RSKERL-Ada Superfund Technology Support Center

The First Two Years

An Internal Report

by

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RSKERL - Ada Superfund Technology Support Center
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RSKERL - ADA SUPERFUND TECHNOLOGY SUPPORT CENTER

Background and Introduction

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), provides for cleanup of sites designated by the EPA to be hazardous to human health and/or the environment. SARA expresses preference for permanent remedies that: 1) protect human health and the environment, 2) are cost effective, and 3) meet Federal and State standards. Superfund site remedial action decision-makers are faced with the problem of determining the appropriate remediation response when the environment is contaminated with hazardous materials. These individuals must plan and/or evaluate remedial investigations and technology demonstration studies. They ultimately must select and/or approve an appropriate combination of cost-effective remediation activities and technologies for each specific site that will be protective of human health and the environment.

By early 1987, a number of personnel and management studies commissioned by the Office of Solid Wastes and Emergency Response (OSWER) and others had identified a number of problems with this decision-making process. The Regional decision-makers, On-Site Coordinators (OSCs) and Remedial Project Managers (RPMs) were generally overloaded. Because of the high turnover rate, they were relatively inexperienced in a field where there is a national shortage of expertise. Their training and experience were in relatively narrow technical areas and they were isolated technically at a time when remediation decisions required a broad, interdisciplinary, state-of-the-science level of expertise in a relatively new, rapidly developing science.

These and other problems resulted in inconsistencies in Regions and between Regions in remediation technologies selected and application of those technologies.

The great majority of Superfund sites have ground-water contamination which is often the limiting component for remediation. The technology to remediate contaminated subsurface soils and ground waters is not well developed. One major problem is accessibility. Near surface contamination is subject to a number of remediation technologies but as the contamination gets deeper, remediation options become limited and remediation costs increase dramatically. Although the science of ground water extraction for water supply purposes has been studied for several decades, only in the last decade has there been an impetus or interest in extracting contaminated ground water as a procedure for "cleaning up" a contaminated aquifer. The technology for treating contaminated water in surface reactors has also been extensively studied, but the technology for getting subsurface contaminants to the surface where they can be treated is in its infancy.

Seldom is ground water remediation a viable approach without associated remediation of the vadose zone. (The vadose zone is the region extending from the ground surface, or top soil, of the earth to the upper surface of the principle water-bearing formation). This is because a contaminated vadose zone often serves as a source for ground water contamination, and ground water "clean-up" is not effective until the source is removed. (However, "containment" measures may be necessary regardless to prevent the spread of the contamination).

An understanding of how contaminants move in the subsurface is the foundation for designing effective ground-water remediation systems. For more than 20 years, RSKERL-Ada has had an extensive in-house and extramural research program designed to better understand the hydrologic, abiotic and biotic processes that control contaminant movement in the subsurface.

In mid 1987, an ad hoc group of ground-water technical specialists from some of the Regional Superfund staffs started meeting to compare notes on technical issues. They also attempted to establish a formal group or "Ground-Water Forum" representing all ten EPA Regions to develop ways to address these and other common issues. Also, at this same time, representatives from OSWER's Technology Staff were exploring ways to make ORD's technical expertise available to Regional decision-makers.

In late 1987, OSWER provided the first direct funding to four ORD laboratories - RSKERL/Ada, EMSL/Las Vegas, RREL/ Cincinnati and ERL/Athens - to establish four technology support centers in their respective areas of expertise. Those technology areas are:

- RSKERL/ADA: Ground-Water Fate and Transport
- EMSL/LAS VEGAS: Monitoring and Site Characterization
- RREL/CINCINNATI: Engineering and Treatment
- ERL/ATHENS: Exposure and Ecorisk Assessment

The objectives of the Technology Support Centers are to:

- Provide technical support and assistance to Regional staff;
- Improve communications among Regions and ORD laboratories;
- Ensure coordination and consistency in the application of remedial technologies; and
- Furnish technology workshops and state-of-the science information for RPMs and OSCs.

OSWER also formalized the establishment of the Ground Water Forum plus an Engineering Forum to interact with the Technology Support Center and act as a contact point for technology support requests from Regional personnel.

RSKERL-Ada Technology Support Center Organization

The RSKERL-Ada Superfund Technology Support Center is located in and directed from the Application and Assistance Branch (Figure 1).

RSKERL is EPA's center for subsurface fate and transport research, focusing its efforts on transport and fate of contaminants in the vadose and saturated zones of the subsurface, methodologies relevant to protection and restoration of ground-water quality, and evaluation of subsurface processes for the treatment of hazardous wastes. This in-house and extramural research program is the foundation for the Technology Support Center.

The components of the RSKERL Technology Support Center consist of a Core Team of RSKERL scientists (Figure 2), supported by an on-site contractor, RSKERL research scientists, Holcomb, the National Center for Ground Water Research, CERI, and the National Ground Water Information Center (Figure 3).

RSKERL - Ada Technology Support CoreTeam (TST)

- RSKERL scientists and engineers provide a readily available source of interdisciplinary technical support with assistance from an on-site contractor and a cross-section of ground water scientific expertise available as consultants;

RSKERL Research Program

- expertise in subsurface processes and systems from more than forty in-house scientists and thirty-five universities and research institutions provides the scientific basis for the Technology Support Program;

On-Site Contractor

- provides support to Core Team in the form of on-site scientific staff, a Subsurface Remediation Information Database, subcontract to GeoTrans, Inc., and over one hundred consultants from the ground-water research and consulting community;

National Center for Ground Water Research

- a consortium of Oklahoma, Oklahoma State and Rice Universities charged with developing and conducting long-range exploratory research to help anticipate and solve the Nations emerging ground-water problems;

International Center for Ground Water Modeling

- Holcomb Research Center, Indianapolis, clearinghouse for ground-water modeling software, providing research, short courses, seminars and educational activities;

National Ground Water Information Center

- National Water Well Association, Dublin, Ohio, repository of ground water quality information accessible to scientists, government agencies, business and the public; and

Center for Environmental Research Information (CERI-Cincinnati)

- provides support to Technology Support Program in the development of seminars, conferences, training, publications, and other technology transfer materials.

ROBERT S. KERR ENVIRONMENTAL RESEARCH LABORATORY
Organizational Chart

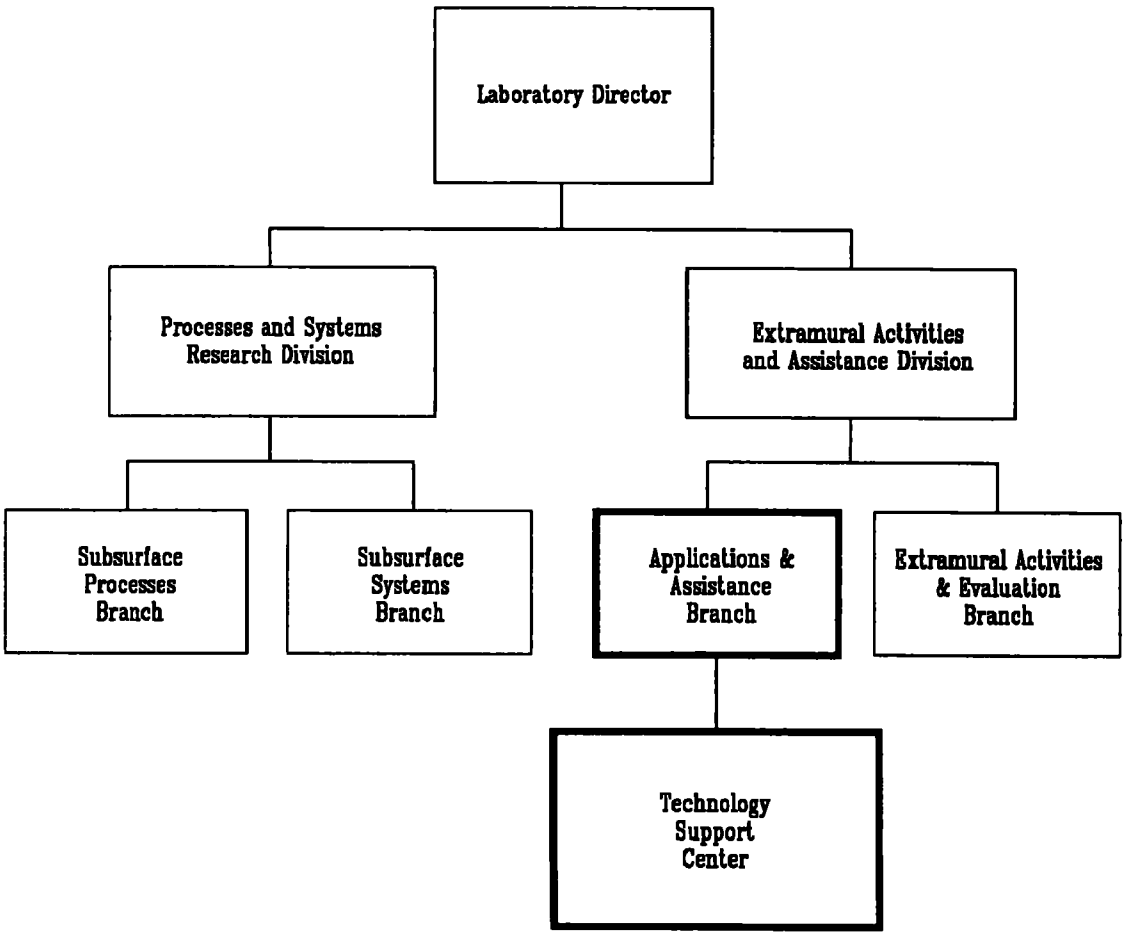

Figure 1

RSKERL-Ada

Technology Support Center

Technical Support Team

Dick Scalf	Branch Chief
Jerry Thornhill	Deputy/Hydrologist
Bert Bledsoe	Chemist
Don Draper	Hydrogeologist
Lowell Leach	Geological Engineer
John Matthews	Biologist
Dom DiGiulio	Hydrologist/Engineer
Scott Huling	Environmental Engineer
Joe Williams	Soil Scientist
Randall Ross	Hydrogeologist
Dave Burden	Hydrologist/Soil Scientist

