



Research and Development

Internal Report

RSKERL-ADA SUPERFUND TECHNOLOGY SUPPORT CENTER The First Three Years

Prepared for

Office of Solid Waste and Emergency Response

Prepared by

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RSKERL-Ada Superfund Technology Support Center

The First Three Years

An Internal Report

by

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RSKERL-Ada Superfund Technology Support Center

Background and Introduction

Offering technical assistance to a variety of users on a variety of environmental issues has been a tradition at the Robert S. Kerr Environmental Research Laboratory (RSKERL) since its beginning in 1965. During the ensuing years the Laboratory gained a National and international reputation for its research related to: transport and transformation of contaminants in the subsurface environment; use of natural soil systems in treating waste; characterizing the hydrogeologic, abiotic, and biotic processes controlling contaminant transport and fate; and expression of these processes in mathematical models. A Laboratory reorganization in 1984 established the Applications and Assistance Branch which was specifically designed to focus on technology transfer and technical assistance activities. However, it was not until 1987 that events occurred which would lead to a structure wherein site specific technical assistance would become a major part of the Laboratory's activities, particularly with regard to the remediation of soil and ground water at hazardous waste sites.

Following the Superfund Amendments and Reauthorization Act of 1986, Regional decision makers, charged with administering cost effective and permanent restoration technologies at Superfund sites, quickly became overburdened by the complexity. This resulted, in large measure, because of the high turnover and inexperience of their technical staff as well as a need for more interdisciplinary professionals who can remain current in a relatively new but rapidly developing and complex environmental field.

The great majority of Superfund sites have ground-water contamination which is often the limiting component for remediation. The technology to remediate contaminated subsurface soil and ground water 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 ground water as a procedure for "cleaning up" a contaminated aquifer. The technology for treating contaminated ground 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 principal 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 contamination).

In 1987, in an attempt to deal with these problems, an ad hoc group of Regional ground-water specialists began a series of meetings in order to share their experiences in Superfund remediation. These meetings led to a formal group called the "Ground-Water Forum" which now includes

representatives from all ten Regions. About this same time, representatives from the Office of Solid Waste and Emergency Response were exploring ways to make the experience of the Agency's research arm available to Regional decision makers. To this end, in late 1987, OSWER provided funding to Laboratories in Las Vegas, Cincinnati, Athens, and Ada to establish Technology Support Centers (TSC). More specifically, these Centers 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.

The RSKERL TSC consists of its Core Team of scientists, in-house Laboratory researchers, Dynamac and its contract affiliates, the National Center for Ground-Water Research, the RSKERL Center for Subsurface Modeling Support (CSMoS), and the Center for Environmental Research Information (CERI-Cincinnati). Activities of the Center include: hosting workshops, seminars, and conferences; conducting training short courses; maintaining the Subsurface Remediation Information Center; developing Superfund Issue Papers; and providing site specific technical support.

Site specific technical support activities range from reviewing and commenting on detailed remediation activities to participating in complex, site specific field investigations.

Three Year Summary of Superfund Support Center Activities

RSKERL and the other three Support Centers have just completed their third year of activity. During this period RSKERL has responded to a total of 145 site specific requests for assistance including 35 in FY 1988, 47 in FY 1989, and 63 during FY 1990. The summary distribution of these responses is shown in Figure 1.

In addition to site specific requests for technology support, the RSKERL Technology Support Center has also made contributions in the following areas:

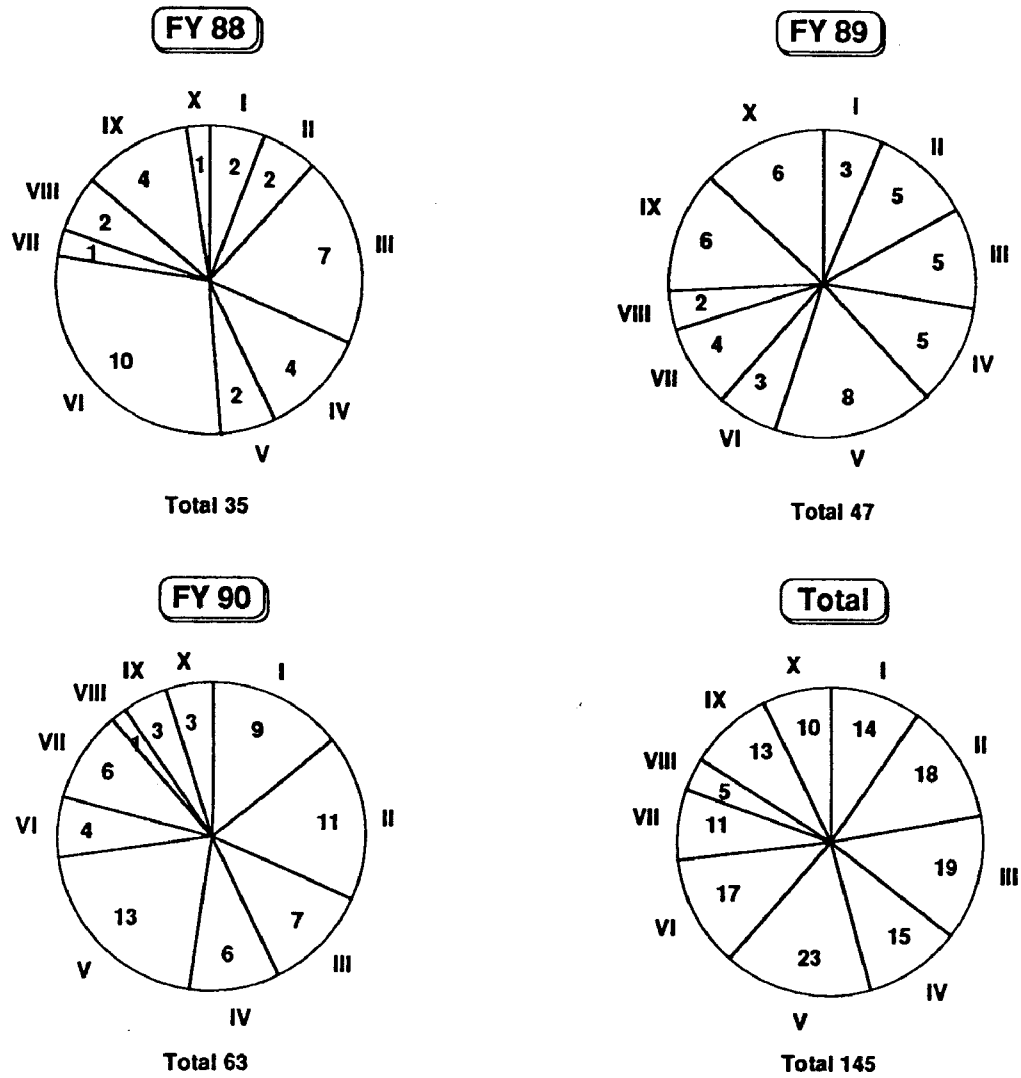


Figure 1. Distribution of Site Specific Technology Support Activities by Regions

● Superfund Issue Papers and Briefing Documents

8 Completed
12 in Preparation

● Workshops, Seminars, Conferences

56 workshops, seminars, and conferences have been held around the Country, including all 10 Regions, which were attended by several thousand professionals concerned with the following topics:

Contaminant Transport Modeling
Remediation at Wood Preserving Sites
Remediation of Soil and Ground Water
Subsurface Sampling
Migration Potential of Subsurface Contaminants
Fractured Media
Site Characterization for Subsurface Remediation
Soil Vacuum Extraction for Subsurface Remediation
Basics of Pump-and-Treat Remediation

● Training Courses

18 training courses have been given to hundreds of students at 7 locations covering the following topics:

Ground-Water Investigations
Remediation of Contaminated Soil
Transport and Fate of Contaminants

● Subsurface Remediation Information Center

Specific research documents and topic-specific information packages pertaining to site investigation as well as transport, transformation and remediation of contaminants in the subsurface were prepared and/or provided to the Regions, Headquarters, states, researchers, and others who are involved in this technical arena. Software driving the Site Subsurface Remediation Data Base is in place and data are being entered into the system.

Revision of software for the Soil Transport and Fate Data Base, including update of the Data Base entries has recently been completed. Copies of the revised Data Base are being prepared for transmittal to previous recipients, including entry into the ATTIC system.

RSKERL-Ada Technology Support Center Organization

The Robert S. Kerr Environmental Research Laboratory functional activities are focused within major divisions, as shown in Figure 2. The "Processes and Systems Research Division" houses the Laboratory's in-house research complement, and the "Activities and Assistance Division" serves as the focus for extramural research, technology applications, and technical assistance. It is important to note that scientific and support expertise in each Division moves freely between discrete portions of the Laboratory's total technical mission. In this way RSKERL research is guided, in large measure, by the Agency's pressing technical needs, and technology support is assured to be of the highest scientific caliber.

A major area of RSKERL research deals with transport and transformation of contaminants in the subsurface environment, including: use of soil systems in treating waste; characterization of hydrogeologic, abiotic, and biotic processes controlling contaminant transport and fate; and expression of these processes in mathematical models. This in-house program and its extension through extramural research is the foundation for the Technology Support Center.

The RSKERL-Ada Superfund Technology Support Center is part of the Applications and Assistance Branch (Figure 2). The Center is composed of a Core Team of RSKERL scientists (Figure 3) who are complemented by scientists from the Laboratory's research Division; an on-site contractor; RSKERL Center for Subsurface Modeling Support (CSMoS) including the International Ground Water Modeling Center; National Center for Ground Water Research; and the Agency's Center for Environmental Research Information (CERI).

● RSKERL-Ada Technology Support Core Team (TST)

RSKERL scientists and engineers in the Applications and Assistance Branch provide a readily available source of interdisciplinary support with the assistance of the on-site contractor and its consultants.

● RSKERL Research Program

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

● On-Site Contractor

Eleven on-site Dynamac personnel, along with over 100 consultants and subcontracts with GeoTrans and firms for treatability studies, provides support to the Core Team, carries out information transfer activities, and is developing the Subsurface Remediation Information Database in cooperation with Core Team staff.

- **National Center for Ground Water Research (NCGWR)**

NCGWR, a consortium of Oklahoma, Oklahoma State, and Rice Universities, develops and conducts long-range exploratory research to anticipate and address ground-water protection and restoration activities.

- **RSKERL Center for Subsurface Modeling Support (CSMoS)**

This Modeling Center is composed of RSKERL personnel and designed to provide modeling related support to the research, technology transfer, and technical assistance activities of the Laboratory. Adjunct to CSMoS is the International Ground Water Modeling Center (IGWMC) located at the Holcomb Research Institute at Butler University in Indianapolis.

- **Center for Environmental Research Information (CERI-Cincinnati)**

CERI provides support to the Technology Support Center through the development of seminars, conferences, training, publications, and other means of technology transfer.

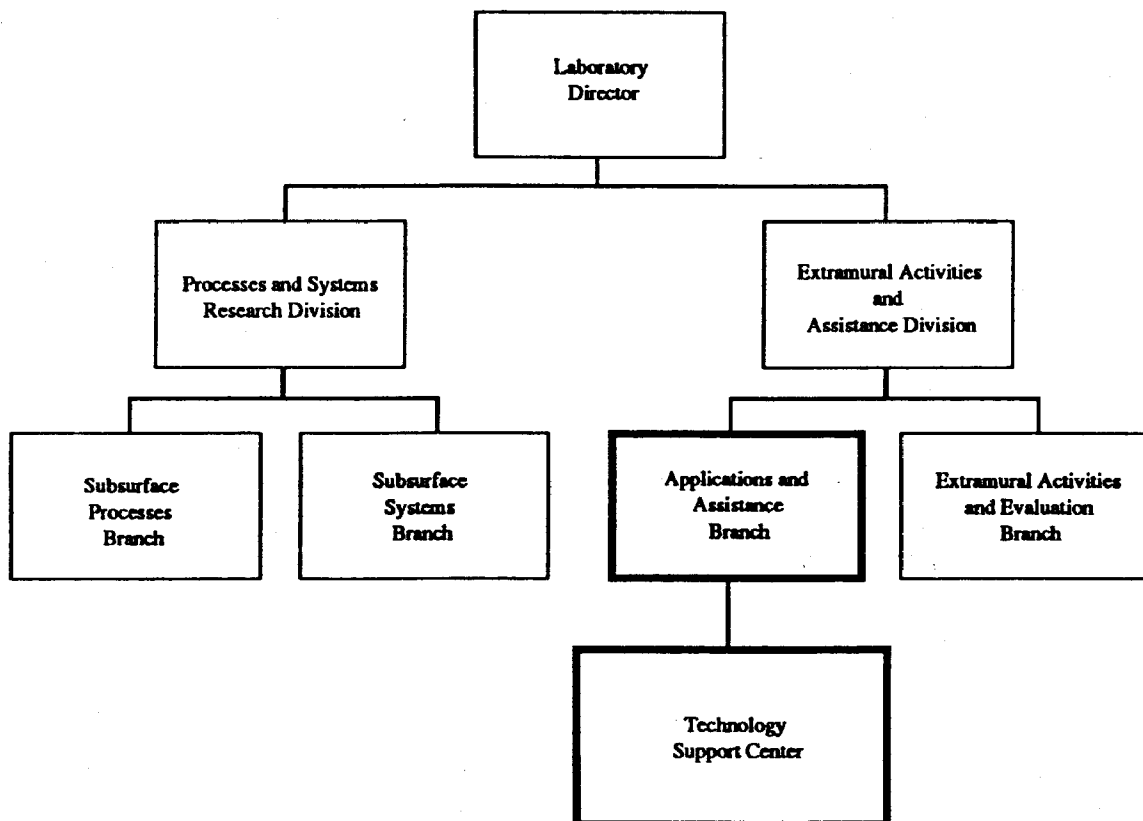


Figure 2. RSKERL Organization Chart

Technical Support Team

Dick Scalf	Division Chief
Jerry Thornhill	Acting Branch Chief/Hydrologist
Bert Bledsoe	Chemist
Don Draper	Hydrogeologist
Lowell Leach	Geological Engineer
John Matthews	Biologist
Hugh Russell	Microbiologist
Dom DiGiulio	Hydrologist/Engineer
Scott Huling	Environmental Engineer
Joe Williams	Soil Scientist
Randall Ross	Hydrogeologist
Dave Burden	Hydrologist/Soil Scientist
Steven Acree	Research Hydrologist

