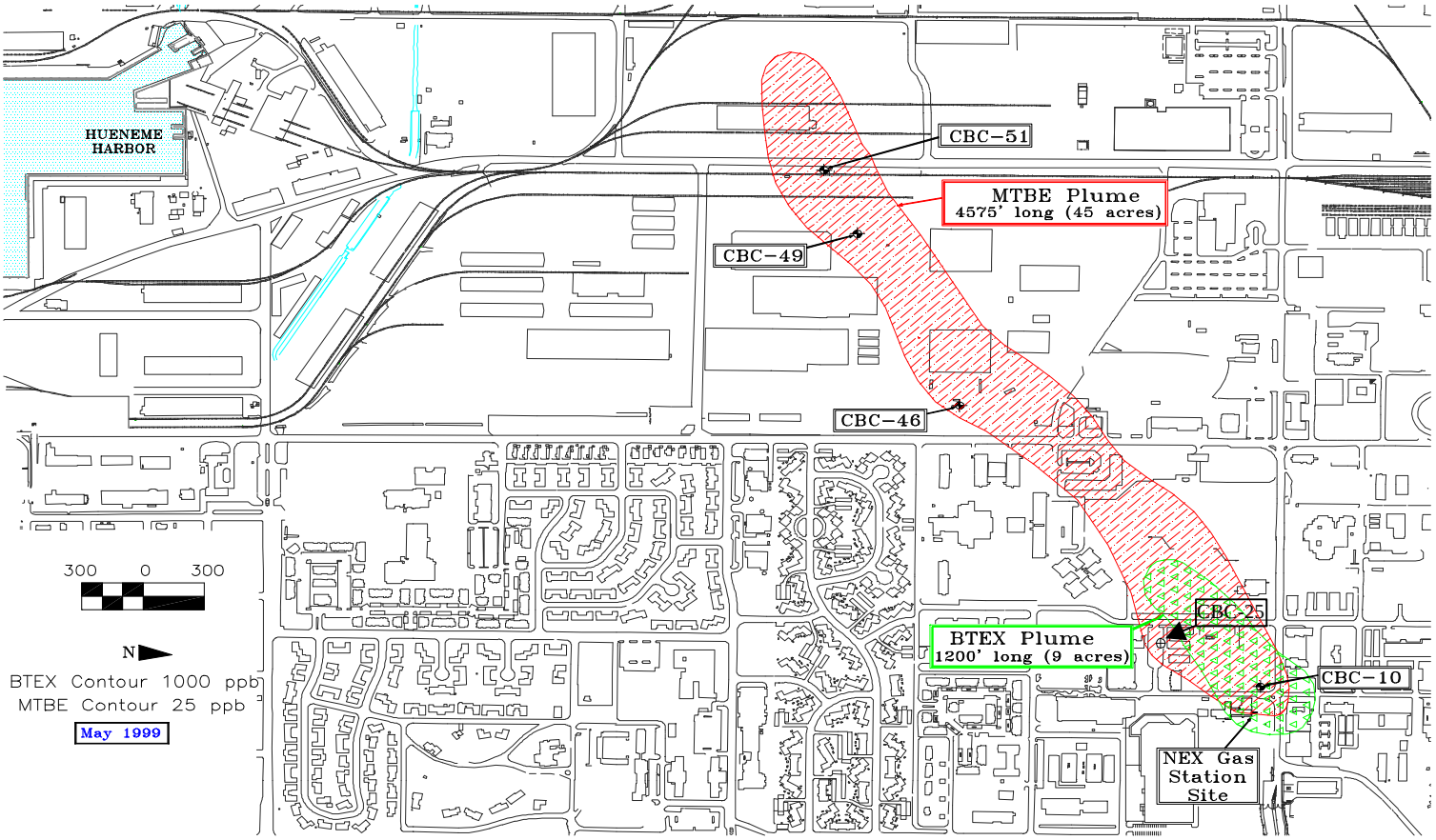
Treated contaminated groundwater is discharged into the sanitary sewer distribution system. This process is permitted through the City of Oxnard via an Industrial Waste Discharge Permit, which is granted through the Regional Water Quality Control Board. Discharge into the sanitary sewer system will require coordination with the CBC Environmental Office and monitoring of the water.

For projects requiring new well installation, an exemption will be obtained through the Ventura Country Public Works Department, Water Resources Division. This exemption is possible because wells shallower than 25' do not require a permit.

Logistical Factors

Infrastructure available for support of a demonstration includes the basewide utility network: (1) 4,160/2,400-volt, three-phase electrical power service with temporary poles installed to demonstration sites, (2) 600- to 800-gpm treated fresh water at 45 to 50 psi from fire hydrants which can be reduced to volume and pressure required for specific projects, and (3) a 90-day hazardous waste storage yard and hazardous material disposal contract.