Figure 2

RSKERL –Ada
Technology Support Center

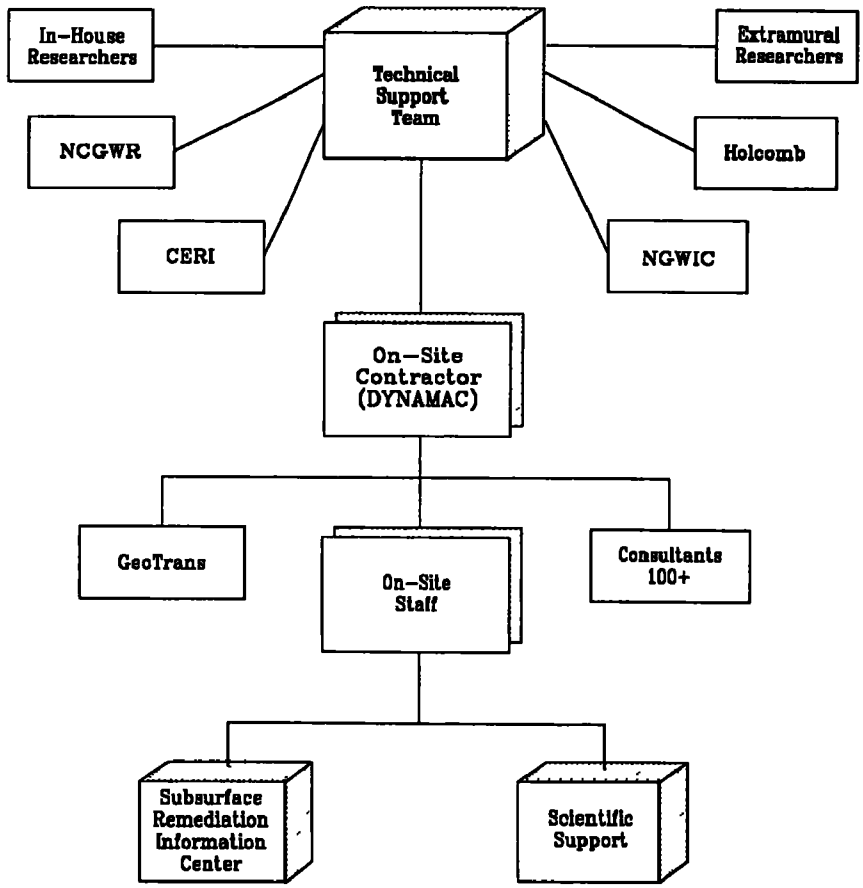

Figure 3

Technology Transfer/Technical Assistance

The Robert S. Kerr Environmental Research Laboratory has long been involved in technical assistance and information transfer with EPA Regional Offices and state and other federal agencies. The terms 'technical assistance' and 'information transfer' identify a multitude of activities. In general, technical assistance is used to describe an activity initiated by a specific request that requires significant RSKERL personnel resources. Information transfer activities may require significant resources but are generally items that are initiated without a specific request. Information transfer/technical assistance of the RSKERL Technology Support Center has primarily been conducted through the development of 'issue papers', workshops, seminars/conferences, training short courses, and site specific technical support.

Issue Papers

Issue papers were initiated by RSKERL in the early months of the Technology Support Programs as a means of addressing a number of technical issues identified by the Ground Water Forum as critical to remediation decisions. These documents are intended to be brief, readable summaries of the current state-of-the-science of a particular technical issue.

Water Level Measurements

A document entitled "Accuracy of Depth of Water Measurements" was printed by CERI as Superfund Issue Paper EPA/540/4-89/002.

Leaching Tests (Methods for Estimating Contaminant Mobility)

The original issue posed by the Ground Water Forum concerned the applicability and limitations of using leaching tests to estimate contaminant mobility at Superfund sites. The consensus developed by RSKERL and outside scientists following a series of meetings and a workshop in Houston on December 14/15, 1989, was that other methods are more applicable than leaching tests at Superfund sites for making remediation decisions. A series of issue papers are being prepared to address these alternatives.

Ground-Water Sampling for Metal Analysis

Printed by CERI as Superfund Issue Paper EPA/540/4-89/001 to address the issue of filtration for ground-water samples. This was a cooperative effort with EMSL-Las Vegas.

Fractured Media/Models

An issue paper entitled "Contaminant Transport in Fractured Media: Models for Decision Makers" has been printed by CERI as Superfund Issue Paper EPA/540/4-89/004. A companion paper that summarizes the status of site characterization technology at fractured rock sites is in preparation.

Facilitated Transport

A document entitled "Facilitated Transport" was printed by CERI as Superfund Issue Paper EPA/540/4-89/003.

Non-Aqueous Phase Liquids

This paper is still in preparation.

Soil Classification Systems

RSKERL is working with EMSL-Las Vegas to complete the issue paper.

Biorestoration

Two documents are being developed for this subject. "Bioremediation of Contaminated Surface Soils" was published by CERI as EPA/600/9-89/073 in August 1989. A companion document for ground water is in preparation.

Vacuum Extraction

A workshop was conducted by RSKERL in May, 1989, with participants from a variety of viewpoints (researchers, consultants, industry). An issue paper is currently being prepared based on this workshop and from other information sources.

Performance Evaluation of Pump and Treat Remediation

A Ground-Water Issue Paper by that title has been printed as EPA/540/4-89/005.

Workshops

Ground Water Modeling Workshops were held in all regions between 8/29/88 and 12/9/88. This "hands-on" three day course covered modeling of the saturated and unsaturated zones and geochemistry. It was conducted by the TSC staff and national experts from Geotrans, USGS, and Universities. Attendance was limited to a total of about 400 so that personal instruction could be given.

Workshops on Remediation at Wood Preserving Sites were held in San Francisco on October 24 & 25, 1988, and in Atlanta on March 20 & 21, 1989. National experts covered such topics as appropriate technology, information needs, limitations of technology and the evaluation process.

A workshop was held in Denver on May 17 & 18, 1989, on the remediation of soils and ground water contaminated with oily viscous and multi-phase contaminants. National experts spoke on the appropriate technologies and their limitations and data needs.

A workshop was held at RSKERL on March 1, 1989, with a panel of experts invited to reach a consensus on the subject of filtering vs. not filtering ground water samples for metal analyses. This workshop resulted in an issue paper on this subject, as noted earlier.

A workshop on Soil Vacuum Extraction was held at RSKERL on April 27 & 28, 1989. The purpose of the workshop was to bring together consultants and researchers from various disciplines to discuss methods of evaluating and enhancing the performance of SVE. The emphasis of the workshop was to evaluate and understand subsurface vapor transport and fate processes. An issue paper is being developed on this subject.

A workshop on Contaminant Mobility (migration potential) was held in Houston on December 14 & 15, 1989. The purpose of the workshop was to identify, summarize and evaluate methods that can be used to estimate the migration potential of inorganics and organics found at hazardous waste sites.

A workshop on Fractured Flow was held in Dallas on January 29, 1989. A select group of researchers and consultants were asked to identify and evaluate methologies for characterizing contaminated sites that overlie fractured media and for developing reliable predictive modeling at these sites. An issue paper resulted from this workshop.

Seminars/Conferences

The annual RSKERL RESEARCH SEMINAR was held in Oklahoma City in the Spring of 1988 and 1989. This annual three-day meeting brings all researchers sponsored by RSKERL and the National Center for Ground Water Research together to present progress of research. Invited guests include scientists from academia, State and other Federal agencies, industry and representatives from EPA program offices. Approximately 300 attendees were present at each of these sessions.

In cooperation with CERI, a series of seminars entitled "Transport and Fate of Contaminants in the Subsurface" were given in all ten EPA Regions between October 1987 and February 1988. These seminars were designed to provide regulators and technical specialists with a brief but intensive overview of the physical, chemical and biological processes that govern the transport and fate of contaminants in the subsurface. The total attendance was approximately 4000.

A series of seminars entitled "Site Characterization for Subsurface Remediations" was initiated in 1989 in cooperation with CERI. These seminars are designed to examine the site characterization requirements necessary to select the most appropriate remediation technologies for contaminated soils and ground water at hazardous waste sites. As of the end of November, 1989, six of the ten planned seminars had been completed with a total attendance of over 2500.

A series of seminars entitled "Bioremediation of Hazardous Waste Sites Workshop" developed by CERI was presented to 9 of the 10 regions. The purpose of these seminars was to inform the target audience on the basic requirements for implementation of biological systems to remediate hazardous waste, the initial data requirements, and reactor and in situ design. RSKERL was responsible for the in situ portion of the seminar as well as a workshop. The in situ portion outlined the basic requirements and design of systems for the biological remediation of soil and ground water.

Training

Until recently, RSKERL training activities have been limited to a two and one-half day training session entitled "Ground-Water Investigations." This training module, which covers the basics of ground-water hydrology, methods for investigating ground-water contamination, transport and fate of contaminants in the subsurface and the basics of ground-water remediation technology, has been conducted at the following locations during the past two years:

June 23-24, 1988 - Dallas
October 12-13, 1988 - Des Moines
January 17-19, 1989 - Dallas
July 18-20, 1989 - Ada
November 15-17, 1989 - Ada

Sessions outside of Ada have been conducted on an "as requested" and "time available" basis where the requesting Region or State agency reimbursed RSKERL for travel expenses of EPA instructors and paid travel and an honorarium for our participating consultants.

With resources available through the Technology Support Program and the Superfund Training Institute, additional training modules are being planned/scheduled as follows:

Transport and Fate of Contaminants in the Subsurface
March, 1990 - Ada
September, 1990 - Houston

Remediation of Contaminated Soils
February 21-23, 1990 - Ada

Solute Transport Modeling at Hazardous Waste Sites
Unscheduled

Bioremediation of Subsurface Environments
Unscheduled

Pump and Treat Technology for Aquifer Remediation
Unscheduled

Subsurface Remediation Information Database

The Subsurface Remediation Technology (SRT) Database provides a focal point for transfer to the user community of the highly specialized, rapidly developing information pertaining to fate, transport, and in-place treatability of contaminants in subsurface environments. Specifically, the SRT Database is designed to locate, assess, and document research and development and other information sources pertinent to reclamation of contaminated soils and ground waters, including planned, active, and/or completed subsurface remediations.