Figure 3. RSKERL-Ada Technology Support Center Technical Support Team

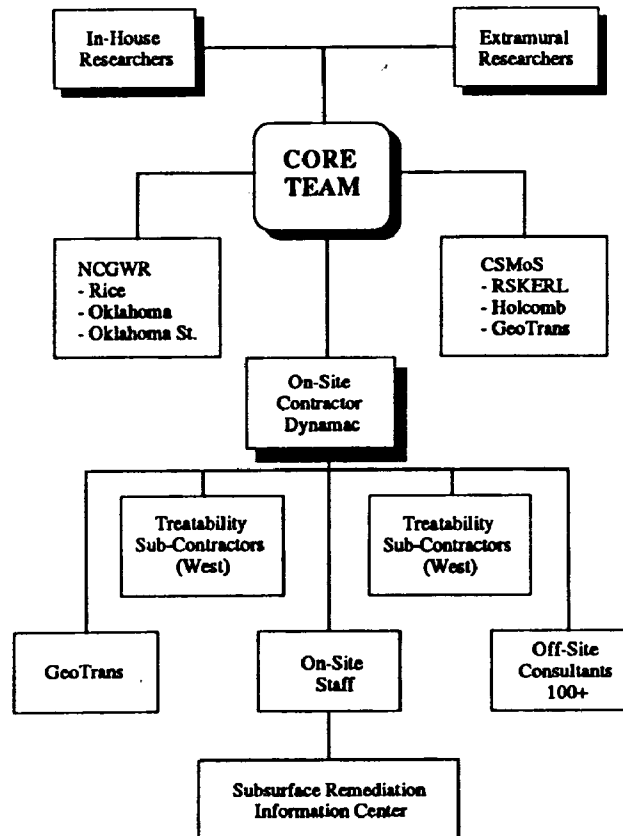


Figure 4. RSKERL - Ada Technology Support Center

The Robert S. Kerr Environmental Research Laboratory has been involved with information transfer and technical assistance in an informal way since its beginning in 1965. These activities became a structured part of the Laboratory following a reorganization in 1984. Technology transfer activities are mainly carried out without specific requests or may be in response to generic needs suggested by groups such as the Ground Water Forum or Headquarters Offices. The RSKERL Technology Support Center focuses on these activities through:

- Development and distribution of topic-specific information packets, Issue Papers and Briefing Documents; and,
- Development and conduct of workshops, seminars, conferences and short courses.

Issue Papers and Briefing Documents

Issue Papers were initiated in the early months of the RSKERL Technology Support Center as a means of addressing a number of technical issues identified by the Ground Water Forum as critical to remediation decisions required of the Regions. These are intended to be brief, state-of-science documents focused on a technical issue of expressed interest and prepared in a concise and readable format. Briefing Documents are much like Issue Papers in that they are prepared to address areas of special interest, however, they are most often of greater length and present the subject in greater depth.

Ground-Water Sampling for Metals Analysis

Printed by CERL as Superfund Issue Paper EPA/540/4-89/001 to address the issue of filtration of ground-water samples when sampling for metals. This was a cooperative effort with EMSL-LV.

Water Level Measurements

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

Facilitated Transport

This document was printed by CERL as Superfund Issue Paper EPA/540/4-89/003.

Fractured Media/Models

A Superfund Issue Paper entitled "Contaminant Transport in Fractured Media: Models for Decision Makers" has been printed by CERL and cataloged as EPA/540/4-89/004. A companion paper, "Status of Site Characterization Technology at Fractured Rock Sites" is in preparation with the initial draft expected in late 1990.

Performance Evaluation of Pump and Treat Remediation

This Superfund Ground-Water Issue Paper has been printed as EPA/540/4-89/005.

Basics of Pump-and-Treat Ground-Water Remediations

This document was printed by CERI as EPA/600/8-90/005.

Bioremediation of Contaminated Surface Soils

900 copies of the document EPA/600/9-89/073 have been received and distributed. An additional 1200 copies are on order.

Basic Concepts of Contaminant Sorption at Hazardous Waste Sites

This Ground-Water Issue Paper has been sent to CERI for publication as EPA/540/4-90/053.

Dense Non-Aqueous Phase Liquids

Final draft of document will be sent to peer reviewers in October 1990.

Light Non-Aqueous Phase Liquids

Document outline is under preparation.

Behavior of Metals in the Soil Environment

A draft document has undergone RSKERL internal review and modifications are under way prior to sending out for peer review.

Fundamentals and Principles of Soil Science as Related to Contaminant Mobility in Soils

A draft document has undergone RSKERL internal review and modifications are under way prior to sending out for peer review.

Soil Classification Systems for Use at Superfund Sites

Preparation of the final draft is under way in cooperation with EMSL-LV with input from IERL. It is anticipated that the document will be sent to CERI in November 1990 following peer review.

Conducting Field Tests to Evaluate SVE Applicability and Design

The original paper, presented at the Las Vegas Outdoor Conference, has been revised and is under review prior to sending for peer review. Anticipated date for submittal to CERI for printing is November 1990.

Bioremediation of Contaminated Ground Waters

A draft document has undergone peer review and is being edited accordingly before being sent to CERI for printing in December 1990.

Reductive Dehalogenation of Organic Halogenated Pollutants in Soil and Ground Water

Draft document has undergone peer review and subsequent revision and sent to Ground-Water Forum members for comment. Will be sent to CERI for printing in November 1990.

Remediation of TCE in the Subsurface

The draft has been through internal review and is undergoing revision and editing before being sent out for peer review. Printing is expected in January 1991.

Remediation of Munitions Contaminants in Soil and Ground Water

The first draft is completed but requires significant revision and editing prior to sending out for peer review.

Basics of Ground-Water Modeling

The initial draft is completed and is undergoing an internal review before being submitted for peer review which is expected in December 1990.

Chemical Enhancements to Pump-and-Treat Remediations

The first draft is undergoing an internal review. An anticipated peer review date is December 1990.

Workshops

Ground Water Modeling Workshops were held in all ten EPA Regions between 8/29/88 and 12/09/88. This "hands-on" three day course covered modeling of the saturated and unsaturated zones as well as geochemistry. These were conducted by RSKERL Technology Support Center staff along with national experts from GeoTrans, the USGS, and universities. Attendance was limited to a total of about 40 per session so that personal instruction could be given.

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

A workshop was held at RSKERL March 1, 1989, with a panel of experts invited to reach a consensus on the subject of filtering or not filtering ground-water samples for metals analyses. This workshop resulted in an Issue Paper on the subject.

At the request of Region VI a workshop was conducted during April 18-19, 1989, at the SCS Technical Center in Ft. Worth, Texas, on vadose zone monitoring.

A workshop on Vacuum Extraction was held at RSKERL April 27-28, 1989, to bring together consultants and researchers from various disciplines to discuss methods of evaluating and enhancing the performance of SVE. There was also a series of presentations on SVE made to states in Regions II and III during the summer of 1989. The emphasis of the workshops was to evaluate and understand subsurface vapor transport and fate processes. An Issue Paper is being developed on the subject.

A workshop was held in Denver May 17-18, 1989, on the remediation of soil and ground water contaminated with oily, viscous, and multi-phase contaminants. National experts discussed available technologies, their limitations, and data requirements.

A workshop on Contaminant Mobility (migration potential) was held in Houston, December 14-15, 1989, to identify, summarize, and evaluate methods available to estimate the migration potential of both organics and inorganics found at hazardous waste sites. Following the presentations, EPA's Science Advisory Board met with some of the participants of the workshop to discuss contaminant migration potential as a result of soil remediation activities. The purpose of the meeting was to address questions being asked by the Regions on contaminant migration in soil. A series of Issue Papers are being developed to address this topic.

A workshop on Fractured Flow was held in Dallas, January 29, 1989. A select group of researchers and consultants was asked to identify and evaluate the available methods for characterizing contaminated sites that overlie fractured media and for developing reliable predictive models for these sites. One Issue Paper resulted from this workshop and another is in preparation.

Workshops on the "Limitations of Pump-and-Treat Remediation Technology" were presented in four Regions. The one-half day sessions were directed toward technical and managerial personnel. The workshops were held in Dallas in January, Boston and New York in February, and in Philadelphia in September, 1990.

Seminars and Conferences

The annual RSKERL RESEARCH SEMINAR was held in Oklahoma City in the spring of 1988, 1989, and 1990. These three-day meetings bring together all researchers sponsored by RSKERL and the National Center for Ground Water Research to present the progress of their research. Invited guests include scientists from academia, state and other federal agencies, industry, consultants, and representatives from EPA Program Offices. Approximately 300 have attended each of these sessions.

In cooperation with CERL, a series of seminars entitled "Transport and Fate of Contaminants in the Subsurface" was 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 governing the transport and fate of contaminants in the subsurface. The total attendance was approximately 2500.

A series of seminars entitled "Site Characterization for Subsurface Remediations" was initiated in 1989 in cooperation with CERI. These were designed to examine the site characterization requirements necessary to select the most appropriate remediation technologies for contaminated soil and ground water at hazardous waste sites. The seminars were presented in all ten Regions with a total attendance in excess of 4000. A publication based on these seminars is in preparation.

A series of seminars entitled "Bioremediation of Hazardous Waste Sites Workshop" developed by CERI was presented in all ten EPA Regions and the State of New York. The purpose was to inform the target audience of basic requirements for implementation of biological systems to remediate hazardous wastes, including initial data requirements, and the design of the reactor and in situ facilities. RSKERL was responsible for the in situ portion of the seminar as well as a workshop. The in situ portion included an outline of the basic requirements for the design of remediation systems for soil and ground water.

Two briefings were arranged for the Headquarters Superfund staff. The first, in February 1990, was directed toward the use of bioremediation of contaminated ground water. The second, in May 1990, was concerned with the application and performance of remediation measures for ground water contaminated by DNAPLs.

At the request of the Florida Department of Environmental Regulation (FDER), RSKERL scientists presented a seminar on bioremediation during August 1-2, 1990, in West Palm Beach, FL. Most of the attendees were FDER employees. Subjects covered during the seminar included: the basic concepts of bioremediation, initial plume location, aseptic sampling, remedial monitoring, hydrologic considerations, and experiences gained in field demonstrations.

At the request of the New York State Department of Environmental Regulation, a seminar on bioremediation was presented in Albany, NY, September 5-6, 1990, for State environmental personnel.

RSKERL presented a one-day seminar on bioremediation at En Sol 90 in Santa Clara, CA, on September 13, 1990. The seminar, which was mainly attended by State employees and consultants, covered initial site characterizations, microbial concepts, and bioremediation of soil and ground water.

Training

Before the RSKERL Technology Support Center was established, training sessions, particularly at locations away from the Laboratory, were conducted on an "as requested" and "time available" basis. In such cases the requesting Region or State

agency reimbursed RSKERL for travel expenses of the EPA instructors and paid travel and an honorarium for participating professors and consultants.

Resources made available through the Center have increased the ability of RSKERL to respond to such requests and have resulted in the development of training modules. These have been increasingly presented in response to Regional and State requests, and the attendees often include consultants. The following provides a summary of these activities:

Ground-Water Investigations

June 1988	-	Dallas
October 1988	-	Des Moines
January 1989	-	Dallas
July 1989	-	Ada
November 1989	-	Ada
February 1990	-	Atlanta
August 1990	-	Baton Rouge
September 1990	-	Dallas

Transport and Fate of Contaminants in the Subsurface

April 1990	-	Ada
September 1990	-	Houston

Remediation of Contaminated Soils

February 1990	-	Ada
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Superfund Basic Training Academy

October 1989	-	Tampa
May 1990	-	Tampa
August 1990	-	Tampa (2 Sessions)

Introduction to Computer Ground-Water Modeling

Held in Regions I through X between August 29, 1988, and December 9, 1988.

Miscellaneous Activities

In addition to the Technology Transfer Activities discussed above and the Site Specific Technology Support Activities which follow, the RSKERL Technology Support Center has responded to a great many requests for assistance which are as varied in content as they are in the effort required for response. The following are offered to convey an awareness of both the variety and depth of these miscellaneous requests for assistance. The list is far from inclusive.

September 20, 1990: At the request of Jennifer Haley, OERR, RSKERL prepared a "Subsurface Contaminant Guide" which was cleared to be published by CERI. The guidance table lists the physical properties of contaminants commonly found at Superfund sites and recommends the most appropriate technology for their removal or remediation.

September 20, 1990: Mary Stinson, START Team Leader, RREL-Cincinnati, requested a review of the first draft of "Planning Guide: Selection of Control Technologies for Wood Preserving Sites." Review comments were provided on October 30, 1990, for discussion at a meeting held in Edison, NJ, on November 1, 1990. Significant changes were recommended.

September 11, 1990: In response to a request by Ed Barth, CERI-Cincinnati, three members of the RSKERL Technology Support Center reviewed a Technical Resource Document (TRD) entitled "Approaches for Remediation of Uncontrolled Wood Preserving Site Wastes." Comments were provided September 25, 1990.

Seminars were presented in three Regions concerning "RCRA Corrective Measures." Essentially, the seminar was directed toward details involved in technologies applicable to the remediation of contaminated soil and ground water using the RCRA Facilities Investigation Guidance Document. The seminar was held in Philadelphia, May 1-3; Chicago, May 15-16; and Boston, September 27, 1990.