Figure 1



SECTION 3. APPLICATION REQUIREMENTS AND EVALUATION CRITERIA

General

This section describes requirements for preparation of proposals. Each developer is required to submit a technical proposal, and EPA may make multiple selections of technologies for demonstration projects. The order of material presented in the technical proposal should correspond to the order of the "Outline of Evaluation Criteria" shown later in this section. This outline is designed to cover material necessary for evaluating the proposal as well as allowing the proposal to serve as the basis for a generic demonstration plan to be included in the CRDA that EPA will establish with selected developers. Technologies will be selected for participation in the program on the basis of their readiness and suitability for field-scale demonstration, their applicability to situations involving MTBE contamination of aquifers, their cost-effectiveness, their potential for commercialization, and their ability to fill existing gaps in knowledge. The demonstration program is not designed to be a developmental arena where equipment and technologies are constructed, tested, modified, and redesigned.

The general descriptions of evaluation criteria in "Discussion of Evaluation Criteria" are provided as assistance in effectively addressing the criteria in the proposal and do not represent comprehensive discussions of each element. Selection or rejection of a proposed technology by EPA will reflect a judgement based on the material presented by the developer in the proposal and the needs and resources of EPA.

The number of pages presented in the proposal shall not exceed twenty-five (25), including charts, tables, diagrams, and drawings. Font used shall be 12-pt. Times New Roman, the typing shall be single-spaced with double-spacing between paragraphs, and margins shall be set at one-inch all around. A summary of previously acquired data is particularly important as part of the application, and reports or papers covering the offered technology may be appended to the proposal. References also may be attached as an appendix. Company literature, brochures, resumes, and references also may be attached as appendices. All appended materials, however, will be counted toward the 30-page limit for proposal length. Proprietary data or confidential business information should not be included at this point.

An original and fourteen (14) copies of the proposal are required. After review of all proposals, EPA may request a meeting with the developer to discuss questions or concerns raised during the review process.

Outline of Evaluation Criteria

I. Technology Factors

- A. Technology Characterization
  - 1. Technology Description and Function
  - 2. Process Flow Sheet (indicating all streams)
  - 3. Technology Capabilities and Limitations
- B. Description of the Equipment
  - 1. Physical Appearance
  - 2. Unit size and Transportability

3. Treatment Capacity (throughput range)
4. Availability

C. Waste Streams Treated
1. Contaminants
2. Media
3. Problem Wastes
4. Concentrations of Feed and Product Streams

D. Material Handling Needs
1. Delivery and Removal of Equipment
2. Pre- and Post-Treatment Requirements

E. Types and Quantities of Waste Streams or Residues Generated
1. Gases and Particulates
2. Liquids
3. Solids and Sludges

II. Performance Factors
A. History or Background of Process Development
B. Bench/Pilot-Scale Test Data
C. Advantages Over Similar Technologies

III. Developer Factors
A. Experience and Availability of Assigned Key Personnel
B. Company Profile
1. Waste Treatment Experience
2. Internal Support
3. Anticipated Subcontracting Needs

C. Capability to Commercialize
1. Marketing Strategy
2. Projected Unit Cost of Treatment

IV. Regulatory Compliance

Discussion of Evaluation Criteria (Perfect Score = 100 Points)

Technology Factors……**30% Weight**

This section of the proposal should deal primarily with explaining the technical aspects of the process and describing its operation. Its capabilities and limitations should be addressed along with information about duration of the test period, availability of equipment, wastes to be treated, etc.

Technology Characterization…….*10 points*

The Developer must describe the technology proposed for demonstration including limitations. The description should include the concepts upon which the technology is based, any scientific literature supporting the theoretical basis of the technology, the purpose of the technology, and all of the process steps involved in its use. Narrative, drawings, photos, and diagrams may be used as appropriate. It is very important that this description be clear, concise, and complete.

Description of the Equipment……*5 points*

Provide a description of the actual treatment unit proposed for the demonstration. This discussion should concentrate on hardware and should include photos if appropriate. The description must address at a minimum the size and transportability of the equipment, the treatment capacity offered (range of feed volume or throughput), and the availability (i.e., approximate date) of the treatment unit for a demonstration. Safety features, past use of the unit, and ease of operation may also be included.

Waste Streams Treated…….*5 points*

It is important to include discussion of the contaminants that can be treated, the media that are targeted (solids/sludges/soils, liquids/water, gases), and the applicable concentration ranges for acceptable waste feed. Include estimates of the quantities of waste that will be needed for adequate evaluation of the technology. This discussion should also include limiting factors for the technology, such as viscosity, metals, volatility, and any problem waste types for which the technology would not be appropriate.