Information sources activities currently include development and maintenance of the following specific databases:

1. Soil Transport and Fate (STF) Database
   a. Prototype completed Fall 1988

b. Contains physical/chemical characteristics data, biodegradation/transport kinetic data, phytotoxicity/ bioconcentration data, and literature citations for 439 hazardous chemicals
c. Distributed to Groundwater Forum representatives in ten regions and selected Headquarter's, Regional, and research personnel
d. Loaded on OSWER Bulletin Board in FY '89
e. Modification/Expansion/Update scheduled in FY '90

2. Subsurface Remediation Literature Database
   a. Publications list compiled during FY '89 containing pertinent RSKERL and RSKERL research cooperator literature
   b. Includes bibliographic citation and information summary
   c. Functional computerized data base planned for FY '90
   d. Data will be extractable relative to a set of key subsurface fate, transport, and remediation terms

3. Subsurface Site Remediation Database
   a. Prototype completed FY '89
   b. Assembly of information from subsurface remediation sites under way
   c. Information files include:
      1) Site description (location, contacts, characterization data, etc.)
      2) Problem description (type, media, degree and extent)
      3) Remedial process information (stage, reports, etc.)
      4) Remediation alternative selection data (RI/FS, design, etc.)
      5) Full scale remediation data (performance, cost)
   d. Functional computerized data base planned FY '90

Site Specific Technical Support

Site specific technical support has been provided officially at more than sixty (60) Superfund sites during the first two years of the RSKERL Superfund Technology Support Program. On many sites, multiple requests have been received and support is provided on a continuing basis. Although TST staff provide assistance through hundreds of phone conversations and information requests, official requests for assistance where extensive resources are required are made in writing to the TSC Program Manager, by the RPM and/or Ground Water Forum member.

The following summaries are on sites where substantial assistance has been provided. Technical assistance on RCRA sites was provided by RSKERL in-house staff and no Superfund resources were used.

Region I - Gilson Road Site - 89-R01-001

The Gilson Road site was the location of unpermitted disposal of household refuse, demolition debris and hazardous materials in the 1960's and 1970's. An estimated 800,000 gallons of aqueous hazardous wastes were disposed of at the site between 1975 and 1979. Presently the shallow aquifer and underlying bedrock aquifer are contaminated with VOC's and SVOC's - tetrahydrofuran, toluene, benzene, chloroform, methylene chloride, phenols, trichloroethylene, and others. Currently, the effectiveness of the active pump-and-treat remediation at the site is under evaluation. RSKERL first became involved with the Gilson Road Superfund site in August, 1988. A preliminary meeting and site visit was made in 9/88 with Regional personnel to discuss the limitations of pump-and-treat remediations. Additionally, RSKERL was represented at a planning meeting with Regional, state, and contract personnel to discuss ground-water modeling efforts. Region I requested additional technical assistance on May 2, 1989, to review the contractors modeling efforts. Verbal comments were provided to Region I 6/89, with written comments provided 9/ 11/89 from a review of the document entitled Remedial Program Evaluation, Gilson Road Site, Nashua, New Hampshire, dated February, 1989. Additional involvement in the remediation evaluation is expected.

Region I - Stamina Mills Superfund Site - 88-R01-001

The Stamina Mills site is the location of a landfill where a spill of TCE occurred at some time adjacent to the land fill. No record exists of when or how much TCE was spilled. An initial request was made by John Zannos, Region I, for assistance in determining partition coefficients for TCE at the site. Partition coefficient determination was done through an in-place contract.

All work related to the request for technical assistance for this site in North Smithfield, Rhode Island, has been completed. Work accomplished for this site was: 1) the determination of soil-water partition coefficients for samples obtained from the site; 2) investigation of reasonable soil physical and hydraulic properties for the site, since none were obtained; and 3) simulation of contaminant transport from the unsaturated zone based on available information. Final response for the technical assistance request was made June 20, 1989. This response detailed the results of the partition coefficient determinations as well as the modeling activities. No further assistance has been requested directly related to this site.

Region I - W.R. Grace & Company Superfund Site - 88-R01-002

A formal technical assistance request was received by the Technical Support Team, June 28, 1988, to review a report entitled "Biodegradation Potential of Acetone, Benzene, and Toluene in Soils from a Contaminant Plume." The request was received from Dave Lang, Region I, regarding the W.R. Grace and Company Superfund Site in Acton, Massachusetts. Comments on the report were prepared by RSKERL and sent to Mr. Lang on July 12, 1988.

Further assistance regarding this site was sought by Dick Willey and Wayne Robinson of Region I in July 1989. This assistance was handled via telephone conversations. Assistance had been requested for advice in selecting soil physical properties for modeling at the site using a fugacity model developed by MacKay (1983). The referenced article was reviewed and suggestions were made on appropriate estimations of the void space, solid volume, and water volume for the textures specified. No further assistance was requested.

Region I - Somersworth Landfill - 89-RO1-002

The Somersworth Landfill is located in Somersworth, New Hampshire, and is characterized by the presence of high organic matter content soils. The site is also located in an area where the water table is either on or very near the surface. Off-site migration of arsenic and organic compounds has been indicated. Primary organic compounds found were DCE, TCE, 1,1-dichloroethane, 1,1-dichloroethylene, xylene, MEK, methylisobutylketone, benzene, toluene, and acetone. RSKERL-Ada was contacted by Dick Willey (Region I) via telephone, August 22, 1989, seeking advice on estimating migration potential in soils with high organic matter content. Problems being encountered dealt with not only organic compounds, but also arsenic. A leaching-type test had been proposed in the RI/FS based on a procedure documented by Houle and Long (1980) in the Proceedings of the 6th Annual Research Symposium (EPA 600/9-80-010). RSKERL scientists reviewed the procedure with respect to this site. Comments were sent to Mr. Willey, August 24, 1989, along with three additional research papers related to the problem.

Region I - Central Landfill Superfund Site - 89-R01-003

Correspondence was received from John Zannos, Region I, September 21, 1989, regarding a leachability study purposed for the Central Landfill site in Johnston, Rhode Island. The Central Landfill SF Site is a general landfill containing both municipal and industrial waste. The site is located over fractured igneous bedrock with the water table at approximately 15 feet. The site is one of the largest landfills in Rhode Island and still in operation. There are numerous organic compounds of concern; no one particular compound more dominant than the other. The procedures were reviewed by a member of the TST and a RSKERL research scientist, with review comments being sent to Mr. Zannos on October 4, 1989. The basic recommendation was to compliment the column-type test with a batch-type test. The proposed column test would allow for the potential of not coming to equilibrium. No further assistance has been requested.

Region II - Amerada-Hess Refinery - RCRA

The Amerada-Hess Petroleum Refinery in Pemberton Township, New Jersey, currently has two landfarms operating under Interim Status. The company would like to close one of these landfarms and has submitted a closure and post-closure plan for the North Landfarm to the New Jersey Department of Environmental Protection. In November, 1988, the State requested that RSKERL review and comment on this plan. Review comments were provided in December, 1988, with follow-up discussions in January, 1989. In general, the reviewers felt that insufficient information was provided by the company to evaluate the soil treatment effectiveness to date. It was recommended that the company provide additional soil-core data from within and below the treatment zone, including its degree of variability.

Region II - Total vs. Dissolved Contaminant Transport - 88-R02-001

Gerard McKenna of Region II requested technical assistance in helping devise site specific and generic approaches to the issue of filtration of ground water samples for metal analysis. Region II had considerable data from many hazardous waste sites where both filtered and unfiltered ground water samples had been analyzed for metals. Dr. Bob Puls of RSKERL visited the regional office for a preliminary look at some of the data to see if it looked promising for a more thorough evaluation. The data observed was for both filtered and unfiltered samples but from different taps or different times. If a proper assessment of the appropriateness of filtering versus not filtering for metal analyses is to be made, the data must be from the same wells and preferably taken at the same time. There must also be adequate documentation of well construction and sampling procedures. RSKERL concluded that the data available at Region II was not adequate for the requested exercise.

Region II - Lang Property, N.J. - 89-R02-001

A technical assistance request memorandum dated 12-22-88 was received concerning the appropriateness of utilizing the model, "Random Walk," to predict the transport of chlorinated compounds, PAH's, BTX, and pesticides at this illegal drum disposal site. The soils and ground water at this site are contaminated from indiscriminate codisposal of many different compounds. Several members of the Kerr Lab staff reviewed the documents submitted with the technical assistance request memorandum and provided comments and recommendations to Kevin Willis on January 13, 1989. The thrust of the comments and recommendations were directed at hydrogeology and the advantages/ disadvantages of using "Random Walk" to model contaminant transport.

Region II - Sarney Farm - 88-RO2-002

The Sarney Farm Site, located near Dover Plains, New York, encompasses 5 acres upon which significant quantities of toxic, flammable, and hazardous substances were illegally dumped and buried in trenches. This illegal action created both soil and ground water contamination problems. Specific waste sources included organic solvents, inks, acids, glues, and machine oils. The proposed remediation includes construction and operation of an active circulation and aeration biodegradation system. In September 1987, the Regional RPM requested RSKERL to review and evaluate the proposed options. Review comments were provided to the RPM in October 1987. The reviewers found the proposed concept and design of the circulation and aeration biodegradation system to be technically sound for the waste types involved.

Region II - Sharkey Landfill Superfund Site - 89-R02-002

A formal technical assistance request was received from Sherry Login of Region II on August 28, 1989, to review the modeling application being proposed for the Sharkey Landfill site in Morris County, New Jersey. The landfill is composed of 3 distinct fill areas, all with a near-surface water table. The "North Fill" is located on a small island in the Rockaway River. The primary goal was to develop a hydraulic scheme to prevent movement of contaminants from the fill areas, without adversely affecting the hydrology of the system. The Princeton Transport Code (PTC) was being recommended to develop this scheme, and Ms. Login was requesting that we review the applicability of the code. This was done through a technical assistance contract with the International Ground Water Modeling Center (IGWMC) in Indianapolis, Indiana. A member of the TST sent review comments he had developed to Ms. Login September 14, 1989, and Paul van der Heijde of IGWMC sent his comments September 22, 1989. Discussions have also been conducted via telephone concerning these comments. There is currently no further assistance being given for this site. However, Kevin Willis, Ground Water Forum member from Region II, has indicated that further assistance may be required to evaluate the use of both the PTC model and the USGC Solute Transport Model (MOC). The request for this assistance will not be made until January, 1990.