August 13, 1990: Neal Durant with the Office of Solid Waste and Emergency Response requested a review of a guidance manual entitled "Ground-Water Net/Flow Line Construction and Analysis" which was developed to provide a technical basis for the design and evaluation of ground-water monitoring systems.

August 10, 1990: Kenneth Brown, EMSL-LV, requested a review of an issue paper entitled "Soil Sampling for Volatile Organic Analysis" which was requested by Rene Fuentes of the Ground-Water Forum. Comments were provided September 15, 1990.

On July 11, 1990, RSKERL staff participated in a seminar provided by Region V to twenty Regional personnel having responsibility for implementing the Underground Storage Tank Program. Included in the seminar was an illustration of the use of soil gas techniques to identify source areas of plumes. Also described were new coring techniques designed to characterize the vertical distribution of gasoline spilled from an underground storage tank. The remediation of fuel spills using hydrogen peroxide and nitrate was reviewed.

April 28, 1990: RSKERL made a telephone response to a written request by the State of Washington Department of Ecology concerning remedial design information for the Cascade Pole wood treatment site on Puget Sound in Olympia, Washington.

March 20, 1990: A petroleum product leak from a pipeline contaminated the water supply of Park City, KS, a suburb of Wichita. The owner of the pipeline company and the consultant requested RSKERL assistance in locating the plume in the saturated zone and providing guidance in the design of remediation systems for both the saturated and unsaturated zones.

January 25, 1990: Bill Massouda, Office of Technology Transfer and Regulatory Support requested a review of "Synthetic Precipitation Leaching Procedures." RSKERL reviews were obtained along with comments of Dr. Ray Loehr (University of Texas) and sent to Bill Massouda on March 8, 1990.

January 20, 1990: A conference call was held with Region IX personnel to discuss a request for RSKERL to evaluate large scale pump-and-treat proposals for two NPL sites in the Region. The request originated from Henry Longest, Director of OERR. A review on the San Fernando Valley projects was transmitted March 28, 1990, and a review of the San Gabriel Valley operation was completed on March 30, 1989.

July 19, 1989: Joe DeSantis, OTTRS, asked for a review of ground-water monitoring analytes at municipal solid waste disposal facilities. Review comments were provided August 7, 1989.

May 24, 1989: Steve Cordle, OEPER, requested a review of a document on contaminated soil. The review was completed in August 1989.

May 23, 1989: Jerry Garman, OTTRS, requested a review of "Municipal Landfill Design Draft Regulation." A response was offered June 6, 1989.

April 28, 1989: John Matthews, RSKERL Research Biologist, was requested by Allen Antley, Chief, Waste Compliance Section, Region IV, to serve as an expert witness in the land treatment of hazardous wastes in a hearing on the Koppers Company site, in Jackson, Mississippi.

February 15, 1989: At the request of Jennifer Haley, OERR, Hazardous Site Control Division, RSKERL reviewed a draft PCB Working Paper. Comments were provided February 27, 1989.

January 24, 1989: Meg Kelly, OSWER, requested staff participation on an advisory group for the development of a second generation ground-water work station. Meetings were held in Washington, March 27-28, 1989, and in Boulder, May 16-17, 1989, during which the participants discussed and developed the essential requirements of the work station. A report expressing these needs was prepared following the second meeting.

August 2, 1988: Kevin Willis, Region II, requested assistance in finding information about well casing schedules of various materials as a function of depth. On August 9, 1988, RSKERL responded by sending a copy of a handbook, "Suggested Practices for the Design and Construction of Ground Water Monitoring Well," which was prepared under the Laboratory's sponsorship.

April 27, 1988: CERI requested an RSKERL review of "Lessons Learned " on Superfund sites. Review comments were provided February 17, 1989.

April 6, 1988: RSKERL provided technical assistance to Region VIII with respect to methods of determining mechanical integrity of wells, particularly a noise tool to determine the movement of fluids behind the casing.

Site Specific Technical Support

Site specific technical support of a significant nature has been provided at more than 133 Superfund sites during the first three years of the RSKERL Superfund Technology Support Center. While some of the specific requests were only concerned with short term reviews of technical documents, others involved protracted field and laboratory investigations. At some Superfund sites the RSKERL involvement was a single event while at others there were multiple requests, and in some cases the involvement has been more or less continuous. In addition to these, the RSKERL Technical Support Team has provided assistance through hundreds of phone conversations and information requests. RSKERL has also provided assistance at 13 RCRA sites where no Superfund resources were used.

The following summaries of activities are provided for sites where RSKERL has provided assistance of a significant nature. At these sites the official requests for assistance are made in writing from the RPM or Ground-Water Forum member to the Manager of the Technology Support Center.

Region I

Stamina Mills Site (88-R01-001)

The Stamina Mills site in North Smithfield, RI, is the location of a landfill where a TCE spill, of an undetermined magnitude, occurred at some time adjacent to the landfill. The original Region I request for assistance was made by John Zannos and concerned the determination of partition coefficients for TCE at the site.

The work accomplished at this site included: (1) the determination of soil-water partition coefficients for samples obtained from the site; (2) an investigation to determine the soil physical and hydraulic properties, since none were obtained earlier; and (3) a simulation of contaminant transport from the unsaturated zone based on available information. All work in response to this request was completed and a final response was made June 20, 1989. The response detailed the results of the partition coefficient determination as well as the modeling activities. No further assistance has been requested directly related to this site.

W.R. Grace & Company Site (88-R01-002)

A formal technical assistance request was received by the RSKERL Technology Support Center on June 28, 1988, to review a report entitled "Bioremediation Potential of Acetone, Benzene and Toluene in Soil from a Contaminated Plume." The request was received from Dave Lang of the Region regarding the W.R. Grace and Company Superfund Site in Action, MA. Comments were prepared by RSKERL and sent to Mr. Lang July 12, 1988.

Further assistance regarding this site was requested by Dick Willey and Wayne Robinson of Region I in July, 1989. This assistance was handled via a telephone

conversation. Advice was requested for selecting soil physical properties to be used for modeling at the site. Suggestions were made on appropriate estimates of the void space, solid volume, and water content for the textures specified. No further assistance has been requested.

Gilson Road Site (89-R01-001)

The Gilson Road site near Nashua, NH, was the location of unpermitted disposal of household refuse, demolition debris and hazardous materials in the 1960s and 1970s. 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 VOCs and SVOCs including tetrahydrofuran, toluene, benzene, chloroform, methylene chloride, phenols, trichloroethylene, and others. Currently, the effectiveness of an active pump-and-treat remediation system at the site is under evaluation.

The first request for RSKERL involvement with the site was received in August 1988. A preliminary meeting and site visit was made in September, 1988, with Regional personnel to discuss the limitations of pump-and-treat remediations. Additionally, RSKERL was requested to participate in a planning meeting with Regional, State, and contract personnel to discuss ground-water modeling efforts. The Region requested additional assistance May 2, 1989, to review the contractor's modeling efforts. Verbal comments were provided to the Region during June 1989, with written comments being provided September 11, 1989. Comments were concerned with deficiencies in a modeling report submitted to the Region by a contractor. Suggestions were also made as to future modeling studies. Additional involvement at the site is anticipated.

Sommersworth Landfill (89-R01-002)

The Sommersworth Landfill, located in Sommersworth, NH, is characterized by the presence of high organic matter in the soil and near surface ground water. Off-site migration of arsenic and organic compounds has been indicated. The primary organic compounds found were DCE, TCE, 1,1-dichloroethane, 1,1-dichloroethylene, xylene, MEK, methylisobutylketone, benzene, toluene, and acetone. The August 22, 1989, request for assistance was concerned with estimating the migration potential of the contaminants in soils having a high organic carbon content. The problems encountered were not only those associated with the organics but with arsenic as well. A leaching 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). The original RSKERL response, offered August 24, 1989, was a review of the procedure as it might be affected by conditions at the site. In addition, a literature search of papers related to the problem were summarized.

The primary problem continues to be the extent of migration of metals from the site. It is expected that future activities will involve the evaluation of additional information, as it becomes available, concerning arsenic migration.

Central Landfill Site (89-R01-003)

The request for assistance was received September 21, 1989, from John Zannos, Region I, regarding a leachability study proposed for the Central/Landfill site near Johnston, RI. The site, containing both municipal and industrial waste, is located over fractured igneous bedrock with the water table being at approximately 14 feet. The site, which is still in operation, is one of the largest landfills in Rhode Island. There are numerous organic compounds of concern with none being particularly more dominant than the others.

The proposed leaching procedures were reviewed by a member of the Technical Support Team and an RSKERL research scientist. The resulting comments were sent to Mr. Zannos on October 4, 1989. The basic recommendation was to complement the column-type test with a batch test as the proposed column test had the potential of not reaching equilibrium. No further assistance has been requested.

Pine Street Canal (90-R01-001)

The site, at Burlington, VT, is a former coal gasification facility. The primary contaminants are benzene, toluene, xylene, and polycyclic aromatic compounds. Both light and dense NAPLs are present. The initial request for assistance, in February 1990, involved a review of a treatability study work plan and QA/QC documents.

The treatability study was discussed in depth during a conference call in April 1990. In addition to members of the RSKERL Technology Support Center, the call included the RPM, Chris Rascher, PEER Consultants, Metcalf and Eddy Engineers, and RREL staff.

The main emphasis of current activities by the Region is to evaluate the recovery potential for the DNAPL (coal tar) via laboratory studies by Metcalf and Eddy, and to perform a reconnaissance investigation of the PAHs, LNAPL, and DNAPL in the soil and ground water.

On October 1, 1990, a review of the "Treatability Study Work Plan (Pine Street Superfund Site, Burlington, VT.)" was sent to Chris Rascher, Region I RPM. The review, made by three members of the RSKERL Technology Support Center, discussed the project objectives, sample collection, test procedures, data analysis, and pumping tests, along with other items under review.

Future activities may include a site visit.

McKin Site (90-R01-002)

The McKin site is a chemical plant located at Gray, ME. Between 1965 and 1978, the McKin Company operated a waste collection, transfer, and disposal facility. In 1985 the site was ranked number 33 on the NPL Group 1 list.

The first request for assistance, from Richard Willey, hydrogeologist, Region I, was dated February 8, 1990. It involved RSKERL estimating the migration rate of metals, based on existing data, and providing input to the design of a sampling program to further define the problem, as well as the design of remediation measures. On March 5, 1990, a response was sent to the Region which included review comments and recommendations for those portions of the Hydrologic Investigation which involved inorganic constituents of water samples from the site. The Hydrological Investigation Plan was prepared by the PRP contractor, Sevee and Maher Engineers.

During the second quarter, documents supplied by the Region were reviewed to determine if additional sampling would be required to address the question of facilitated transport of metals. The Technical Support Team expects further requests from the Region concerning the metals transport question.

SACO Tannery Waste Site (90-R01-003)

The SACO Tannery waste site is located on 233 acres near Saco, ME. The site contains 53 waste pits and two lagoons which were used for the disposal of chromium sludge, acid and caustic wastes, and methylene chloride. The major concerns at this site pertain to the mobility of chromium and facilitated transport of arsenic due to the change of pH resulting from the use of lime at the site.

The first request for assistance, dated February 8, 1990, involved a definition of geochemical conditions which promote the mobility of metals including arsenic, chromium, and lead. The March 19, 1990, response provided a rather detailed explanation of the theory of metals transport as well as insights gained from a field scale research investigation of tannery sludges carried out by RSKERL scientists.

On May 23, 1990, after a review of the Remedial Investigation Report, two members of the Technology Support Center met at the site with representatives of Region I and the Maine Department of Environmental Protection. At that time soil cores were collected and shipped to RSKERL for studies aimed at characterizing the mobility of the chromium as well as the possible facilitated transport of arsenic. Those wells that have shown elevated levels of arsenic were sampled by RSKERL Technology Support Center personnel during the first week of August 1990.

During the period July 31 through August 2, 1990, three members of RSKERL conducted colloid transport studies to characterize site material. The tests were run to address questions essential to the Region in determining the type and extent of

remediation at the site. Colloidal transport of metals in ground water is a major research activity at RSKERL, and scientists were able to evaluate state-of-art ground-water sampling technology while at the same time providing assistance to the Region.

Mottolo Site (90-R01-004)

The request for technical assistance, received February 26, 1990, involved a RSKERL review of a proposed leaching study to be used at the Mottolo Superfund site in Raymond, NH. Contaminants of highest concentration in soil at the site are toluene, ethylbenzene, xylene, and methylene chloride. TCA, TCE, and PCE are present in low concentrations, even in the most contaminated areas.

The response, dated June 1, 1990, included discussions about sample locations and sample handling. A detailed discussion of the proposed leaching procedure was also provided. No additional requests are expected for this site.

Hooper Sands Removal Site (90-R01-005)

The Hooper Sands site is located in South Berwick, ME. During the fall of 1989, approximately 3,000 cubic yards of mixed clays and sands were excavated and temporarily stored on site. The material contained up to 100,000 ppm dichlorobenzene isomers, diesel oil, lube oil, and bunker "C" oil. The request for assistance concerned the applicability of bioremediation to the degradation of the contaminants in the soil still stored at the site.

The review of preliminary field data was provided in a telephone conversation in April 1990, and a formal review of the work plan was completed and comments were provided to the Region in August 1990.

Silresim Site (90-R01-006)

The site, in Lowell, MA, was used as a collection, storage, processing, and disposal facility for mixed wastes. Dense non-aqueous phase liquids (DNAPLs) and associated contaminants mainly consist of chlorinated hydrocarbons, substituted benzenes and aromatic compounds.

In a request dated June 4, 1990, Dick Willey, Region I Hydrogeologist, asked the RSKERL to review a proposed plan for investigating DNAPLs at the site. The proposed plan was directed at determining the volume and distribution of DNAPLs in the field. Also proposed was an investigation of the mobility of DNAPLs using cores taken from the site. Comments on the plan and recommendations for improvement were provided to Leslie McVickar, Remedial Project Manager, Region I, on June 19, 1990.