Material Handling Needs…….*5 points*

Provide details concerning the material handling requirements of the technology including equipment necessary to prepare and deliver the feed stream and equipment or facilities necessary to remove both product and waste streams. As part of this discussion provide information on pre-treatment and post-treatment needs associated with the demonstration system.

Waste Streams or Residues Generated…….*5 points*

Describe the wastes that will be generated through operation of the process. Estimate the quantity and character of the process wastes. Estimate potential unit costs for disposal of wastes generated. This section should address gases and particulates, liquids, solids, and sludges.

Performance Factors…….**30% Weight**

This section of the proposal should deal with the operation of the treatment unit or technology. Discussions should cover history of development for the process and applicability to MTBE sites. Of most importance for this evaluation factor is the presentation of bench-, pilot-, or field-scale data from previous testing.

History or Background of Process Development…….*5 points*

Describe the steps that have been taken in bringing this technology to the demonstration stage. In addition, discuss any field experience with the proposed technology and equipment and note any other waste streams to which it has been applied.

Bcnch/Pilot-Scale Test Data……..*15 points*

Provide summaries of data that have been generated by this technology in bench-, pilot-, and field-scale tests on MTBE waste streams. These data must illustrate that this technology is indeed ready for field demonstration. Data may be presented in tabular or graphical form and may be supported by appended reports. Highlight data generated through previous projects with EPA and note the supporting offices. **This portion of the proposal is critical to the evaluation process**.

Advantages Over Similar Technologies……..…*10 points*

The developer should explain the advantages of the proposed technology over similar treatment schemes. Differences with or advantages over similar technologies already being evaluated elsewhere should be discussed where possible.

Developer Factors……**25% Weight**

Experience and Availability of Assigned Key Personnel……..*10 points*

Name the key persons involved in the demonstration and briefly note their relevant experience. Include estimates of the percentage of time that each key person would have available to spend on the project.

Company Profile……..*5 points*

Describe waste treatment experience that the developer's firm has gained and note special internal support that is available. This support may include engineering departments, field work crews, geology/hydrogeology groups, etc. Specify anticipated needs for subcontracting or acquiring consultants by the developer. It is important here to show that the developer is capable of mounting a field demonstration.

Capability to Commercialize…….*10 points*

Describe and discuss the capability and commitment of the developer to make the technology widely and commercially available. Explain the marketing strategy to accomplish commercialization and estimate the per unit cost of treatment using this technology if possible.

Short Term Risk and Regulatory Compliance……**15% Weight**

Capability to comply with regulatory requirements……..…*5 points*

Describe the ease with which process-specific regulations and commitments in compliance agreements or orders are satisfied. Regulatory requirements include state and local laws, EPA and Department of Transportation (DOT) laws, and other laws that specify requirements or milestones. This parameter gives high scores to treatment technologies or options that are relatively straightforward, have an operational history, and demonstrate capability to comply.

Requirements for additional permits for products or residues……..… *5 points*

Describe any regulatory permits that may be required for pre- or post-treatment products and/or residues. Lower scores are given to technologies or options that may require additional permits.

Short term risk due to technology application……..… *5 points*

Describe the risk to on-site workers, off-site populations, and the surrounding environment of applying the technology. This includes all occupational safety and health issues, mechanical and electrical hazard issues, legally driven issues, as well as reclamation required to achieve restoration. This parameter gives high marks to processes providing little or no added health or safety risk or reclamation due to collateral impact on the environment.

SECTION 4. REVIEW AND SELECTION PROCESS

Applications will be reviewed by a panel made up of technical representatives both from within and outside EPA as well as State agencies. Applicants will be selected on the basis of their readiness and suitability for providing, operating, and maintaining *in-situ* and/or *ex-situ* remedial (source area) or groundwater treatment (wellhead) equipment for up to one year, its applicability to fuel oxygenate contamination problems, its amenability to treatment technology remediation, and its potential for providing information addressing problems common to a large number of fuel-contaminated sites. Selection or rejection of a technology by EPA will reflect a judgement based on the material presented in the application and the needs and resources of EPA. All applicants will receive a written response outlining the results of the review. EPA reserves the right to reject any and all applications based on technical review or insufficient EPA funds.

SECTION 5. SOLICITATION SCHEDULE

This solicitation for treatment technologies will be conducted according to the following schedule:

Request Technology Applications:	April 17, 2000
Proposals due:	May 30, 2000
Technology Selection Completed:	Week of June 26, 2000
Field Demonstration Start-Up:	September, 2000

One original application plus 14 copies should be sent to:

Ms. Ruth L. Goller
U.S. Environmental Protection Agency
26 W. Martin Luther King Drive
Cincinnati, OH 45268