Region II - Seneca Army Depot Landfill - 89-R02-003

This site has been proposed for the Federal Facilities NPL list. The existence of a narrow plume of ground water contamination by VOC's has been documented. It extends to and possibly beyond the Depot's western boundary.

The army has proposed a carbon filtration wall as an interim remedial measure while more detailed studies are performed to delineate the full extent of contamination.

RSKERL questioned the effectiveness of the wall and the design criteria, especially the absorption capacity of the carbon and other factors regarding the organics and metals.

Region II - Nascolite Superfund Site - 90-R02-004

A telephone request was received from Jim Hahnenberg of Region II on November 8, 1989, requesting advice concerning the Nascolite site in Millville and Vineland, New Jersey. The Nascolite site is the location of a spill of methyl methacrylate from underground storage tanks. Mr. Hahnenberg was primarily requesting information concerning the properties of Methyl Methacrylate (MMA or liquid Plexiglas). Their problem was that the substance was in the ground water, seeming to disappear in the summer and reappear during the winter. The advice given to Mr. Hahnenberg was that the fluctuation in the ground water table was a possibility for the appearance and reappearance of the compound; i.e., the compound was being left in the soil as residual when the ground water level would fall. Sampling of the water would then show very low concentrations. Follow-up conversations with Mr. Hahnenberg were carried out November 9, 1989. At that time, the TST suggested that he talk to one of the RKSERL researchers regarding the chemical properties of the compound, since he was also interested in appropriate extraction technologies.

Region III - Lord-Shope Landfill - 89-R03-003

The Lord-Shope site, located near Erie, Pennsylvania, consists of a 4 acre capped landfill and surrounding contaminated soils. Prior to capping, a variety of waste solvents were disposed in the landfill in bulk (i.e. liquid) and containerized (i.e. drums) form.

At the request of Region III, the RSKERL Superfund Technology Support Center reviewed the results of a soil vacuum extraction (SVE) field test at the Lord-Shope site in Pennsylvania. RSKERL advised regional and state representatives at a meeting held on October 18th in Philadelphia that the vacuum extraction may not be capable of remediating semi-contained wastes (e.g. solid in deteriorated drums). SVE could be used to reduce subsurface vapor concentrations to acceptable levels for safe test pitting within the presently capped landfill. Contaminated areas outside the landfill could be effectively remediated through using SVE.

Region III - Douglassville Disposal - 88-R03-003

The Douglassville Disposal site in Berks County, Pennsylvania, is an abandoned waste disposal facility. In December 1987, the Region III RPM requested that the RSKERL review the report on proposed source control technologies for this site and provide additional assistance as requested for subsequent stages of the remediation process. Review comments pertaining to source control technologies were provided to the RPM in February 1988. In general, the report was found to be a very comprehensive and well written evaluation of potential source control technologies for this site. Specific comments addressing new information and situations for in-situ biodegradation, land treatment and pump and treat technologies were provided. In June 1988, the RPM requested review of the draft remedial, technical, and treatability study evaluation report. Review comments were provided to the RPM in July 1988. Reviewers found the documents well written but much less comprehensive than the original document.

Region III - Greenwood Chemical Site - 88-R03-001

The Greenwood site is an area of about 15 acres in Newton, VA. The property was used as a batch processing facility for the production of various organic chemicals. Ground water contamination has occurred in the overburden aquifer and the fractured bedrock aquifer from a drum disposal area of five lagoons.

Kathryn Davies, Region III, requested (3-2-88) that we provide assistance on this site in regards to planned aquifer pump tests, time-series sampling, and cation-anion distribution to characterize upper and lower aquifer interconnection. After review of technical documents was completed, assistance was provided by a series of teleconferences with Ms. Davies and the Region III consultants.

In a later request (7-26-88), the TST was contacted regarding clean-up levels at the site and procedures developed at RSKERL for partition coefficients.

Region III - Hereford Township Site - 88-R03-007

Ground waters at the Hereford Township site in Berks County, Pennsylvania, have been contaminated by surface disposal of TCE. TCE disposal took place at one or more sites on the Crossley farm near the town of Huffs Church. The area is rural, and the TCE contaminated private wells are in an area about two miles long by one mile wide. The site is characterized by strong topographic relief and is underlain by a mixed fractured bedrock/fractured carbonate system. The distribution of TCE in the wells was very erratic and did not appear to follow an easily discernible pattern. RSKERL was asked by the Environmental Response Branch (ERB) for assistance in understanding the hydrogeology of the site. RSKERL personnel obtained and analyzed water samples from monitoring and domestic wells at the site during May 1988. The samples were analyzed for the major naturally occurring anions and cations. This data was interpreted by Dr. Charles Kreitler of the University of Texas to see if geochemical analysis could be used to help understand the complex hydrogeology of the site and to make sense of the apparently erratic distribution of TCE in domestic and monitoring wells. Such an understanding was needed before any attempt at remediation could be undertaken. Dr. Kreitler's report was submitted to the ERB through its REACT contractor in January 1989. The geochemical study did help in gaining a better understanding of the hydrogeology of the site, but it also confirmed that the hydrogeology is very complex. Largely as a result of changes in personnel at the ERB, RSKERL involvement ended at that point.

Region III - Drake Chemical Superfund Site - 88-R03-002

A technical assistance request for the Drake Chemical Company site in Lock Haven, Pennsylvania, was received in early 1987 from Dominic DiGiulio, Ground Water Forum Member from Region III. The request was to assist in the development of appropriate laboratory procedures and the determination of site-specific partition coefficients. It was also determined to develop a revised version of the RITZ model for use at the site. Laboratory and model development activities were performed during the summer of 1987. The ContPro model was developed from this work and is currently in an inhouse beta test version. The laboratory procedures were documented in an internal report and are the basis for other work which is currently being done. The internal report on the laboratory procedures and the model were delivered to Mr. DiGiulio December 3, 1987. Due to changes in the Regional perspective of what was to be done at the site, no additional technical assistance was required.

The ContPro model is currently being evaluated for method of solution. A paper was given describing the model at the Validation of Flow and Transport Models for the Unsaturated Zone Workshop in Ruidoso, New Mexico, May 22-25, 1988. A report further describing the model is to be completed by mid-1990. The model is also being evaluated through the joint work with Environment Canada on the RITZ model.

Region III - GPIA Midfield Terminal - 89-R03-002

During preliminary construction activities at the newly proposed Greater Pittsburgh International Terminal Project in Allegheny County, PA, an old dump site was discovered that is contaminated with a variety of petroleum hydrocarbons, including PAHs. Onsite bioremediation involving treatment in a prepared bed was proposed for the contaminated soils. In May 1989, the Pennsylvania Department of Environmental Resources requested that the RSKERL review plans for the proposed treatment demonstration. Review comments and follow-up discussions were provided in June 1989. In general, the reviewers felt that the consulting company involved lacked the expertise needed to carry out the proposed studies. As a result, appropriate experts were contacted and revisions were made in the final plan. The remediation is now ongoing; and, at the request of the State Project Manager, a site visit by three RSKERL scientists was made in November 1989.

Region III - Tyson's Dump - 89-R03-004

EPA-Region III requested technical assistance at the Tyson's Dump site to evaluate the operation of a soil vacuum extraction system and explore potential causes of extraction well plugging with a viscous, tar-like material. Technical assistance is on-going. The vacuum extraction systsem was installed to remediate soils highly contaminated with 1,2,3-trichloropropane, xylene, toluene, and ethylbenzene. Soils are also contaminated with lesser but still significant concentrations of trichloroethene, tetrachloroethene, dichlorobenzenes, benzene, and chlorobenzene. RSKERL is presently conducting analysis of the tar-like material.

Region III - Ashland Floreffe Terminal - 88-R03-004

The Ashland Floreffe Terminal site is an emergency response site near Pittsburgh, PA, where a ruptured diesel tank at a tank farm resulted in large scale contamination of surface waters, surface soils and possibly ground waters. In March 1988, the Region 3 Project Manager (RPM) requested that RSKERL scientists review the proposed remedial action plan for contaminated soils. Comments were provided and discussed with the RPM on April 19, 1988, in Bethesda, MD. At the request of the RPM, these comments also were discussed with the Pennsylvania Department of Environmental Resources Soil Scientist assigned to the project. Major discrepancies were identified in the proposed plan and called to the attention of the Region and State. In a subsequent meeting between the Region, State and responsible party, these discrepancies were discussed and a bioremediation work plan was formulated for contaminated site soils. In July 1988, the Region and State requested that the RSKERL review this work plan to insure that the identified discrepancies had been corrected. Review comments were provided to the Region in August 1988, and follow-up discussions were held in September 1988. The reviewers felt that the identified discrepancies had been corrected and that the plan presented was scientifically sound if implemented in the manner stated.

Region III - L.A. Clarke Wood Treating - 88-R03-005

This site near Fredericksburg, VA, is contaminated with polynuclear aromatic compounds from wood treatment using creosote over a 50-year period. The proposed remedial action involves pumping and recovery of free-phase creosote, soil flushing using surfactants, and in-situ soil bioremediation using land treatment techniques.

Since receipt of the technical assistance request in January 1987, a number of support actions have been requested and completed. The initial request was to evaluate the feasibility of bioremediation at the site. Review comments were provided to the RPM in 1987. Reviewers considered bioremediation to be one feasible treatment alternative for the site; however, it was stressed that site specific conditions would ultimately determine if, and to what extent, bioremediation would be appropriate in the overall site cleanup plan. In December 1987, a copy of the Bioplume Model was provided to the Region for use in determining the potential for use of in-situ bioremediation for contaminated ground waters at the site. In May 1988, the RPM requested review of the soil washing/bioreclamation proposal for contaminated soils at the site. Review comments plus soil washing information for another wood preserving site were provided to the RPM in 1988. Reviewers again pointed out the need for site- specific studies prior to making a final decision. A follow-up conference call to discuss the review comments was held in June 1988. The revised remedial design plan was received for review in September 1989; comments were provided in October 1989. Reviewers expressed concern about the lack of bioremediation and hydrogeological expertise by the site contractor. It was recommended that such expertise be obtained prior to initiating free-phase product removal and bioremediation demonstration studies.