Sylvester Site at Gilson Road (90-R01-007)

The Gilson Road site, near Nashua, NH, was the location of unpermitted disposal of household refuse, demolition debris, and hazardous materials in the 1960s and 1970s. 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 VOCs and SVOCs including: tetrahydrofuran, toluene, benzene, chloroform, methylene chloride, phenols, trichloroethylene, and others. Currently, the effectiveness of the pump-and-treat remediation system is under evaluation.

The request, dated June 4, 1990, specifically addressed assistance in the adaptation and utilization of an existing simulation model for the site, including the Region's concerns for:

1. Ongoing extraction of contaminated ground water within the containment area to be efficient and expeditious,
2. Recharge of treated ground water to enhance the flushing of contamination from the containment area,
3. Whatever residual contamination that exists outside the containment area does not pose a threat to public health and the environment and,
4. When ground-water treatment goals specified in the ROD for the containment area are attained (and pumping ceases) the transport of any remaining contamination does not pose a threat to the surrounding area.

RSKERL personnel met separately with Dr. Milovan Beljin, University of Cincinnati, and Richard Willey, Region I Hydrogeologist, to outline funding needs, determine the respective responsibilities of those involved, and agree on specific outputs of the modeling effort. It is anticipated that Dr. Beljin and RSKERL personnel will coordinate modeling efforts to adapt and utilize an existing model for the site to address the Regional concerns and improve the efficiency of ongoing pump-and-treat remediation activities.

Again on August 16, 1990, the RSKERL representative met with Regional personnel in Boston to discuss modeling efforts at the site. It is anticipated that results from ground-water flow and contaminant transport modeling will help increase the efficiency of the existing ground-water remediation project.

Wells G&H Site (90-R01-008)

The Region's request for technology support at the Wells G&H Site, dated August 3, 1990, was concerned with an RSKERL review of a proposed soil desorption testing procedure for the site. The site, located in Woburn, MA, is contaminated with volatile organics. A rapid response was requested as the Region was negotiating with those affiliated with the remediation of the site. Essentially the issues of concern are:

1. Are the proposed methods and procedures acceptable?
2. What changes, if any, need to be made in the proposed tests?
3. Are there other tests that are more appropriate than the proposed tests?
4. Are there any suggestions regarding the number of samples that may be needed to obtain reasonable estimates of soil partitioning for the site?

RSKERL's Technology Support Center responded with a detailed written report on August 14, 1990. The reviewers agreed that the proposed tests appear to be acceptable for most conditions, and offered suggestions as how to deal with specific problems. In addition, other batch tests for determining partition coefficients were referenced.

New Hampshire Plating Site (90-R01-009)

The Region I OSC, Janis Tsang, requested technical assistance at the New Hampshire Plating Site August 27, 1990. The site is in Merrimach, NH. Specifically the request to RSKERL was to assess the credibility of the information provided in the "Hydrogeological Investigation Report at the New Hampshire Plating Site" as prepared by the OHM Remediation Services Corporation, the ARCS contractor. The request was also for continuing support in all hydrogeological aspects of the work at the site.

The reply, dated September 12, 1990, stated that the report provided the basic hydrological data necessary to develop a ground-water dewatering program; the calculations to support the design were not provided.

Region II

Sarney Farm (88-R02-002)

The Sarney Farm Site, located near Dover Plains, NY, 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 wastes include organic solvents, ink, acid, glue, and machine oil. The proposed remediation includes the construction and operation of a circulation and aeration biodegradation system.

In September 1987, the Regional RPM requested RSKERL to review and evaluate the proposed remediation facility. Review comments, provided to the RPM in October 1987, found that the proposed concept and design of the system was technically sound for the waste found at the site. No further requests for assistance are expected.

Lang Property (89-R02-001)

A request for technical assistance for the Lang Site, dated December 22, 1988, concerned the appropriateness of utilizing the model "Random Walk" to predict and describe the transport of chlorinated compounds, PAHs, BTX, and pesticides at this illegal drum disposal site located in Burlington County, NJ. Several members of the RSKERL staff reviewed the submitted documents and provided comments and recommendations to the RPM on January 13, 1989. The thrust of the reply was directed at the site's hydrogeology and the advantages and disadvantages of using "Random Walk" to model contaminant transport under the conditions at this site.

Seneca Army Depot Landfill (89-R02-003)

The site, in Romulus, NY, has been proposed for the Federal Facilities NPL. The existence of a narrow plume of VOC contaminated ground water extending to and possibly beyond the Depot's western boundary has been documented. 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. When asked to comment on the plan by Kay Stone, RPM, September 12, 1989, RSKERL questioned the design criteria, especially the effectiveness of the wall's sorption capacity as well as other factors regarding organics and metals at the site.

The RSKERL reply of September 27, 1989, stated that although the design of the treatment and monitoring system appeared to be sound, other chemical analyses should be made to determine the breakthrough time of the carbon filtration wall.

GE Moreau (90-R02-001)

The GE Moreau Site, in Moreau, NY, was used as an industrial waste disposal site from 1958 to 1968. An evaporation pit at the site received 452 tons of waste materials, including; trichloroethylene, trans-1,2-dichloroethylene, vinyl chloride, 1,1,1-trichloroethane, tetrachloroethylene, methylene chloride, and chloroform. A plume of VOCs has been identified that originates at the disposal pit and follows regional ground water flow to the south-southeast. A slurry wall was constructed around the evaporation pit in 1984. Contaminated ground water is currently being treated at the discharge point along the escarpment by air stripping.

Alison A. Hess, Region II, requested technical assistance from RSKERL in a letter dated October 30, 1989. All written correspondence between RSKERL and Regional personnel are Enforcement Confidential. RSKERL and Dynamac personnel have met with EPA Regional, and State personnel to discuss the limitations of pump-and-treat remediation technology. A draft report was submitted to Region II in January 1990.

During April 1990, interim final technical review comments and recommendations were provided to the Regional RPM regarding the feasibility of implementing pump-and-treat technology at the site. In addition to the RSKERL Technology Support Team, Dr. Mark Brusseau of the University of Arizona participated in the review and the development of recommendations. These final recommendations discouraged the use of pump-and-treat technology based on modeling studies incorporating the effects of hydraulic conductivity heterogeneities, sorption capacity heterogeneities, and desorption non-equilibrium.

During September 18-19, 1990, RSKERL conducted a site visit and met with the RPM and PRP contractor to discuss the efficiency of ongoing site remediation activities which consist of natural flushing and treatment.

GEMS Landfill (90-R02-002)

The GEMS Landfill is a municipal site located in Glouster Township, NJ. Acetone, toluene, other organics, and trace metal contaminants have been isolated in the site's soil and ground water.

The Regional request for assistance involved a review of the Draft Preliminary Design Report, Phase II. Review comments were provided to the Region on January 30, 1990. The geology and hydrogeology of the site were summarized along with observations on the strengths and weaknesses of the data presented, the methods used in data interpretation, and some apparent inconsistencies in the conclusions obtained. Considerable effort was dedicated to the proposed modeling plan for the site including the assumptions used in defining boundaries, recharge, and grid design. In addition, several comments were offered for improving the modeling component of the design report.

Kentucky Avenue Well Field Site (90-R02-003)

The Kentucky Avenue Well Field Site, located in the Village of Horseheads, Chemung County, NY, covers about 4,500 acres overlying a valley-filled aquifer. Approximately 20 potential sources of contamination have been identified which may be responsible for contaminating ground water with VOAs (primarily TCE) and metals (primarily chromium).

In a November 6, 1989, request from Pamela Tames, Region II, RSKERL was asked to review three different contractor pumping scenarios for remediating the aquifer. Verbal comments were provided on several occasions and written comments were sent on January 24, 1990.

The response was directed toward rather specific questions contained in the letter of request, including: the model used in the RI/FS; the time of remediation; the reinjection of water; and the probable cause of chromium contamination.

The models proposed for the study were discussed along with the hydrological parameters needed for their proper use. It was suggested that the chromium problem did not appear to be related to screen deterioration and ideas were offered for locating the source of the problem.

Nascolite Site (90-R02-004)

See 90-R02-010

The Nascolite site is located in the cities of Millville and Vineland, Cumberland, NJ. Between 1953 and 1980 the Nascolite Corporation manufactured polymethyl methacrylate (MMA) sheets, commonly known as plexiglass, at the 17.5 acre facility. Waste residues from the distillation of scrap acrylic, a manufacturing by-product, were stored in buried tanks on site. In 1981 and 1983, the New Jersey Department of Environmental Protection (NJDEP) conducted ground-water investigations at the site and found significant concentrations of VOCs with MMA up to 5,000 ppm. In addition, over 100 fifty-five gallon drums were found buried, along with several buried tanks.

A telephone request was received from Region II on November 8, 1989, concerning the Nascolite Site in Millville and Vineland, NJ. It is the location of a spill of methyl methacrylate from underground storage tanks. The request was primarily for information concerning the properties of methyl methacrylate (MMA or liquid plexiglass). The problem was that the contaminant was in the ground water, but seemed to disappear in the summer and reappear during the winter. The advice given to the Region was that the fluctuation of the ground-water table was a possible explanation for this observation. Additional conversations were held with Regional staff on November 9, 1989, concerning chemical properties of the contaminant and possible extraction technologies.

Sharkey Landfill (90-R02-005)

A formal technical assistance request was received from Region II on August 28, 1989, to review the modeling application being proposed for the Sharkey Landfill in Morris County, NJ. The landfill is composed of three 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 had been recommended to develop this scheme, and the Region requested RSKERL to review the applicability of the code under these circumstances. The review was carried out in-house as well as through a technical assistance contract with the International Ground Water Modeling Center (IGWMC) in Indianapolis, IN. The RSKERL reviewer sent comments to the Region September 14, 1989, and the IGWMC followed on September 22, 1989. There has been no further assistance provided at this site but the Region has suggested that additional requests will be made to evaluate the use of the Princeton model as well as the USGS Solute Transport Model.

FAA Technical Center (90-R02-006)

The Regional request, dated January 3, 1990, was for a review of a treatability study for Area 29 at the Fire Training Center in Atlantic County, NJ. The plan was to enhance the biodegradability of PAHs with the addition of hydrogen peroxide. On January 22, 1990, comments were offered as to the scientific approach of determining degradation rates including the use of microcosms, sample collection, microbial characterization, and the chemical characterization of soil and ground water.

Fate and Transport of Inorganic Contaminants in New Jersey Soils (90-R02-007)

The request for assistance was made by the New Jersey Department of Environmental Protection in a letter dated December 19, 1990. It requested RSKERL to review two proposals which had been submitted to that State Agency to develop mathematical models for predicting the movement of selected metals through soils. Also RSKERL determined transport constants from equilibrium data using New Jersey soils. The evaluation of this data was completed and sent to the State on January 23, 1990. It is expected that further evaluations will be required as additional information is made available.

St. Croix, Virgin Islands (90-R02-008)

During Hurricane Hugo, in September 1989, an oil storage tank release resulted in the contamination of approximately 12,000 cubic yards of beach sand on St. Croix with Bunker C (No. 6) fuel oil components. The Chief of the Response and Prevention

Branch in Region II requested assistance from the RSKERL Technology Support Center in selecting and designing a remediation process for the contaminated sand. Two members of the RSKERL Technical Support Team accompanied the Region II On-Scene Coordinator to St. Croix in early January 1990, to examine the site, discuss potential treatment options, visit prospective land treatment locations, talk to local authorities, define the actual extent of the problem, and collect samples for analyses. Following a literature evaluation and examination of the data collected at the site, a detailed screening evaluation of the proposed treatment options was prepared and submitted to the Region on January 26, 1990. If bioremediation is the treatment alternative selected, RSKERL will be asked to help design the land treatment facility.

Niagara Mohawk (90-R02-009)

The Niagara Mohawk site, located in Saratoga Springs, NY, was a manufactured gas plant (MGP) constructed by the Saratoga Gas Light Company in 1873 and operated until 1929. After closure as an MGP, the site became and still operates as a service and maintenance facility for electric and gas utilities. Major contaminants at the site are PAH compounds, phenolics and cyanide.

Brooks Mullen, Region II RPM, in a request dated February 20, 1990, asked the RSKERL Technology Support Center to review the Draft RI/FS Work Plan on February 20, 1990. Review comments were provided in early March 1990, followed by a conference call discussing these comments. In general, reviewers expressed concern as to whether or not the field work proposed would provide a sufficient data base for decision making. A detailed soil boring program was recommended.

A revised RI/FS Work Plan was received for review on March 14, 1990. Review comments were provided March 30, 1990, with a follow-up teleconference. Concerns about the extent of the field work were alleviated. Possible safety problems were expressed; however, since a sniff test was proposed for cyanide contaminated soils, it was suggested that contaminants other than from MGD sites could be present. Upon completion of the RI/FS, the RSKERL will be requested to review and comment on the final document.

Nascolite Corporation (90-R02-010)

See 90-R02-004

The Nascolite site is located in the cities of Millville and Vineland, Cumberland, NJ. Between 1953 and 1980 the Nascolite Corporation manufactured polymethyl methacrylate (MMA) sheets, commonly known as plexiglass, at the 17.5 acre facility. Waste residues from the distillation of scrap acrylic, a manufacturing by-product, were stored in buried tanks on site. In 1981 and 1983, the New Jersey Department of Environmental Protection (NJDEP) conducted ground-water investigations at the site and found significant concentrations of VOCs with MMA up to 5,000 ppm. In addition, over 100 fifty-five gallon drums were found buried, along with several buried tanks.

The Kansas City District Army Corps of Engineers is designing a pump-and-treat remediation system. The request for assistance is for a technical review of the remediation design at 35, 65, and 95 percent completion.

On June 8, 1990, following a review of the document at 35 percent completion, two members of the RSKERL TSC met in Gainesville, FL, with representatives of the Region, Corps of Engineers, and Environmental Science and Engineering Inc., the firm preparing the design analysis. Various aspects of the proposed pump-and-treat system were discussed, along with the direction that will be taken in completing the remediation plan.