A site visit by three members of the TST met with the RPM and the Remediation Team and Laboratory Director (Hydrosystems, Inc.) for the PRP. The proposed site remediation plan and RSKERL review comments were discussed. Questions regarding in-situ bioremediation, site characterization and recovery of free-phase product were answered.

Region III - Henderson Road Site - 88-R03-006

The Henderson Road site consists of 7.6 acres located approximately 2000 feet south and upgradient of the Upper Merion Reservoir, a public water supply in which volatile organic compounds have been detected since 1979, in the Upper Merion Township, Pennsylvania. VOC's are present in the unsaturated and saturated fractured rock at the site.

RSKERL provided verbal and written comments to LEMSCO, a technical support contractor for EMSL-LV, regarding soil vacuum extraction and fracture characterization at the site.

Region IV - Hunt Refining Co. - RCRA

Hunt Refining Company has operated a landfarm at this Tuscaloosa, AL, refinery since 1981. The company has submitted a Part B Permit Application to continue operation of this system. To satisfy the Land Treatment Demonstration requirements of RCRA, the company submitted a Preliminary Information Needs Report (P.N.R.) dated February 1986, which presents results of a study conducted to determine the status of past landfarm operations. In

October 1988, Region 4 requested that the RSKERL review and evaluate the data presented in this report to see if the conclusions drawn are supported. Review comments were forwarded to the Region in December 1988, with a follow-up meeting held in Atlanta with the Region and State of Alabama in January 1989. In general, the reviewers felt that the conclusion, that complete degradation or transformation of organics was occurring in the treatment zone, was not adequately supported by the data presented in the document reviewed.

Region IV - Geiger (C&M Oil) Site - 87-R04-001

The five-acre site centers around earthen lagoons where waste oil was stored prior to incineration. The bottoms of the unlined lagoons, constructed between 1969 to 1971 in sandy soil, are at, or near, the water table. Ground water from the site appears to discharge to an environmentally sensitive wetlands. The primary contaminants appear to be benzene, lead and chromium.

RSKERL and Regional personnel conducted an aquifer test and logged selected wells at the site during the week of November 16, 1987. A report containing interpretations of drawdown, recovery, geochemical and geophysical data collected during the field study was submitted to the Region in May 1988.

Region IV - Tower Chemical Site - 88-R04-001

The Tower Chemical site manufactured and distributed various pesticides and fungicides. The major products were a miticide (chlorobenzilate) and a copper based fungicide. Past disposal practices have resulted in ground-water and soil contamination. The contaminated shallow surficial aquifer overlies the Floridan aquifer, a major source of ground water in the state of Florida.

Region IV requested technical assistance in designing, instrumenting, and conducting aquifer tests at the site. RSKERL provided instrumentation and expertise to Regional personnel and conducted two aquifer tests to better understand the complicated hydrogeology associated with relic sink holes present at the site. Data were provided to the Region and technical support contractor prior to report preparation.

Region IV - Perdido GW Contamination Superfund Site - 88-R04-002

A request for technical assistance was received to review a no-action remediation proposal for this site in Perdido, Alabama. The no-action remediation was based on the assumption that the natural microbial activity could take care of the problem. The formal request for review was received February 29, 1988. A formal response was returned to Ms. Ellen van Duzee of the Superfund Branch in Region IV. The site was the scene of train derailment and the spillage of benzene in the late 60's. The overall response of the Technical Support Team was that a no-action remediation would not be appropriate. A memorandum containing the Technical Support Team comments was sent February 17, 1989. (This was in response to the initial telephone request dated February 16, 1989.) Additional phone conversations were conducted related to the request. No further assistance was requested; however, another request was received later to review a pump and treat proposal for the site (88-R04-003).

Region IV - Chemtronics Site - 89-R04-002

The Region requested information on the clean-up capabilities and limitations of pump-and-treat remediation technologies. The State maintains that clean-up levels for the Chemtronics site should be to background (zero VOC concentration).

The Region was sent a package of information containing journal articles and reprints of work done at RSKERL and abroad, as well as the Pump-and-Treat Issue paper outlining the chemical and physical processes which affect pump-and-treat remediations.

Region IV - Perdido GW Contamination Superfund Site - 88-R04-003

A second formal request for technical assistance was received for this site in Perdido, Alabama in March 1988. This request was to review a pump and treat proposal for the site and the potential for bioremediation. This request was received from Ellen van Duzee of the Superfund Branch in Region IV. A formal response was made by the TST in cooperation with RSKERL researchers on March 17, 1989, after reviewing the information received. Ms. van Duzee

was to meet with the PRP's on March 29, 1989. An additional telephone request for assistance was received from Larry Meyer of Region IV in April 1989, after Ms. van Duzee transferred to another division. This request was handled via telephone conversations in April and May 1989. After Mr. Meyer transferred to another division, a formal request for technical assistance was received from Jim Orban, Engineering Forum Member from Region IV, on July 5, 1989. He requested that the Technical Support Team review the RI/FS before they went to the RA with the ROD. A response was prepared by the TST and sent to Mr. Orban July 25, 1989. No further assistance has been requested for this site.

Region V - Anderson Development Co. - 89-R05-008

The Anderson Development Company site in Adrian, Michigan, is an actively operating, specialty organic chemical manufacturing facility that has been producing MBOCA (4,4'-methylene-bis-2-chloroaniline) since 1970. Surface soils at the site have become contaminated with MBOCA and its metabolites. In August 1989, the RSKERL was requested by the Region V RPM to provide technical review of three documents relative to proposed bioremediation of surface soils at this site. Review comments were provided in September 1989. In general, the reviewers considered that the data presented in the three documents was insufficient to conclude that bioremediation would be a feasible remediation alternative at this site. It was recommended that well-designed site specific biotreatability studies would be necessary before feasibility of this technology could be considered as a viable option for this site.

Region V - Wausau Water Supply - 89-R05-006

The Wausau, Wisconsin, Water Supply site is characterized by aquifer contamination with halogenated aliphatic hydrocarbons, predominantly TCE and PCE. The Region V RPM requested that RSKERL provide technical assistance in evaluating the potential for in situ bioremediation alone or in combination with pump and treat for the east well field. Comments and recommendations were provided to the RPM 7-31-89. Briefly, the concentration and chemical type does not favor effective, large scale implementation of bioremediation.

Region V - Organic Chemicals, Inc. Site - 89-R05-005

The Organic Chemicals, Inc. site in Grandville, Michigan, has soil and ground waters contaminated with a wide variety of organic chemicals including chlorinated aliphatics and PCB's. In June 1989, Region V requested the RSKERL to provide technical assistance concerning the evaluation of the applicability of bioremediation to the site. Comments were provided to the Region V Ground Water Forum representative on 7-20-89.

A follow-up request was received in November 1989, asking RSKERL to conduct/oversee treatability studies for those soils and ground waters contaminated with petroleum hydrocarbons. Negotiations for conducting these treatability studies are underway.

Region V - Allied Signal Site (Bendix) - 89-R05-004

This project was initiated in July 1989 by RSKERL to determine the applicability of the methylotrophic biodegradation process to remediate ground water contaminated with vinyl chloride at the Allied-Bendix site in St. Joseph, Michigan. The methylotrophic process to degrade chlorinated ethenes was initially discovered in laboratory studies at RSKERL and has been undergoing pilot-scale studies at Moffet Field Naval Base by a team from Stanford University. As part of an agreement between RSKERL, Stanford, EPA Region V, and Allied-Signal, Inc., treatability studies have been initiated by Stanford with a series of core samples collected by the RSKERL drilling crew. The RSKERL Technology Support Center is providing funding for initiating the treatability studies and Allied-Signal, Inc. will pay for the major effort.

Region V - Allied Chemical/Ironton Coke - 89-R05-001

Maureen Leavitt, Bio Technology Laboratory Supervisor with the IT Corporation met with Technical Support Center personnel on September 18, 1989 at the Robert S. Kerr Environmental Research Laboratory, to solicit recommendations on a bioremediation pilot study for the Allied Signal Inc. Ironton, Ohio NPL site. Volatile organics, PAH's and cyanide are present in lagoon sediments and ground water at this former coke processing plant. The pilot systems are to demonstrate bioremediation of the vadose zone by the addition of oxygen and nutrients through a sprinkler system and the in-situ remediation of ground water and aquifer materials utilizing an injection recovery well.

Hydrogen peroxide will be added to supply oxygen as well as needed nutrients determined from the laboratory studies. If the pilot is successful, a functional field demonstration may be established. Region V has requested that the TST provide continued overview and support this project.

Three members of the TST met with State, EPA-Regional and Allied Chemical staff in Ironton (Ocotber 30, 1989) to further discuss the details of the bioremediation pilot studies for the saturated and unsaturated zones. The TST also visited the field pilot studies and the contaminated sites. Final technical recommendations were transmitted by letter (11/7/89) to the RPM (Jim Van Derkloot). The RSKERL staff is periodically being updated on the bioremediation efforts by progress reports.

Region V - Cliffs-Dow - 89-R05-003/007

The site is a coal tar waste pit where PAH's have leached into the ground water. Remedial action will consist of an above-ground biological treatment system referred to as "forced aeration pile treatment" (FAPT). A comprehensive technical review and evaluation has been made of both the ground water system and the FAPT. Technical review comments and recommendations have been submitted to the RPM concerning these two areas on 5/23/89 and 8/29/89, respectively, and the review staff has participated in several telephone conferences. The main focus in the review concerns the interpretation of field ground water data and laboratory treatability data. Additionally, analysis of two proposed biological remediation strategies was performed. Recommendations concerning additional treatability studies, biological process optimization, and field study procedures were made.

Region V - Gemeinhardt Superfund Site - 89-R05-002

The Gemeinhardt site is the location of a piccolo manufacturing plant. Volatile organics, possibly used in the plating operations, were dumped down a dry well into a sand and gravel aquifer. A request for technical assistance was received from Doug Yeskis, Ground Water Forum Member representing Region V, to review the modeling activities being proposed for the Gemeinhardt Site in Elkhart, Indiana, in October 1989. This review was assigned to the technical assistance contract with the International Ground Water Modeling Center (IGWMC) in Indianapolis, Indiana. The model being proposed for use at the site was a 1986 version of the Princeton Transport Code (PTC). This code has been primarily recognized as a research code. Phone conversations and reviews were conducted with Paul van der Heijde of IGWMC in November and December 1988. One meeting was held November 22, 1988, in Chicago between Dr. van der Heijde and Luanne Vanderpoel, Ken Thyssen, and Mr. Yeskis of Region V. Final comments were made via a memorandum dated January 11, 1989. No further activities have been conducted related to this assistance request.

Region V - Dover Chemical - 88-R05-002

A technical assistance request was received concerning leaching of chlorinated compounds from the soil at an industrial waste site in Dover, Ohio. Both the soil and ground water were contaminated with these compounds.

A draft plan to leach contaminants out of a laboratory soil column was proposed in order to develop information that would be used as input into a fate and transport ground water model. Technical review comments and recommendations on the draft and revised draft plan were submitted from a well diversified review staff on November 18, 1988, and March 31, 1989, respectively. The main focus of the review comments and recommendations concerned testing procedures, soil sample collection, and data interpretation.

Region V - Byron Salvage Yards - 88-R05-001

The Byron site is an area of about 20 acres near Byron, IL, where uncontrolled dumping of hazardous wastes occurred during the 1960's and 1970's. The site has a thin layer of glacial deposits which overlie a series of fractured dolomites and a sandstone aquifer. TCE and cyanide have been detected in the ground water and in the Roch River.

Doug Yeskis requested the assistance of the TST on 1-28-88, and subsequently visited the laboratory to solicit the advice of the TST and researchers, particularly on the complex fractured dolomite contamination. Previous work on the hydrogeology was reviewed and approaches were suggested for additional site characterization work. The TST issued a work assignment to PEI under contract # 68-03-3413 for additional drilling and coring on wells on-site. Region V added funds to supplement the available contract funds for other site work.

Region V - Rose Township - 89-R05-009

The remedial action proposed is to leach chemicals from the unsaturated zone into the saturated zone and recover the chemicals via a ground water recovery and treatment system. A preliminary review has been conducted and comments have been conveyed to the RPM. An additional technical assistance request has been received and is currently being evaluated. Preliminary recommendations involve abandonment of the proposed leaching remediation and investigation of the merits of vacuum extraction instead. Contaminant removal efficiency/effectiveness and minimization of future ground water contamination is the impetus of this preliminary recommendation. A comprehensive multidisciplinary evaluation was submitted to Kevin Adler 12-8-89.

Region V - Egbert Site - RCRA-05-01

The Egbert Corporation previously manufactured clutch, brake parts, and heavy construction equipment at its facility in Bedford, Ohio. The corporation had an interim RCRA permit for a drum storage area on which drummed spent solvents were placed for removal. Spent solvents consisted of xylene, methyl ethyl ketone (MEK), perchloroethylene (PCE), and isopropyl alcohol. Storage of wastes on the pad was discontinued in May 1986. Under a RCRA closure plan, the Egbert Corporation had proposed using soil vacuum extraction (SVE) to remediate silty clay soils contaminated with TCE and PCE. A pilot test was proposed to evaluate potential SVE operation.

The Superfund Technology Support Center at RSKERL received a technical assistance request on April 10, 1989, from Francine Norling, EPA Region V, to review the SVE pilot test design. A response was submitted June 12, 1989. The proposed design did not appear capable of determining the ability of SVE to remediate soils in a reasonable period of time.

RSKERL recommended that the Contractor consider many design modifications including:

1. Using 4-inch in lieu of 2-inch diameter extraction wells.
2. Drilling exploratory boreholes to determine variation of permeability with depth.
3. Installing passive air inlet wells around each extraction well to isolate vacuum.
4. Conducting pneumatic pump tests on each extraction well with incrementally increasing applied vacuum.
5. Operating extraction wells until mass flux or concentration decreases substantially.
6. Installing additional vapor monitoring wells.
7. Using steel canisters or direct GC injection in lieu of sample storage in Tedlar bags.
8. Drilling confirmations boreholes to compare PCE and TCE concentrations in soil samples before and after the pilot test.
9. Conducting laboratory scale tests to determine effective diffusion coefficients and residual soil levels.

Region VI - Hardage-Criner, Criner, Oklahoma

The Criner site encompasses 60 acres and consists of several surface impoundments and a drum burial area. The site, which was in operation from 1972 - 1980, poses a potential health risk from contamination of surface water, ground water and surface soils by pesticides, solvents, alcohols, acids, caustics, and metal sludges.

Involvement from scientists at RSKERL has included review of technical documents relating to occurrence and movement of ground water, siting of monitoring wells, and depositions as an expert witness prior to court proceedings. No further involvement is anticipated.

Region VI - Old Midland Products Site

The Old Midland site is located near Ola, AR. This 38-acre wood treating facility was operated from 1969 to 1979. Creosote compounds and pentachlorophenol are present in soils and sludges associated with the waste ponds on the site. In September, 1988, Tim Mahon, RPM, requested RSKERL review proposed ground water recovery approaches to be used in conjunction with incineration of soils and sludges for site clean up. After review and evaluation of site characteristics, it was suggested that a french drain to recover shallow ground water and contaminants may be the most cost-effective approach.

Region VI - Tar Creek Superfund Site - 89-R06-001

On March 16, 1989, the EPA Region 6, at the behest of the Oklahoma Water Resources Board, requested that the RSKERL Technical Support Center provide assistance to evaluate the effectiveness of remediation activities at the Tar Creek Superfund Site which is a former lead and zinc mining area in the Tri-State Mining District of Kansas, Oklahoma and Missouri.

Acid water from the Pitcher mine field is discharged into Tar Creek, which passes through several communities in northeastern Oklahoma and then empties into the Neosha River. The mine water also has the potential to migrate downward into the area's major water supply, the Roubidoux aquifer.

In December 1986, a series of remediation measures were completed at the Tar Creek Site. The surface water runoff flowing into the collapsed mines was diverted and a number of deep wells providing potential communication with the Roubidoux aquifer were plugged. These actions were followed by post-remediation monitoring.

Data were collected from several sources to evaluate the effectiveness of the well plugging operations in preventing or reducing contamination in the lower aquifer as well as the stream diversions to lower the amount of mine water discharges. Ground water quality, mine water level, rainfall and mine discharge data were gathered from the Oklahoma State Department of Health, Oklahoma Water Resources Board and the United States Geological Survey.

Members of the Technical Support Center assisted by Dynamac on-site personnel, and an outside consultant made a site visit to gain firsthand knowledge of the problem, the steps taken in the remediation, and the geology and hydrology of the system. The data in disk, tape, printout and report form were examined and extensive statistical analyses were performed.

A presentation and a report on the effectiveness of remediation, further remedial actions which may be considered, and recommendations for continued monitoring at the site was given to representatives of the Oklahoma Water Resources Board and the Superfund Branch, Region VI, on September 6, 1989.

Region VI - Brio Refining Site - 88-R06-002

The Brio Refining site occupies approximately 51 acres near Houston, Texas. Soils in 24 areas at the site are contaminated with a wide variety of contaminants associated with the petroleum refining and petrochemical industry, including polycyclic aromatic hydrocarbons, phenolics, and chlorinated aliphatics.

Heavily contaminated soils are confined to 24 former waste pit areas which are now filled in. In November 1986, Region VI requested that RSKERL provide continuing technical assistance at this site, beginning with soil bioremediation feasibility and design studies. The initial request involved review and evaluation of the proposed bioremediation plan. Major review comments were (1) that the detailed microbiology proposed as part of the field biodegradation demonstration study was not necessary to answer the question of whether or not the proposed bioremediation would achieve the desired results, and (2) that appropriate control plots be incorporated into the design plan so that the results could be properly evaluated. In March 1987, a site visit was made by two RSKERL scientists to discuss RSKERL comments and preliminary field demonstration results with the RPM, PRP, and PRP contractor. The next support request involved review of the final remedial design plan. Review comments were provided in June 1988. Since an aqueous phase bioreactor was proposed, reviewers recommended that aqueous phase treatability studies should be conducted prior to design. The next request was received in January 1989, to review results of the aqueous degradation study. Comments were provided to the RPM in March 1989. All reviewers expressed concern about the high solids level (approximately 30%) used in the bench-scale bioreactor study and potential impacts on contaminant reductions in a full-scale system. The latest request was received in December 1989, and involved review of the proposed plan for location and removal of free phase product from the saturated zone. Reviewers expressed concern that the work plan in its present form might be of questionable use. Specific review comments addressed those areas of most concern and provided recommendations for improving the plan. These specific comments were provided to the RPM for his use in a planning meeting with the Brio Task Force and PRP.

Region VI - Old Inger - 85-R06-001

The Old Inger site near Darrow, LA, is an abandoned oil refining facility, approximately 40 acres in size, having surface and buried oily sludges and soil contaminated with hazardous constituents contained in such sludges, i.e. BTX and PAH compounds.

On-site land treatment was proposed as the remediation technology of choice for the heavily contaminated sludges and soils. In 1984, Region VI requested RSKERL to provide technical assistance, (analytical, bioassay, and technical review), during the laboratory and field plot land treatability studies. This assistance consisted of metals analyses, Microtox™ bioassays and review of study results. Based on results of these studies, on-site land treatment was selected as the final remedy for this site. In November 1987, The Office of Solid Waste requested comments from the Laboratory Land Treatment Expert regarding the "no migration" demonstration prepared by the Office of Emergency and Remedial Response. Following final approval of land treatment as the remediation technology for this site, the RPM requested (October 1988) review of the final design plan. These comments were provided in December 1988.