South Jersey Clothing and Garden State Cleaners Site (90-R02-011)

The site includes long-term contaminant disposal of two different hazardous wastes from adjacent businesses in the Buena Borough, Atlantic County, NJ. The South Jersey Clothing Company (SJCC), a clothing manufacturer, has apparently discharged TCE wastewater and sludge near their building since the early 1940s. Across the street, the Garden State Cleaners (GSC) has dumped PCE waste cleaning fluid since 1966. Both of these contaminants have been discovered in local domestic wells.

On May 21, 1990, the Regional Project Manager, Sharon Atkinson, requested the RSKERL to review the site contractor's proposal for Phase II, a possible additional phase of investigation. On June 15, 1990, a written review and extensive comments were provided to the Region monitoring well installation and the performance of an existing pump-and-treat system.

Region III

Greenwood Chemical Site (88-R03-001)

See 90-R03-003 and 90-R03-004

The Greenwood Chemical 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, resulting from a drum disposal area consisting of five lagoons, has occurred in the shallow aquifer as well as the fractured bedrock aquifer. The major contaminants were naphthalene and acetic acid.

On March 2, 1988, Region III requested that RSKERL provide assistance in reviewing plans for aquifer tests, time-series sampling, and cation-anion distribution to characterize upper and lower aquifer interconnection. After reviewing the technical documents supplied by the Region, additional assistance was provided via teleconferences with Regional staff and their consultants.

In a later request, dated July 26, 1988, RSKERL was contacted regarding restoration levels at the site and procedures for determining partition coefficients. Procedures developed at RSKERL for making these determinations were provided to the Region.

Drake Chemical Site (88-R03-002)

A technical assistance request for the Drake Chemical Company Site in Lock Haven, PA, was received in early 1987 from the Region III Ground Water Forum Member. The request was for assistance in the development of appropriate laboratory analytical procedures and the determination of site-specific partition coefficients. RSKERL was also requested to develop a revised version of its RITZ model for application at the site. Laboratory and model development activities were performed during the summer of 1987. The ConPro model was developed from this work and 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 provided to the Region December 3, 1987.

Douglassville Disposal Site (88-R03-003)

The Douglassville Disposal Site in Berks County, PA, 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 and recommendations 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 a review of the draft remedial, technical, and treatability study evaluation report. Review comments were provided in July 1988. The reviewers found the documents to be well written but much less comprehensive than the original document.

Ashland Floreffe Terminal (88-R03-004)

The Ashland Floreffe Terminal is a site near Pittsburgh, PA, where a ruptured diesel tank at a tank farm resulted in large scale contamination of surface water, soil, and possibly ground water. The Region III Project Manager requested RSKERL scientists to review the proposed remedial action plan for the contaminated soils. The RSKERL informed the RPM of the remediation plan's major problems on April 19, 1988, during a meeting in Bethesda, MD. Later these comments were provided to the Pennsylvania Department of Environmental Resources (PADER) by the RPM during a telephone conversation.

In subsequent meetings, a bioremediation plan was formulated for the contaminated soils. In July 1988, RSKERL was requested to review the work plan to assure that the discrepancies had been corrected. Review comments were made available to the Region in September 1988. The reviewers stated that the discrepancies had been eliminated and that the plan was scientifically sound if implemented in the manner stated. A site visit by three RSKERL scientists was made in November 1989, to observe the area of contamination and the land treatment operation.

In January 1990, the RSKERL Technology Support Center was requested to review the field data collected in 1989. Review comments were provided to PADER in late January 1990. Reviewers felt that conclusions drawn were not supported by the highly variable data presented. Also concern was expressed with the site operational practices, especially tilling frequencies and soil packing.

A request to review the final data collected in 1990 is expected.

L.A. Clark Wood Treating Site (88-R03-005)

This 40 acre site near Fredericksburg, VA, is contaminated with polynuclear aromatic compounds from wood treatment using creosote over a 50-year period. Over the years soil and sediment contamination resulted from facility operation spills and waste streams entering drainage ditches. Also, wastewater was sprayed around the storage yard to control dust. 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 was made in November 1989. Three members of the RSKERL Technology Support Center met with the RPM plus 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.

A meeting was held in June 1990, with the RPM to discuss progress at the site. A request for assistance will be submitted by the RPM for a review of the revised remediation plan including the location and removal of DNAPLs and bioremediation.

Henderson Road (88-R03-006)

See 90-R03-001

The Henderson Road Site, located in upper Merion Township, PA, consists of 7.6 acres located approximately 2,000 feet south and upgradient of the Upper Merion Reservoir, a public water supply in which volatile organic compounds have been detected since 1979. VOCs 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.

Hereford Township Site (88-R03-007)

Ground water at the Hereford Township Site in Berks County, PA, has been contaminated by the surface disposal of TCE which took place at one or more sites on the Crossley farm, a rural area near the town of Huffs Church. TCE contaminated private wells in an area about two miles long and 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 is very erratic and does not appear to follow an easily discernable pattern.

RSKERL was asked by the Environmental Response Branch (ERB) for assistance in understanding the hydrology of the site. RSKERL obtained and analyzed water samples from monitoring and domestic wells during May 1988. Samples were analyzed for major naturally occurring anions and cations to see if geochemical analysis could be used to understand the complex hydrogeology, and to make sense

of the erratic distribution of TCE in the ground water. Such an understanding was needed before any attempt at remediation could be undertaken. The report was submitted to the Region in January 1989. The study facilitated an understanding of the hydrogeology and confirmed that the system is very complex.

GPIA Midfield Terminal (89-R03-002)

During preliminary construction activities at the newly proposed Greater Pittsburgh International Terminal in Allegheny County, PA, an old dump site was discovered that was contaminated with a variety of petroleum hydrocarbons, including PAHs. On-site remediation involving treatment in a prepared bed was proposed for the contaminated soil.

In May 1989, the Pennsylvania Department of Environmental Resources requested that the RSKERL Technology Support Center 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 firm that designed the system 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. After the remediation system was activated, three RSKERL scientists visited the site at the request of the State Project Manager.

Lord-Shope Landfill (89-R03-003)

The Lord-Shope Site, located near Erie, PA, consists of a four acre capped landfill and surrounding contaminated soil. Prior to capping, a variety of waste solvents were disposed in the landfill in bulk (liquid) and containerized (drums) form.

At the request of Region III, the RSKERL Technology Support Center reviewed the results of a soil vacuum extraction (SVE) field test at the site. At a meeting held in Philadelphia on October 18, 1989, RSKERL advised Regional and State representatives that vacuum extraction may not be capable of remediating semi-contained waste solids in deteriorated drums. SVE could be used to reduce subsurface vapor concentrations to acceptable levels within the presently capped landfill. Contaminated areas outside the landfill could be effectively remediated using SVE.

Future activities may include the proposal of methods for soil restoration standards and a review of the proposed pilot scale plan and results.

Tysons Site (89-R03-004)

The Tysons Superfund Site is a 4-acre abandoned septic and chemical waste disposal facility located in southeastern Pennsylvania. During its operation from 1962 to 1970, several unlined lagoons were used to dispose of various industrial, municipal, and chemical wastes. Soils are highly contaminated with 1,2,3,-trichloropropane,

toluene, and xylene with lesser amounts of trichloroethylene, ethylbenzene, dichlorobenzene, and tetrachloroethene. Soil vacuum extraction (SVE) is currently being applied to remediate soils at the site. Region III requested technical assistance at the Tysons Site to evaluate the operation of the SVE system and potential causes of well clogging by a black tar-like viscous material.

On October 23, 1989, RSKERL sent a detailed review of the on-site and off-site RI/FS reports. In addition, suggestions for addressing operational problems with the remediation project were provided, and arrangements were made for RSKERL to conduct analyses of tar-like material found at the site. Further activities involved a review of well clogging data from the extraction wells and an evaluation of the performance of the SVE system.

In February 1990, RSKERL provided Region III comments on a list of questions from the U.S. Department of Justice regarding SVE operations. Generally, RSKERL believed that: the extraction well clogging could not have been anticipated prior to the SVE operation; the remediation goal will probably not be met within the stipulated time period; and the SVE operation may require some refinement.

On September 13, 1990, a TSC member and Dr. Dan Evans from the University of Arizona met in Philadelphia with Regional personnel and the PRPs and their contractor. The Region requested RSKERL to provide recommendations for assessing the performance of the active soil vacuum extraction system. RSKERL is continuing to provide assistance.

Henderson Road - Injection Well (90-R03-001)

See 88-R03-006

The Henderson Road Superfund Site is located in southeastern Pennsylvania. Liquid and semisolid wastes were introduced into the subsurface via an injection well which had been previously used as an industrial water supply well. The waste products disposed of in the injection well are unknown; however, high concentrations of toluene, 1,1-dichloroethane, benzene, 1,1,1-trichloroethane, and perchloroethylene have been detected in ground water with lesser concentrations of trichloroethylene, 1,2-dichloroethane, chloroform, 1,2-dichloroethene, and vinyl chloride.

The site stratigraphy consists primarily of 40 to 60 feet of silty clay soil underlain by unsaturated and saturated limestone containing large solution cavities and fractures. The depth to water is variable throughout the site, but is frequently encountered at 120 feet below grade. It is believed that most of the waste was injected directly into cavities in the saturated zone. There is, however, a possibility that some waste migrated through fractures and cavities in the unsaturated zone due to mounding during disposal.

A Record of Decision was signed in June 1988, for remediation of the Injection Well Operable Unit. The ROD stipulated further characterization of the unsaturated zone to determine the applicability of vacuum extraction or another technology. As part of this work, the PRPs retained a consulting firm to collect additional soil samples and conducted subsurface air flow testing. Region III requested that RSKERL review this work and provide ongoing comprehensive oversight of the PRPs' efforts in evaluating the applicability of soil vacuum extraction.

In April 1990, RSKERL met with Region III to evaluate work completed to date by the responsible parties. The feasibility of air sparging of ground water in solution cavities, the potential presence of contaminants in the unsaturated zone, and the need for additional unsaturated zone characterization was discussed.

In May 1990, RSKERL provided the Region with comments on the PRPs' unsaturated zone characterization report. Primarily, the investigation conducted by the PRPs was an attempt to understand migration pathways from the injection well into solution cavities and fractures in the unsaturated portion of the bedrock. The PRPs' consultant believes that there is little or no contaminant mass in the unsaturated zone because: (1) staining from immiscible fluids was not visibly noticeable on drilling cores and rock cuttings; (2) immiscible fluids were not observed while conducting borehole TV scans above the water table; and (3) the highest concentrations of volatile organic vapors were detected only when drilling at depths below the water table.

Based on these findings, the consultant concluded that vapors detected in solution cavities are from offgassing (i.e., volatilization) from the water table, not from contaminant mass in the unsaturated zone itself. RSKERL stated that while the consultant's observations do provide some evidence to support their assertion, the possibility that a significant source of volatile contaminants in the unsaturated zone still exists. The probability of detecting remnant waste or immiscible fluids in unsaturated solution cavities or fractures is very small given the number of boreholes and the cross sectional area of solution cavities and fractures in the disposal area. RSKERL stated that an increase in vapor concentrations while drilling through contaminated ground water may represent an increase over baseline values for vapor concentrations generated by saturated and unsaturated sources. An increase in vapor concentrations while drilling through the saturated zone could be interpreted to mean that there is no unsaturated contaminant source.

In attempting to discern potential previous pathways of contaminant migration, the consultant conducted air flow testing of open boreholes (i.e., not cased in the unsaturated limestone). Testing consisted of applying a vacuum to individual boreholes and observing air flow in other boreholes. In RSKERL's opinion, the testing was inconclusive and hampered with quality control problems. Also, RSKERL was concerned with the goal of air flow testing. The consultant believes that the fact that connections exist between boreholes is more important than the nature of the connections. RSKERL stated that pneumatic connections between

boreholes are meaningless unless it can be shown that connectiveness is in fractures or cavities which could have received gravity driven flow or lie below cavities found in the unsaturated portion of the injection well.

Region III has requested that RSKERL provide specific recommendations on methods to better characterize the unsaturated zone and evaluate the applicability of vapor extraction. RSKERL has drafted a series of recommendations and is awaiting review by the Region, EPA-HDQS, USGS, and the Dynamac Corporation.

On September 12, 1990, an RSKERL representative along with Dr. Dan Evans of the University of Arizona attended a meeting in Philadelphia to discuss activities at the site. Also attending the meeting were Regional personnel and the PRPs and their contractor. The Region has requested RSKERL to prepare a workplan for submittal to the responsible parties which entails further site characterization to determine the source of vapors so that remediation using SVE can proceed.

William Dick Lagoons Site (90-R03-002)

This NPL site is in Chester County, PA. The request for assistance centers on the evaluation of a soil vacuum extraction system at the site. Specifically, the request was to: (1) determine the applicability of SVE technology, (2) provide recommendations for obtaining additional data not included in the Draft RI, and (3) provide recommendations for performing treatability tests if vacuum extraction appears to be a strong candidate for remediation. A meeting was held at the site with the RPM on February 9, 1990, to discuss ongoing activities.

At the January 24, 1990, request of the Region, RSKERL again provided assistance concerning the applicability of SVE at the site. In a response dated August 30, 1990, the review suggested that a well designed SVE system would remediate most, but not all contaminated soils at the site through venting as well as biodegradation.

Greenwood Chemical Site - Pattern Diagrams (90-R03-003)

See 88-R03-001 and 90-R03-004

The 18-acre Greenwood Chemical site, located in Albemarle County, VA. was the waste disposal facility for the Greenwood Chemical Company for 40 years. The use of unlined lagoons, surface storage of drums, and direct waste burial resulted in the contamination of soil and ground water by a wide variety of organic and inorganic chemicals.