Region VI - South Valley Site - 88-R06-004

The South Valley SJ-6 site is located in the South Valley of Albuquerque, New Mexico. Ground water investigations indicate inorganic, volatile organic and semivolatile organic contaminants are present in three hydrogeologic zones in the subsurface.

RSKERL provided verbal and written comments to Region VI primarily concerning the limitations of pump-and-treat remediation.

Region VI - Oklahoma Refining - 89-R06-002

The Oklahoma Refining site is an abandoned petroleum refining site in Cyril, OK, having soil and ground waters contaminated with petroleum hydrocarbons, including BTX and PAH compounds. In May 1989, the RSKERL received a request from Region VI regarding continuing technical support for a proposed biotreatability pilot scale study; specifics of the technical support required would be supplied at a later date. Conversations with the site RPM have revealed that delays have been encountered in initiating the feasibility study phase. It is expected that a specific request for technical support will be forthcoming in the Spring of 1990.

Region VI - North Cavalcade Site - 88-R06-005

The North Cavalcade site in Houston, TX, is an abandoned wood treating facility that operated for approximately 50 years. Major soil and ground water contaminants include those associated with creosote wood treating operations, i.e. PAHs. In June 1988, the Region VI RPM requested that RSKERL provide continuing technical assistance during the site remediation process. Two specific support activities have been completed to date. Review comments for the site remedial design plan were provided to the RPM in July 1988. In general, the reviewers found that the remedial design scope of work cover the needs for remedial design work; however, the remedial design memo gave cause for concern. A lack of understanding of the biodegradation process was indicated. The draft field samples and analysis plan was received for review in May 1989; review comments were provided to the RPM in June 1989. In general, the seven reviewers agreed that the plan as presented was inadequate and needed substantial revision in most areas prior to implementation. Specific areas of concern were: 1) soil bioremediation treatability studies; 2) soil sampling; 3) free phase product location and recovery; 4) pump tests; 5) ground water treatability studies; and 6) potential presence of dioxins and furans at the site.

Region VII - NIES Site - 89-RO7-004

The National Industrial Environmental Services, Inc. (NIES) hazardous waste disposal facility near Wichita, KS, was operated from February 1977, through January 1982. The state of Kansas closed the site in 1982, and remediation was begun.

Region VII personnel requested a technical review and overall evaluation of a proposed bioremediation plan for one of the contaminated aquifers at the site. The review, which was completed and forwarded to Region VII on May 5, 1989,

found several major limitations to the use of bioremediation at the site and recommended a careful prioritization and investigation of this approach prior to implementing either a laboratory or pilot scale study.

Region VII - Hastings NE Superfund Site - 88-R07-001

The region requested assistance to evaluate the contractor's modeling and data collection efforts and to recommend other site characterization work. This is a 200' alluvial aquifer with a 100' saturated thickness. Several diverse sources of contamination are responsible for TCE, PCE, CCl_4 and EDB in the ground water. Site visit was made by the TST on 11/15/88 with a consultant (Hendry) and RPM. The TST conducted a review of several documents and water quality data was extracted from a disk, analyzed and plume maps were prepared. Hendry performed some conceptual modeling and made estimates of plume size and shapes. A meeting was held on 05/18/89, with Sommerhauser, Hendry, PRC and CH_2M Hill, to determine future activities. RSKERL has run tritium analyses to determine age of ground water but results were inconclusive. Gamma-ray logging was conducted by RSKERL at the site to better define the geology, and these logs have been sent to the RPM. Now under consideration is a soil gas extraction system for source control and pumping for plume control.

Region VII - Scott Lumber Co. - 89-R07-001

Bruce Morrison of Region VII requested a technical review of remediation proposals for the Scott Lumber Company Superfund site. The nine acre site, located in Alton, Missouri, is an abandoned creosote wood treatment facility found to be contaminated with polycyclic aromatic hydrocarbons (PAHs) with concentrations up to 63,000 parts per million in the soil. The Prime Emergency Response Clean-up Service Contractor, through a subcontract was to provide a bioremediation technology capable of biodegrading creosote contamination in soil and sludge. Two proposals were technically reviewed and rated. The combined comments were returned to the region as requested.

Region VII - Waverly - 89-R07-002

The Waverly site at Waverly, Nebraska, has a contaminated ground water plume containing chlorinated solvents. Major contaminants are carbon tetrachloride and trichloroethylene. In November 1988, the Region requested that the RSKERL identify alternative treatment techniques that had been used for ground water contaminated with such solvents. An extensive literature search was initiated through the Laboratory's Subsurface Remediation Information Center to generate an information package pertaining to subsurface fate, transport and remediation of the two major chlorinated solvents found at the site. This information package was provided to the RPM in December 1988.

Region VIII - Colorado Refinery Co. Site - RCRA-08-02

The Colorado Refinery Co./Denver Refinery site is a RCRA site with extensive shallow ground-water contamination by hydrocarbon products. Currently, a french drain is removing a portion of the free product present in the unconsolidated alluvial material. A pump-and-treat system was proposed as remediation at the site. Comments describing the limitations of the proposed system were provided to Region VIII.

Region VIII - Union Pacific - 88-R08-001

The Union Pacific Tie Plant site in Laramie, Wyoming, is an abandoned wood treating facility that was operated for over 50 years prior to its closure in the 1970's. This operation resulted in creosote and pentachlorophenol contamination of soils and ground waters in a 100 acre area adjacent to the Laramie River. In 1987, the RSKERL was requested by Region VIII to provide continuing technical review and evaluation of plans and results for the In Situ Treatment Process Development Program for the site. Primary technical support input was to be directed toward activities associated with bioreclamation of contaminated soils and ground waters.

The first technical support action involved review and evaluation of proposed plans for bioreclamation at the site. A meeting between RSKERL scientists and the Region VIII RPM was held at the RSKERL in September 1987, to discuss Laboratory comments pertaining to the proposed plans. Following the meeting, detailed written comments were provided to the RPM. The major thrust of these comments were directed toward the lack of adequate controls to be able to properly evaluate the data generated for the different studies to be conducted at the site. In the Fall of 1988, the site RPM requested review of the Milestone II report and results of surface bioreclamation studies. Review comments were provided in December 1988. In general, reviewers felt that the initial results were positive and the

plans for further studies were scientifically sound. It was suggested, however, that potential impacts of transformation products be included in future studies. A meeting was held in Denver in February 1989, with the RPM, to discuss the proposed studies. As a result of this meeting, additional information on soil remediation of wood treating chemicals was provided to the RPM. In March 1989, at the request of the RPM, a meeting was held with the PRP to discuss the proposed plan for ground water bioreclamation demonstration studies. Recommendations were made regarding the delivery of oxygen and nutrients as well as monitoring performance of the four different treatment demonstration trains. The major recommendation was for collection of monitoring samples closer to the delivery point since the oxygen demand is so high. These recommendations also were provided to the RPM. Site visits by two sets of RSKERL scientists and support contract personnel were made in the Summer of 1989 to observe the design of the bioremediation demonstration and to receive a briefing by the PRP on site remediation activities. In July 1989, the RPM requested review of the Milestone III reports. Review comments were provided. There were no problems with interpretation of the data presented. The data was consistent with what has been found in RSKERL research studies. The latest technical support activity involved review of the proposed final sampling evaluation plan for the in-situ Ground Water Bioreclamation studies. The major recommendation was that additional soil core samples be collected to insure that the treatment trains demonstrated could be adequately evaluated for potential effectiveness.

Region VIII - Champion International - 88-R08-002

RSKERL staff is providing technical support for the remedial design of the in-situ bioremediation system, land treatment design of the contaminated surficial soils, and the subsurface dense oil investigatory efforts currently ongoing at the Champion International (wood-preserving) Superfund site in Libby, Montana. Technical review comments on the upper aquifer bioremediation system were provided 9-5-89. The bench scale heavy oil treatability study is currently underway and two teleconferences have been held regarding technical review and evaluation.

Region IX - San Fernando Valley - 89-R09-002

The San Fernando Valley site is actually four sites being handled as one very large site. The individual sites are Polloch, Glorietta, Crystal Springs, and North Hollywood serving approximately 600,000 residents with ground water. This ground water is contaminated with TCE and PCE from multiple sources, not all of which have been identified.

Henry Longest requested that the TST review and evaluate the available studies and comment on the appropriateness of the recommendations. A multi-disciplinary team of scientists from the TST, including researchers from RSKERL, reviewed the Burbank Operable Unit Proposed Plan and associated documents which called for pumping for plume control, treating and re-use of the water for drinking water supplies. A memorandum providing review comments was submitted to Longest and the Region on 3-28-89.

Region IX - South Bay Toxicity Profile - 88-R09-003

The South San Francisco Bay area has 29 NPL sites along with many more hazardous waste areas being addressed under other federal, state, and local programs. A request was received from Region IX to review a toxicity profile on 22 chemicals commonly found at sites in the area. The report provides general information regarding the chemical and physical properties, toxicity data, common background values, a fate and transport discussion and MCL, AWQC and risk values. The report is to be used by all of the regulating agencies involved in the development of risk assessments for site remedy selections. Review and comments were provided through the TST by Dr. Dermont Bouchard, RSKERL.

Region IX - San Gabriel Valley - 89-R09-003

The San Gabriel Valley site consists of four large areas of ground water contamination from volatile organic compounds. The ground water basin provides over 90% of the water supply for over one million people.

Henry Longest has requested that the TST review and evaluate the available studies. An interdisciplinary team from the TST received a briefing on the GIS approach applied to the basin. Other reports necessary to complete the TST review have not been received from the Region.

Region IX - Brown & Bryant Site - 89-R09-004

The site was a pesticides formulating facility and EDB, DNBP (Dinoseb), DBCP, and 1,2-dichloropropane are found in the soils and the shallow (65') perched aquifer. The extent of the aquitard associated with the perched zone has not been determined. The ability of the clay layers to prevent migration of the contaminants down to the regional drinking water aquifer cannot be predicted. The City of Arvin has a water supply well approximately 1500' down gradient.

A site visit was made 7-17 thru 7-20-89 and discussions were held with OSC on additional site characterization necessary. We have contracted with GeoTrans to aid in the hydrogeological investigation. We contacted EMSL regarding the possibility of doing some geophysical work and the Region formally requested their assistance. Field work was done the week of 10-23-89. This TST, along with GeoTrans, has been working with E & E (the OSC's contractor) on specifications for additional drilling and monitoring well installation. The specifications have gone out for bid. Members of the TST and GeoTrans will be on site in February to complete hydrologic characterization.

Region IX - Montrose Chemical Site - 89-R09-005

The Montrose Chemical site is located near Los Angeles. DDT was manufactured at the facility from 1947 - 1982. The 13 acre facility included a DDT processing building, a waste recycling pond, and various auxiliary buildings and structures. The soils and ground water are contaminated with DDT and its metabolites, BHC, and chlorobenzene. The surface soils, vadose zone and the ground water (about 70' from the land surface) contain varying amounts of contamination. RSKERL has provided final recommendations to formulate the laboratory treatability study on pesticides being conducted by ECOVA Corporation for the Montrose Chemical Company. The studies will provide information on the feasibility of biotreatment for the soils and ground water.

Region IX - Watkins-Johnson Superfund Site - 89-R09-001

The Watkins-Johnson site at Scotts Valley, California, is a case of TCE & PCE contaminated ground water. The request in October, 1988 from Leo Levenson of Region IX was to review the ground water flow and solute transport modeling report. The report was reviewed by RSKERL staff and was found to be fairly well done regarding the models chosen and their application to the site. The conclusions of the report seemed reasonable based on the materials presented. The comments and reviews were given to the Region as requested.

Region IX - J.H. Baxter Site - 88-R09-002

The J.H. Baxter site in Weed, California, is an operating wood treating facility having soils and ground waters contaminated with creosote, pentachlorophenol, and metals. In FY '88, the Region IX RPM requested that the RSKERL provide continuing technical support related to proposed soil and ground water bioremediation activities at the site. Since initiation of technical support for this site, several specific support activities have been completed. In March 1988, two scientists from the RSKERL met with the PRP in Dallas, Texas, pertaining to the planning and design for the lab- and pilot-scale phases of proposed bioremediation studies. A follow-up teleconference was held with the RPM and State agencies involved. A written report of this meeting was provided to the RPM. Based on this meeting, the PRP prepared a work plan which was reviewed by the RSKERL at the request of the RPM. The reviewing scientists made a site visit to the facility in September 1988, to observe set up of the pilot-scale field studies by the PRP. At the recommendation of these scientists, the location of the pilot-scale setup was moved to prevent possible outside contamination. Following the site visit, the scientists stopped at the Regional office to brief the RPM and his supervisor. In February 1989, a meeting with the PRP was held at the RSKERL to discuss laboratory results, preliminary pilot results, and proposed ground water extraction studies. In March 1989, the two reviewing scientists traveled to Mississippi State University to meet with the RPM and PRP consultant regarding all aspects of bioremediation of soils and groundwaters at this site. At this time the RPM requested review of the pilot project proposed for ground water pumping. Review comments were provided in April 1989. The reviewers recommended that the initial extraction wells be located so that free phase products could be removed and needed hydrological data could be obtained. Such data could be used to help locate additional wells and establish optimum pumping rates.

Region X - Time Oil Site - 89-R10-003

A Record of Decision was signed at the Time Oil site in Tacoma, Washington, to implement soil vacuum extraction (SVE) to remediate soils contaminated with high concentrations of tetrachloroethylene (PCE), 1,1,2,2-tetrachloroethane (PCA), and trichloroethylene (TCE). Design has been delegated to the U.S. Army Corps of Engineers. The maximum detected concentration of PCE + PCA and TCE was 29,500 and 25,000 mg/kg respectively. Soils at the site are predominantly sandy gravel to gravely sand in texture. Most of the contaminant mass appears to be near the water table with evidence of prior transport by a light nonaqueous phase fluid. Soil samples near the water table were described as "oily" in bore logs.

At the request of Region X, the RSKERL Superfund Technology Support Center reviewed a 65% complete SVE design submitted by the Corp's contractor. Immediate development of performance standards with concurrent use of representative data such as soil-water partition coefficients was recommended. The results of the contractor's air flow and contaminant transport modeling were questioned. Design appeared to be based on inappropriate and inadequate modeling. Information required for design (e.g. placement and screened intervals of extraction and observation wells, applied vacuum and flow rates) was absent.

Region X agreed with the need to develop performance standards and subsequently requested that RSKERL collect soil cores to evaluate soil-water and soil-air partitioning relationships. Cores would also be used to assess potential limitations on the enhanced volatilization of contaminants present in soil at the site due to the presence of waste oil. Cores were scheduled to be collected using RSKERL's wireline piston sampling device during the week of October 30 but was postponed for three months because of difficulty in obtaining a compatible drilling rig.

In a meeting held on October 4, Region X informally requested that RSKERL review a field test work plan submitted by the Contractor. RSKERL submitted extensive comments on October 16th and proposed an alternative work plan.

Region X - Ponder's Corner Site - 89-R10-002

In response to a request from EPA Region X for technical assistance, on April 18, 1989, RSKERL reviewed the design and operation of a soil vacuum extraction (SVE) system at the Ponders Corner. Contamination of soils and ground water resulted from improper disposal of tetrachloroethene (PCE) into a septic system of a dry cleaning facility. The site is underlain by three unsaturated soil units of interest. The soil unit is an imported fill which varies in thickness from a few feet to over 15 feet. The second soil unit are sands and gravels from recessional outwash deposits which vary in thickness from 1 to 58 feet in the Ponders Corner area. The third unit consists of sands and gravel with high silt and clay content which varies from 8 to 92 feet in thickness and is of low permeability. High concentrations of PCE were detected in soils.

In general, SVE performance was limited by unclear remedial objectives, poor subsurface characterization, and design based on information collected from other sites. RSKERL recommended that Region X:

- Establish clear performance standards.

- Better define the lateral and vertical extent of PCE soil contamination especially in suspected source areas.

- Determine depth to an unperched water table underneath the site.

- Install vapor probes to monitor pressure gradients, vapor concentration, temperature and relative humidity.

- Conduct pneumatic pump tests on each extraction well to determine the magnitude and spatial distribution of permeability and vacuum differential.

- Monitor flow rates and PCE concentrations in each extraction well during pneumatic pump tests and PCE rebound in vapor monitoring points during periods of inactivity. The use of extraction wells to monitor soil air concentration was discouraged.

Region X - Frontier Hard Chrome - 89-R10-001

In May, 1989, John Barich of Region 10 requested assistance in evaluation of procedures to establish site clean-up criteria for Frontier Hard Chrome, Vancouver, Washington. The site's soil and ground water is contaminated with chromium, lead, nickel, and cyanide, although the primary contaminant is chromium. The ROD has been issued for the remediation of the site and establishes a tentative clean-up level. The goal of the procedure is to estimate leachate contaminant concentration at equilibrium between soil and water. It was requested that an expert be supplied in an advisory role during protocol development and interpretation of results. Dr. Carl Palmer, (Oregon Graduate Center) through RSKERL's technology support contract, is providing ongoing assistance as requested.

Region X - Wyckoff/Eagle Harbor - 88-R10-001

The Wyckoff Company site is an active wood treating facility on Bainbridge Island occupying approximately 40 acres at the mouth of Eagle Harbor, adjacent to Puget Sound. The site has been operating since 1910. Both soils and ground waters at the site are contaminated with creosote and PCP. Ground waters also contain floating and sinking pure-phase product. In March 1988, the Region requested review of the proposed ground water clean up feasibility study and subsequent attendance at a meeting to discuss preliminary results of the study. As a result of this meeting, a final remediation plan was prepared. Review comments on the final plan were submitted to the RPM in June 1988. The reviewer felt that the biological system proposed was acceptable for these ground-water contaminants. He did recommend, however, that scale-up studies should be conducted prior to final design due to the high flow rates involved. He also recommended that a standby carbon column system be included as a precautionary method due to the anticipated high variability in influent concentrations.

Summary and Future Directions

RSKERL-Ada is EPA's center of expertise for research into the environmental processes that control the transport and transformation of contaminants in the subsurface. Understanding these processes is fundamental to controlling sources of contamination, monitoring contamination and remediating subsurface contamination. Subsurface remediation is a relatively new interdisciplinary technology that is not yet developed to the point of design manuals and standardized remediation procedures. Effective remediation at each site requires the application of a number of scientific disciplines to understanding and controlling the hydrologic, biological and non-biological interaction between the contaminants and the subsurface environment.

The RSKERL Superfund Technology Support Center was established to provide decision-makers with a source of easily accessible, up-to-date subsurface fate and transport information and the associated multidiscipline expert assistance to effectively use this information. The RSKERL Center has provided site-specific technical support to all ten EPA Regions relative to more than 60 different sites. On many of these sites, multiple requests have been received and services have been provided in more than one area of technical support. The most common area of technical support has been review of design, treatability/demonstration studies for in-situ remediation of contaminated soils and ground waters.

Treatability Studies

Treatability studies for contaminated sites are used to provide specific information concerning the potential rate and extent of remediation by providing information on fate and behavior of constituents at a specific contaminated site. Treatability studies can be conducted in laboratory microcosms, at pilot scale facilities, or in the field. These studies are conducted to determine whether a specific site is suitable for a particular technology. The information from treatability studies is combined with specific information concerning site and waste characteristics in order to determine potential applications and limitations of the technology. Information from treatability studies also is used to prepare an approach to the engineering design and implementation.

In the future, the RSKERL Superfund Technology Support Center will be increasing efforts to incorporate site specific treatability studies of in-situ technologies, such as soil vacuum extraction, soil and ground-water bioremediation, and pump and treat, into the overall RSKERL research efforts to better understand subsurface processes and provide treatability studies for the Regions.

Technology Support to Other Programs

Many requests for technical assistance come from other programs such as RCRA, Well-Head Protection, Emergency Removal and the Underground Injection Control (UIC) Programs. The level of support provided is limited generally to in-house, long distance assistance because of resource constraints on travel and contractor and consultant support. If resources become available in these programs, an increased level of support could be made available.