Since 1988, numerous requests for technical assistance have been received concerning this site. This particular request, dated February 6, 1990, involved an RSKERL computer program to create pattern diagrams using major cations/anions and pH data from wells at the Greenwood Chemical site. The program is used to determine if interconnections between the aquifers exist and if chemicals from the site have

resulted in ground-water contamination. The diagrams have been completed and provided to the Region. Additional requests are expected for assistance in interpretation.

Greenwood Chemical Site - Modeling (90-R03-004)

See 88-R03-001 and 90-R03-003

The 18-acre Greenwood Chemical site, located in Albemarle County, VA, was the waste disposal facility for the Greenwood Chemical Company for 40 years. The use of unlined lagoons, surface storage of drums, and direct waste burial resulted in the contamination of soil and ground water by a wide variety of inorganic and organic chemicals including naphthalene and acetic acid.

Numerous requests for technical assistance have been received on this site. This request involves the evaluation of a model proposed for use at the site. The State received a proposal to develop a numerical solute transport model to be used to perform simulations for various remediation scenarios at the site. This request for assistance concerned a review of this proposal and a subsequent meeting with Regional Staff to discuss the model followed by a meeting with the model developer. The document has been received and is being reviewed.

On June 14, 1990, two members of the RSKERL Technology Support Center met in Washington, D.C., with Regional and State personnel. It was the opinion of the reviewers that the use of an equivalent porous media approach was not appropriate for this site.

Trans Tech Site (90-R03-005)

The Trans-Tech site is located in Adamstown, MD. The responsible party, Trans-Tech Inc., is a manufacturer of ceramic components for the microwave industry. In 1985, analyses of ground-water samples from nearby residential wells revealed the presence of 1,1,1-trichloroethane (TCA) and trichloroethylene (TCE). Analyses from monitoring wells indicated that a ground-water contaminant plume was emanating from a source located near the northeast corner of the Trans-Tech property.

Trans-Tech Inc. conducted a soil boring and soil venting field study in July, 1989. The purpose of this study was to determine whether 1,1,1-trichloroethane and 1,1-dichloroethane in soil gas were due to ground water contamination and to evaluate the feasibility of soil vacuum extraction (SVE) application. Trans-Tech's consultant, O'Brien & Gere, concluded that VOCs observed in soil-gas surveys were a result of volatilization from the water table and that soils found at the site lack sufficient permeability to apply soil venting. Soils at the site were described as silt with a trace of fine sand and clay.

At the request of the Maryland Department of the Environment, the RSKERL Technology Support Center reviewed these findings and concluded that the study was deficient, especially in regard to flow and pressure measurements. The report did not adequately demonstrate the feasibility of inducing air flow in soils nor the assertion that VOCs in soil result from volatilization from the water table. RSKERL recommended further soil-gas work and soils analyses and another venting field test using appropriate equipment and measurement techniques.

Eastern Diversified Metals (90-R03-006)

The Eastern Diversified Metals (EDM) Site is a former metals reclamation facility located in Rush Township, Schuylkill County, PA. EDM reclaimed copper and aluminum from wire and cable by chopping the wire and stripping the plastic coverings with steel blades. No solvents or chemicals were used in the process. The waste plastic and insulation materials were dumped in a swale area behind the plant creating a "fluff" pile, which is the cause of soil and ground-water contamination at this site.

On February 5, 1990, a request was made that the RSKERL Technology Support Center review the Feasibility Study Report, along with other documents, and make comments and recommendations. Due to time limitations, the response, dated April 16, 1990, was prepared by Geodysey Inc.

Revere Chemical Site (90-R03-007)

The 70 acre chemical company site is located near Doylestown and New Hope in Bucks County, PA, and contains about 20 acres of highly contaminated lagoons and a sludge disposal area. Contaminants of primary interest at the site are metals associated with the reclamation of circuit boards such as antimony, arsenic, beryllium, chromium, copper, lead, and vanadium. Other contaminants of concern are volatile organic compounds, base/neutral extractable compounds, and PCBs.

In a request dated September 11, 1990, the RPM, Donna McCartney, asked RSKERL for an evaluation of a serial batch extraction test (Houle and Long) for potential use in characterizing the fate and transport of metals as a part of the RI/FS at the Revere Site. To date, several discussions have taken place through telephone conversations between RSKERL Technology Support Center, the Region, the PRPs and their contractor, Dames and Moore.

Region IV

Geiger Site (87-R04-001)

The five-acre site near Charleston, SC, centers around earthen lagoons where waste oil was stored prior to incineration. The sandy bottoms of the unlined lagoons, constructed between 1969 and 1971, are near or at the water table. Ground water from the site appears to discharge to 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.

Tower Chemical Site (88-R04-001)

The Tower Chemical Site near Orlando, FL, manufactured and distributed various pesticides and fungicides. The major products were a miticide (chlorobenzilate) and a copper-based fungicide. Past disposal practices 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.

On December 30, 1987, Region IV requested technical assistance in designing, instrumenting, and conducting aquifer tests at the site. During March 19-21, 1988, 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 April 20, 1988.

Perdido GW Contamination Site (88-R04-002)

See 88-R04-003

On February 29, 1988, the RSKERL Technology Support Center received a request from Region IV for technical assistance to review a no-action remediation proposal for this site in Perdido, AL. The no-action remediation was based on the assumption that the natural microbial activity could take care of the problem.

The site was the scene of a train derailment and the spillage of benzene in the late 1960s. The overall response of the Technical Support Team was that a no-action remediation would not be appropriate. A memorandum containing the RSKERL comments was sent February 17, 1988, and was followed by several phone conversations. No other request was received on this topic; however, another request was later received to review a pump-and-treat proposal for this site.

Perdido GW Contamination, Pump-and-Treat (88-R04-003)

See 88-R04-002

A second Regional request for technical assistance was received for this site in Perdido, AL, in March 1988. The request involved a review of a pump-and-treat proposal and the potential for bioremediation. A formal response was made by RSKERL March 17, 1989. There were several other requests which were handled by phone conversations. The final written request was made by the Region IV Engineering Forum Member on July 5, 1989, which concerned a review of the RI/FS before site activities moved to the ROD stage. The July 25, 1989, RSKERL response suggested an agreement with the "no-action" alternative, however, it was emphasized that good plume characterization was needed to assure remediation was occurring.

Whitehouse Oil Pits (89-R04-001)

On November 10, 1988, Paul Barber, Kansas City District of the Corps of Engineers, requested RSKERL to comment on the use of the Hume Process for treating contaminated soil at the Whitehouse Oil Pits Site in Jacksonville, FL. Basically, the Hume Process uses a microbial elixir or proteins and special organics to accelerate the activity of natural bacteria. The problem at the Whitehouse Oil Pits Site is the leaching of metals and organics from sludges. The original Corps of Engineers plan was to solidify the sludge with cement, but organics in the sludge made this process difficult and not very successful from an environmental standpoint. The RSKERL response of November 11, 1988, notes that the sludge contains solids that would be difficult to separate, such as bed springs, car bodies, and tree stumps. The work plan for testing the Hume Process was too brief to allow comment.

Chemtronics (89-R04-002)

On December 13, 1988, the Region requested information on the remediation capabilities and limitations of pump-and-treat technologies. The State maintains that remediation levels for this site in Swannanoa, NC, should be to background (zero VOC) concentrations.

On January 8, 1989, RSKERL sent the Region a package of information containing 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 this technology's effectiveness.

Koppers/Beazer Wood Treating Facility (90-R04-001)

This active wood treating site is located about 1.5 miles east of Florence, SC. The plant site encompasses 200 acres where various wood treatment processes have been under way since 1946 using creosote, pentachlorophenol, copper-chromated arsenicals, and fire retardants. Contaminants are present in the site's soil and ground water.

The request for assistance, received November 15, 1989, centered on an assessment of the data being collected at the site in terms of its significance in selecting appropriate remediation technology for contaminated soil and ground water. In addition to a visit by the RPM to RSKERL in December, 1989, there have been a number of phone conversations dealing with remedial investigation sampling. A detailed review of the site investigation plan was submitted by RSKERL on December 14, 1989, covering geology and hydrogeology in addition to monitoring well construction, sampling methods, and appropriate sampling parameters.

A site visit by RSKERL Technology Support Center Staff was conducted March 27-28, 1990, to discuss the potential applicability of bioremediation at the site and the need for and location of additional monitoring wells required for hydrogeology investigations. The meeting included representatives from the State of South Carolina, PRP and PRP contractor, and Region IV.

A meeting was held in June 1990, in Starkville, MS, with the PRP contractor and Dr. Gary McGinnis of Mississippi State University. The potential for initiating a soil and ground water bioremediation demonstration at the site was discussed.

At the request of the Regional RCRA Project Manager, RSKERL attended a meeting in Atlanta on August 14, 1990, to discuss project activities and status at the site. Others at the meeting included Regional RCRA and Superfund project managers, State RCRA and Risk Assessment personnel, and the PRP and PRP contract personnel. A number of site specific technical issues were addressed, and the Region requested that RSKERL continue to provide assistance during subsequent remediation activities including oversight of all bioremediation studies.

Following the August 14, 1990, meeting, RSKERL reviewed the Draft Interim RFI Report. Comments provided to the Region on August 24, 1990, found the document to be markedly improved over an earlier version, especially with respect to hydrology. Other areas of concern were discussed in depth.

Hardeman County Landfill (90-R04-004)

The Hardeman Site was an active landfill from 1964 to 1973 used for the disposal of plant waste generated at the Memphis, TN, Velsicol Chemical Corporation Plant Site. Due to the extent of ground-water contamination with pesticides, the use of the local aquifer for a domestic water supply was halted in 1979. A cap was placed on the site in 1980.

The basic request for assistance, dated June 6, 1990, involved a review of the RI, possible additional characterization at the site, and the potential of developing an FS. During June 5-7, 1990, RSKERL visited the site to assist in the evaluation of the characterization data. Also present were representatives from EPA's RREL-Cincinnati

TSC, two RSKERL consultants and the PRP consultant. The written response provided review comments as to existing RI information in terms of its completeness and made recommendations as to other work needed to better characterize the hydrology of the area.

During August 1990, in response to a request from the Regional RPM, RSKERL provided a detailed review of a Feasibility Study for the site. The primary concerns expressed in the review were that the areas being modeled may not represent the most serious zones of contamination and that septic systems and leach fields may still pose a threat that has not been evaluated.

Chemform (90-R04-005)

The Chemform Site is located in Pompano Beach, FL. The site is currently the focus of a Remedial Investigation (RI) as well as an ongoing Removal Action (RA) with both phases being conducted by the identified PRPs. A part of the RA Plan involves sampling and leach testing of soils to establish site specific partition coefficients for the contaminants of concern. Primary contaminants are chromium and nickel; although data will also be required for cadmium, cobalt, cyanide, lead, and mercury. This information will be used in conjunction with other data developed through the RI to calculate a cleanup level for these constituents.

In a letter dated July 13, 1990, the Region requested RSKERL to review the proposed sampling and analytical procedures to ensure that the methods used to derive site specific K_d values would accurately predict transport and fate characteristics at the site. In a written response dated August 10, 1990, RSKERL stated that those carrying out the work are pursuing the stated objectives in a valid and scientific manner. Some detailed suggestions were offered in hopes that they could improve and enhance the plan.

Fort Hartford Coal Company Stone Quarry (90-R04-007)

This site, near Olaton, KY, is a massive underground limestone formation that has been used by the Barmet Aluminum Corporation for the storage of secondary aluminum dross (salt cake fines), a by-product of aluminum recycling. Approximately 120 acres of underground storage space exists; an estimated 1.2 million tons of fines were in place in November 1989, with 500 tons being brought to the site daily. The fines contain heavy metals including barium, chromium, copper, lead, and manganese.

The investigation at this site is complicated by the karst hydrogeologic setting. Also there is concern about the potential for a tremendous amount of water to continue moving through the formation, thereby making it impossible for the waste to remain dry.

The Regional RPM requested RSKERL to provide technical assistance in the form of a review of the proposed RI/FS Work Plan. The request was dated August 8, 1990. The response, dated September 10, 1990, was sent to Kimberly Gates, the Regional RPM. It discussed several issues including the location of monitoring wells, sample parameters, geophysical logs, and the use of a dye study in the placement of monitoring wells.

Yellow Water Road Site (90-R04-008)

The site is located off Yellow Water Road, one mile south of Baldwin in Duval County, FL. It encompasses approximately 14 acres of predominantly vegetated land with limited topographical relief. Commercial development of the site began in November 1981 with the formation of the American Environmental Energy Corporation (AEEC). AEEC was formed on the premise that transformer fluids contaminated with PCBs could be removed from transformers which then could be salvaged. Plans were to dispose of the PCB-contaminated fluids by on-site incineration; however, a permit for on-site incineration was never obtained.

In November 1984, EPA initiated an emergency response action at the site based on background information and inspections that led to a concern regarding an imminent hazard to human health and the environment. The quantity of PCB-contaminated fluids stored at the site was estimated to be 150,000 gallons.

Contaminants confirmed at the site are consistent with its operational history. These include PCBs and chlorinated benzene isomers. Various halogenated and non-halogenated solvents were identified in low concentrations but were found to be representative of ambient background conditions. The areal surficial distribution of contaminants is primarily limited to the operational areas of the site. The State plans are to contain PCB migration with conventional pump-and-treat methods until an effective alternative for remediation is determined. Two methods under consideration are flooding to desorb PCBs and bioremediation.

In a request dated August 10, 1990, the Florida State Department of Regulation asked that RSKERL review the "Draft Feasibility Study Report" and "Draft Remedial Investigation Report" and provide comments concerning proposed remediation technologies at this site. The response is being prepared.

Carrier Air Conditioning (90-R04-009)

The site consists of approximately 145 acres located in Collierville, Shelby County, TN. The Carrier Corporation has operated an industrial facility for producing residential air conditioners and heat pumps since 1967.

The Tennessee Department of Health and Environment (TDHE) issued a Site Inspection Order (SIR) on September 15, 1986, which showed trichloroethylene

(TCE) in ground-water monitoring wells and in the City water wells located at the edge of the Carrier property. Three possible sources of the TCE contamination have been identified: a waste lagoon used by Carrier, a TCE spill from a solvent degreaser in 1979, and a TCE leak in 1985 from pipes connecting a TCE storage tank to TCE degreasers.

Carrier entered into an Administrative Consent Order with EPA on September 29, 1989, to conduct an RI/FS. On December 15, 1989, the Work Plan was approved.

RSKERL was requested by the Regional RPM September 21, 1990, to review the Remedial Investigation and the Feasibility Study reports. Specifically, the request was to determine if additional information for the RI will need to be collected to delineate the ground-water contamination plume. A review of the FS is to determine if the proposed remedial alternatives are appropriate for addressing the problems which exist at the site.

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 1960s and 1970s. 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.

On January 28, 1990, the Regional RPM requested RSKERL technical assistance and subsequently visited the Laboratory to solicit the advice of the Technical Support Team and researchers, particularly with respect to the complex fractured dolomite contamination. Previous work on the hydrogeology was reviewed and approaches were suggested for additional site characterization work. Additional drilling and coring at the site was carried out through a contract with funds supplied by RSKERL and the Region.

Dover Chemical (88-R05-002)

The site is located in Dover, OH, and both the soils and ground water are contaminated as a result of leaching of chlorinated compounds from this industrial facility. RSKERL was requested to review a draft plan for leaching contaminants from laboratory soil columns to develop information for use in a transport and fate ground-water model. Technical review comments and recommendations from a multidisciplinary RSKERL review staff were provided on November 18, 1988, and again on March 31, 1989.

The main focus of the review comments and recommendations concerned testing procedures, soil sample collection, and data interpretation. Field evidence indicates the presence of dioxins at the site; therefore, the future course of action necessarily will change from the current plan. The Regional staff will inform RSKERL when the new information is incorporated into the leaching plan. Additional technical reviews are expected.

Allied Chemical/Ironton Coke (89-R05-001)

See 90-R05-011

Personnel from the IT Corporation Bio Technology Laboratory met with Technology Support Center personnel on September 18, 1989, at RSKERL to solicit recommendations on a bioremediation pilot study for the Allied Signal Inc., Ironton, OH, site. Volatile organics, PAHs, and cyanide are present in lagoon sediments and ground water at this former coke processing plant. The pilot systems are intended to demonstrate bioremediation of the vadose zone by the addition of oxygen and nutrients through a sprinkle system and the in situ remediation of ground water utilizing an injection/recovery process.

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

Three members of the Technical Support Team met with the State, Region, and Allied Chemical staff on October 30, 1989, at the Ironton site to further discuss details of the bioremediation pilot studies for the saturated and unsaturated zones, and visit field plot studies at the contaminated site. Final technical recommendations were transmitted by letter on November 7, 1989, to the RPM. RSKERL is continually updated on the bioremediation efforts by progress reports.

Gemeinhardt Site (89-R05-002)

See 90-R05-014

The Gemeinhardt site in Elkhart, IN, 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 the Regional Ground-Water Forum Member in October 1989, to review the modeling activities being proposed for the site.

The review was assigned to the technical assistance contract with the International Ground Water Modeling Center (IGWMC) in Indianapolis. The proposed model was a 1986 version of the Princeton Transport Code (PTC) which has primarily been recognized as a research code. Phone conversations were held in November and December, 1988, and one meeting was held in Chicago on November 22, 1988. These discussions were held between IGWMC and Regional staff.

Final written comments were made January 17, 1989. Discussed were problem definitions, conceptualization of the hydrogeological system, model selection, data and parameters used and model calibration.

Cliffs-Dow (89-R05-003)

See 90-R05-004

The site is a coal tar waste pit in Marquette, MI, where PAHs have leached into the ground water. Planned remedial action consists of an above-ground biological treatment system referred to as "forced aeration pile treatment" (FAPT). At the request of the Region, a comprehensive technical review was made of technical material describing both the ground-water system and the FAPT. Comments and recommendations were submitted to the RPM on May 23, 1989, with respect to the ground water, and August 29, 1989, concerning the FAPT. The review staff participated in several telephone conferences following the written review comments. The main focus of the review was in reference to the interpretation of ground-water data and laboratory treatability data. An analysis of two proposed biological remediation strategies was made, followed by recommendations concerning additional treatability studies, biological process optimization, and field study procedures.

Allied Signal Ground Water Remediation (89-R05-004)

This project was initiated to determine the applicability of the methanotrophic biodegradation process to remediate ground water contaminated with vinyl chloride at the Allied-Bendix site in St. Joseph, MI. The methanotrophic process is a bioremediation technique which uses bacteria in the presence of methane to degrade chlorinated hydrocarbons. Pilot and laboratory studies have been performed by Stanford University which demonstrated that this process is a feasible means to degrade chlorinated solvents (vinyl chloride, PCE, TCE, DCE). 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 will finance the major effort. A treatability progress report dated May 31, 1990, has been completed by Stanford. Conclusions from this study indicate that vinyl chloride, t-DCE, and TCE were biodegraded (VC>t-DCE>TCE); sorption of these compounds is weak; and in-situ bioremediation of these compounds is feasible. This site has been selected as a candidate for the Bioremediation Field Initiative Demonstration and Evaluation.

Organic Chemicals Site (89-R05-005)

See 90-R05-002

The soil and ground water at the Organic Chemicals site in Grandville, MI, is contaminated with a wide variety of organic chemicals including chlorinated aliphatics

and PCBs. 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 Regional Ground Water Forum representative on July 20, 1989.

Wausau Water Supply (89-R05-006)

The Wausau, WI, Water Supply Site is characterized by aquifer contamination with halogenated aliphatic hydrocarbons, predominantly TCE and PCE. The Regional RPM requested RSKERL to provide technical assistance in evaluating the potential for in situ bioremediation alone or in combination with a pump and-treat system for the East Well Field. Comments and recommendations provided to the Region on July 31, 1989, suggested that the contaminants present and their concentration did not favor an effective, large scale implementation of bioremediation.

Anderson Development (89-R05-008)

See 90-R05-006

The Anderson Development Company Site in Adrian, MI, 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 Regional RPM requested RSKERL to review three documents relative to proposed bioremediation of surface soils at the 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 site specific biotreatability studies would be necessary before the feasibility of the technology could be considered as a viable option at this site.

Rose Township Site (89-R05-009)

See 90-R05-001

The proposed remedial action at the Rose Township, MI, site is to leach chemicals from the unsaturated zone into the saturated zone and to recover the chemicals via a ground-water recovery and treatment system. In response to a Regional request dated August 31, 1989, a preliminary review was conducted and comments were conveyed to the RPM. Preliminary recommendations involve abandonment of the proposed leaching system and to investigate the merits of a soil vacuum extraction. Contaminant removal efficiency and the minimization of future ground-water contamination is the impetus of the recommendation.

Rose Township Site #2 (90-R05-001)

See 89-R05-009

In a request dated October 30, 1989, the Region asked for a review of the "Remedial Design and Remedial Action Work Plan, Rose Township - Demode Road Site" with particular reference to a soil flushing program proposed for the site. Specifically, the request addressed the following points:

1. Will the process work?
2. What levels are achievable?
3. Will the soil allow a sufficient leaching rate?
4. What alternatives are available to accelerate the process or achieve the same goal?
5. What will be the impact of the process on the site, and;
6. What is a reasonable time frame?

In a reply dated December 12, 1989, a response was offered which stated that soil flushing could not be supported and suggested that soil vacuum extraction should instead be considered.

Organic Chemical Site #2 (90-R05-002)

See 89-R05-005

The soil and ground water at the Organic Chemicals site in Grandville, MI, is contaminated with a wide variety of organic chemicals including chlorinated aliphatics and PCBs. The original request (89-R05-005) was received in June 1989, and involved the feasibility of bioremediation at the site.

A follow-up request was received in November 1989, asking RSKERL to conduct or oversee in-situ bioremediation treatability studies for the contaminated soils and ground water at the site.

In January 1990, three representatives of the RSKERL Technology Support Center met in Chicago with the RPM and contract Regional support staff. The decision to conduct the treatability study was postponed until February to take advantage of the RI data being collected.

In February 1990, members of the Technical Support Team met with the Region and its support contractors to discuss the applicability of bioremediation to degrade soils contaminated with petroleum hydrocarbons. Future activities will involve a review of the work and its results as the project proceeds.

Main Street Well Field Site (90-R05-003)

The Main Street Well Field Superfund site in Elkart, IN, poses a complex set of circumstances in terms of selecting an appropriate and efficient method of remediation. The movement of trichloroethylene (TCE) under various remediation scenarios is difficult to estimate due to high concentrations of anthropogenic organic carbon in soils at the site.

The Region requested technical assistance from RSKERL to determine soil-water partition coefficients for trichloroethylene (TCE) in selected soil samples from the Main Street Well Field Superfund Site. The request was initiated because of the concern of using literature values to estimate sorption of TCE on site-specific soils. Soil-water partition coefficients (K_p) will be used to help determine soil remediation standards.

The response consisted of two reports. The first was a rather detailed report dated December 27, 1989, on sorption phenomena including theoretical background, examples from the literature, the role of soil TOC, batch tests for determining coefficients, sample collection and preparation, and the use and interpretation of data.

In addition, RSKERL focused on determining whether sorption at the Main Street site is dominated by hydrophobic interactions and the influence of anthropogenic organic carbon present in site soils. RSKERL determined soil-water partition coefficients using radiolabeled TCE in a batch method. Batch tests were conducted on 12 samples from four cores. Each sample was spiked with five concentrations of radiolabeled TCE with four replicates at each concentration. Controls of radiolabeled TCE in water without soil were used to ensure insignificant TCE loss during batch testing.

K_p values of background and on-site soils were approximately 0.3 l/kg. K_p values of stained soils on site (i.e. visible anthropogenic organic carbon) were approximately 1.2 l/kg or 4 times higher. K_{oc} values below 0.4% organic carbon were erratic and generally higher than K_{oc} values above 0.4% organic carbon. K_{oc} values at lower organic carbon concentrations could be due to non-hydrophobic interactions. A linear equation was fit to the K_p and TOC data of the form:

$$K_p = 0.65 * \%TOC + 0.11$$

indicating that sorption occurs at a low TOC content. This empirical relationship is only applicable at the Main Street site. A detailed report on the batch partitioning tests with associated quality control information was submitted to the Regional RPM July 6, 1990.

Cliffs-Dow Disposal Site (90-R05-004)

See 89-R05-003

The site is a coal tar waste pit at Marquette, MI, where PAHs 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 have been made of both the ground-water system and the FAPT. Technical review comments and recommendations were submitted to the RPM concerning these two areas on May 23, 1989, and August 29, 1989, 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.

In a February 8, 1990, written request, the RPM asked RSKERL to participate in the development and evaluation of the design for bench and pilot-scale bioremediation studies of the contaminated fill material after the removal of surface contaminants in the Spring of 1990.

Wayne Reclamation and Recycling Site (90-R05-005)

The 30-acre Wayne Reclamation and Recycling Site is located in Columbia City, IN. Chlorinated solvents, BTX, alkanes, and lead are present in the sites' soil and ground water.

A request for technical assistance was made by the Regional RPM on February 23, 1990, for RSKERL to evaluate the necessity of a slurry wall to be used in conjunction with a pump-and-treat system at the site. After reviewing "Statement of Work for Remediation Design/Remedial Action," RSKERL provided comments and recommendation on February 23, 1990. Basically, the comments stated that a correctly designed slurry wall can reduce the required pumping and permit more efficient removal of contaminated water and also reduce the amount of clean water that can become contaminated during pumping by artificially limiting the radius of influence of the pumping well.

Anderson Development Company #2 (90-R05-006)

See 89-R05-008

The Anderson Development Company Site in Adrian, MI, 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 Regional RPM requested RSKERL to review three documents relative to proposed bioremediation of surface soils at the 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 the feasibility of this technology could be considered as a viable option for this site.

Request No. 2 was received March 12, 1990, for the Technology Support Center to review a proposed bioremediation/chemical oxidation remedial action alternative for the site. Review comments were provided March 22, 1990. The reviewers considered the information on degradation processes to be theoretical and recommended documentation to support the proposed treatment scenario. Site specific treatability studies with monitoring of all potential loss pathways also should be conducted.

Ott/Story/Cordova Site (90-R05-007)

The contractor has prepared a Feasibility Study for the Ott/Story/Cordova Superfund site, located near Muskegon, MI. The site has been used since the mid-50s as a manufacturing plant of synthetic organic chemicals used mainly for agricultural purposes. Disposal pits were used for by-product waste streams which are the source of subsurface contamination. The RPM, Russ Hart, would like to consider a broader range of options than had been proposed in earlier remediation plans. Therefore, in a request dated March 20, 1990, RSKERL was asked to review a proposal for using soil vapor extraction technology at the site. The second phase of the request concerns an evaluation of the clean-up levels proposed by the contractor for the soils. The RSKERL Technology Support Team responded to the request in a conference call and submitted final written comments and recommendations dated April 25, 1990.

The current approach to soils remediation is to excavate, transport, and landfill. The focus of the technical review was to examine the possibility of utilizing other technologies as alternates to landfilling. The Technology Support Center team recommended that vacuum extraction is likely to be effective on the types of soil and contaminants present at the site, and could be implemented in situ.

Ritari Post and Pole Site (90-R05-008)

The Ritari Pole and Post Site is located in Sebeka, MN. The site is an old wood preserving plant where creosote and PCPs are present in the soil and ground water. The Remedial Investigation and Feasibility Report contained a number of sections including sampling procedures for soil and ground water, hydrogeological investigations, and treatability studies.

The Regional request, dated May 18, 1990, was for a review and comments of the proposed treatability study for soil and ground water at the site. This is a State lead

site where Delta Environmental Consultants have been retained by the State. On June 7, 1990, the comments were discussed via a conference call which included the Regional RPM and representatives of Delta Environmental Consultants. The major points of discussion centered on the proposed Limited Scope and Comprehensive Treatability Studies as well as the Quality Assurance Plan for the project.

Zanesville Well Field (90-R05-009)

The municipal well field for the City of Zanesville, OH, was found to be contaminated with trichloroethylene (TCE) and dichloroethylene (DCE) in 1981. Since that time, a number of investigations have been conducted to define the source and extent of contamination. The site is currently in the RI/FS Phase and some work has been directed toward hydrogeologic studies including pump tests in the contaminated part of the aquifer.

On June 12, 1990, the Region V Ground-Water Forum Member, Doug Yeskis, requested assistance from RSKERL in a number of areas related to the collection of information which will be used to design a remediation program for the site. Specifically, the request for assistance is directed in the following areas:

- °Review existing site related documents.
- °Recommend appropriate methods to determine K_d values to be used in predictive models.
- °Suggest improvements for new pump tests.
- °Review future documents involving the design of a pulse pumping, ground-water extraction system.
- °Discuss the application and results of modeling.

The response to this request was completed October 12, 1990, and provided a summary of the information which had been provided in past responses. It also made recommendations on future activities.

Wright-Patterson Air Force Base (90-R05-010)

The Fire Training Area 5 is located at a remote area on Wright-Patterson Air Force Base near Dayton, OH. The site, designed for fire fighting training operations, includes underground storage tanks and buried lines that supply the system with water, fuel, and power. Aviation fuel leaked from the facility in the fall of 1986 contaminating soil and ground water with JP-4 fuel. Approximately 3,000 gallons of fuel were lost and only about 300 recovered.

On June 7, 1990, the Regional Ground-Water Forum Member, Doug Yeskis, requested that RSKERL review a "Groundwater Quality Restoration Program" prepared by DuPont Biosystems of Aston, PA. Specific questions contained in the request are:

- Was the study designed and conducted properly, the state-of-art at the time?
- Are the results consistent with what one might expect, given the site conditions?
- Are the conclusions drawn by the contractor valid and consistent with the results?
- How much residual contamination appears to remain at the site?
- What level of understanding of the report and its implications for future clean-up needs do the attached comments from the Base indicate?

Review comments were provided to the RPM June 29, 1990. The reviewers felt that a significant quantity of JP-4 fuel still remained in the capillary zone and that a monitoring program should be initiated to insure that BTX concentrations remain below MCL. A follow-up telephone conference was held with the RPM, Turpin Ballard, to discuss the review comments.

Allied Chemical/Ironton Coke Site (90-R05-011)

See Project 89-R05-001

Volatile organics, PAHs, and cyanide are present in lagoon sediments and ground water at this former coke processing plant in Ironton, OH.

A Regional request for assistance was received June 11, 1990, concerning clean-up goals utilizing bioremediation at this site. The request involved a review of the document entitled "Lagoon Soil Clean-Up Goals for Allied Chemical Ironton Coke Site" at Ironton, OH. One issue which repeatedly develops at Superfund Sites employing bioremediation is to what level can contaminants be reduced by bioremediation. Presently, this is a major issue at Superfund Sites and at the Ironton Coke site.

On June 12, 1990, members of the RSKERL TSC provided technical comments and recommendations on the laboratory and field scale bioremediation demonstration and the proposed goals for the site.

Hagan Farm (90-R05-012)

The Hagan Farm site, located near Stoughton, WI, was a sand and gravel pit prior to 1950. From the late 1950s to the mid 1960s the pit was used for the disposal of waste material from the City of Stoughton and Uniroyal. The disposal areas have now been

covered with soil and are vegetated with grass and small trees. Documentation of waste quantities is unavailable but studies in the area indicate that the major contaminants include acetone, dichloroethene, vinyl chloride, tetrahydrofuran, and vinyl scrap.

On June 12, 1990, Doug Yeskis, Ground-Water Forum Member, requested TSC assistance in reviewing the RI/FS documents to evaluate the potential of using soil vacuum extraction as a remedial measure at this site. A telephone response was made to the Regional RPM, Jae Lee, during which it was stated that SVE appears to be a favorable remediation for this site.

INJ Corporation (90-R05-013)

The INJ Corporation (I.J. Recycling) Site is located in Ft. Wayne, IN. On June 20, 1990, Doug Yeskis, Ground-Water Forum Member, requested RSKERL to determine if oil at the site as described in the document "Determination of Hazard" might be covered by the petroleum exclusion provision under Superfund.

In a response to the Region dated July 25, 1990, it was pointed out that the data provided only accounted for about 20 percent of the constituents present and it was not possible to offer an opinion. It was suggested that the following constituents be analyzed or included: substituted benzenes such as trimethyl benzene, butyl benzene, and propyl benzene; alkanes, cycloalkanes, as well as naphthalenes. It was also suggested that chromatograms be furnished or that a sample of the oil be sent to the RSKERL Laboratory for further analysis. The acquisition of this additional data would make the determination much more valid and achievable.

Gemeinhardt Site (90-R05-014)

See 89-R05-002

The Gemeinhardt site in Elkhart, IN, 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.

On September 14, 1990, Ground Water Forum Member Doug Yeskis requested the RSKERL Technology Support Center to provide a technical review of a document from this Elkhart, IN, site where the PRPs are presently using a soil vacuum extraction system. The document for which the review was requested discusses the rationale for shutting off the vapor extraction system at this time.

In a response dated October 1, 1990, the reviewer compared findings from the site with three criteria for SVE shutdown and recommended that the system should not be allowed to discontinue based on the data the operators have presented at this time.

Region VI

Old Inger Site (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 of these sludges such as 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 analytical, bioassay, and technical review assistance during the laboratory and field plot land treatability studies. Based on the results of these studies, on-site land treatment was selected as the final remedy for the site. In November 1987, the Office of Solid Waste requested comments from RSKERL regarding the "no-migration" demonstration prepared by the Office of Emergency and Remedial Response. In October 1988, following final approval of land treatment as the remediation technology for this site, the RPM requested RSKERL to review the final design plan. These comments were provided in December 1988. The Remedial Design is nearing completion and the land treatment operation will begin in January 1991. RSKERL will be requested to make a site visit at that time.

South Valley Albuquerque, NM Site (88-R06-001)

See 88-R06-004

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

On December 8, 1987 Region VI requested RSKERL to review plans to remediate the site. Verbal comments were made followed by written comments and recommendations on June 9, 1988, concerning limitations of pump-and-treat remediation.

Brio Refining (88-R06-002)

See 90-R06-001

The Brio Refining Site occupies approximately 51 acres near Houston, TX. Soils in 24 acres at the site are contaminated with a wide variety of contaminants associated with the petroleum refining and petrochemical industry, including polycyclic hydrocarbons, phenols, 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 RSKERL to provide continuing technical assistance at this site, beginning with soil remediation feasibility and design

studies. The initial request involved a review and evaluation of the proposed bioremediation plan. One of the major review comments was that the detailed microbiology proposed, as part of the field biodegradation demonstration study, was not necessary to answer the question of whether or not bioremediation would achieve the desired results. A second major point of the review was that control plots should 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 the RSKERL comments and preliminary field demonstration results with the RPM, PRP, and PRP contractor.

The next support request involved a review of the final remedial design plan, and 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, and comments were provided to the RPM in March 1989. All reviewers expressed concern about the high solids level (30 percent) used in the bench-scale bioreactor study and the potential impact on contaminant reductions in a full-scale system.

Another request, received in December 1989, involved a 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 comments addressed those areas of most concern and provided recommendations for improving the plan. These specific comments and recommendations were provided to the RPM for use in a planning meeting with the Brio Task Force and PRP.

South Valley Site, FS Review (88-R06-004)

See 88-R06-001

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

At the request of the RPM a review was made of the modeling efforts carried out at the site, and comments were provided on September 8, 1988.

North Cavalcade (88-R06-005)

See 90-R06-005

The 21 acre North Cavalcade Street site is located in northeast Houston, TX. The site was developed in 1946 when the Houston Creosoting Company began a wood preserving facility. In 1955 pentachlorophenol was added to the preservation

services. The facility ceased operations in 1961. Between September 1985 and November 1987, EPA sampled all environmental media and found PAHs, VOCs, and components of creosote in soil, ground water, and sediments.

The Regional RPM requested RSKERL to provide technical assistance during the remediation process. Review comments for the site remedial design plan were provided to the RPM in July 1988. In general, the reviewers found that the scope of the remedial design covered the needs but a lack of understanding of the biodegradation process was indicated.

In June 1989, a review of the field sampling and analysis plan was completed which suggested that substantial revision was needed in the areas of (1) soil bioremediation treatability studies, (2) soil sampling, (3) free phase product isolation and recovery, (4) pump tests, (5) ground-water treatability studies, and (6) potential presence of dioxins and furans at the site.

During the second quarter of FY 90 three versions of the Field Study Work Plan and the Field Sampling and Analysis Plan of FY 90 were reviewed. In addition, two trips were made to meet with the Region, State, and State contractor to discuss in-situ bioremediation, a hydrogeological investigation, and the location and removal of DNAPLs.

Previous investigations at the site resulted in conflicting hydrogeologic information. Region VI requested RSKERL to assist in further studies to collect data to be used in remediation planning. During May 14-18, 1990, four members of the Technology Support Center completed the work by logging eight wells and carrying out an aquifer test.

Three members of the RSKERL Technology Support Center attended a meeting held in Dallas June 26, 1990, to discuss results from the field study and its implications on remediation planning. Included in the meeting were the RPM, State of Texas Project Manager and the support contractor. It was determined that the low permeability found at the site precluded the use of in-situ bioremediation. Bench and pilot scale studies are planned to determine the merits of using soil slurry reactors and/or land treatment.

Future activities will involve the review of results from these studies as well as plans for DNAPL location and recovery.

Motco Site (88-R06-006)

This site, located in La Marque, TX, consists of about 11.3 acres which was previously operated as a waste recycling and storage area. There are seven unlined pits on the property which range in depth from about 15 to 20 feet and contain approximately 15 million gallons of various wastes, some of which are classified as

toxic and hazardous. Contaminants in the soil and ground water consist of metals, volatile organic compounds, semi-volatile organics, pesticides, and PCBs.

The request for assistance was made by Ruth Izraeli from Region VI on August 23, 1988. RSKERL reviewed the applicability of models utilized by the PRP and the validity of the assumptions used on the Endangerment Assessment. Comments, provided on September 8, 1988, discussed the conceptual site model, vertical model, dilution factors, sensitivity analysis, calibration, and biotransformation.

Tar Creek (89-R06-001)

On March 16, 1989, Region VI, in behalf of the Oklahoma Water Resources Board, requested the RSKERL Technology Support Center to assist in the evaluation of the effectiveness of remediation measures at the Tar Creek Superfund Site, 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 Neosho River. The mine water also has the potential of migrating downward into the area's major water supply, the Roubidoux Aquifer.

In December 1986, a series of remediation measures was completed at the Tar Creek Site, including the diversion of surface water runoff from collapsed mine features, and the plugging of a number of deep wells which provide a potential communication between the contaminated mine water and the Roubidoux. These actions were followed by remediation monitoring.

Data were collected from several sources to evaluate the effectiveness of the remedial actions including ground-water quality determinations, and water levels in the mines. Rainfall and mine discharge data were collected from the Oklahoma Water Resources Board, Oklahoma State Department of Health, and the U.S. Geological Survey.

Members of the Technology Support Center made a site visit to gain firsthand knowledge of the problem, the steps taken in remediation activities, as well as the geology and hydrology of the system. 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 were given to representatives of the Oklahoma Water Resources Board, and the Superfund Branch of Region VI, at RSKERL on September 6, 1989.

Oklahoma Refining (89-R06-002)

The Oklahoma Refining site is an abandoned petroleum refinery in Cyril, OK, having soil and ground water 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, the specifics of which would be supplied at a later date. Conversations with the 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 early 1991, including specific items of support as needed.

Brio Refining Site (DNAPL) (90-R06-001)

See 88-R06-002

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 of these sludges such as BTX and PAH compounds. On-site land treatment was proposed as the remediation technology of choice for the heavily contaminated sludges and soils.

On November 30, 1989, Lou Barinka of Region VI requested RSKERL to review and comment on the "Brio Site DNAPL Delineation Program Work Plan" submitted by Groundwater Technology, Inc. RSKERL review comments were returned to the Region on December 15, 1989, and addressed 7 points including DNAPL delineation, the location of borings, water table elevations, monitoring well completions, and DNAPL collections.

Crystal Chemical Site (90-R06-002)

Arsenic has contaminated the shallow ground water at this abandoned chemical site at Houston, TX. On December 5, 1989, the Region requested that proposed remedial action information be reviewed in order to assist in selecting a technology for the site. Once a technology was selected, a full-scale design would be developed. The following items were of specific concern.

- Recovery well placement.
- The necessity of isolating 15 and 35 foot water bearing zones during remediation.
- A time estimate for pump and treat remediation to reduce the arsenic concentration to MCL (0.05ppm).
- Whether pump-and-treat will be effective given the information known to date.

- Recommended treatment method.

Due to time constraints, Dr. R. Charbeneau, University of Texas, was asked to provide a review and recommendations. These were obtained on January 5, 1990. All of the specific concerns were addressed in considerable detail including approaches used, tables of calculated results, and appropriate equations. Dr. Charbeneau's general conclusion was that a pump-and-treat system is the only feasible remediation method for this site, but remediation to a MCL of 0.05mg/l is not necessary or warranted.

Texarkana Wood Preserving Site Feasibility Study (90-R06-003)

The Texarkana Wood Preserving Site located in Texarkana, TX, is an area where soils and ground water are contaminated with creosote, PAHs, VOCs etc. A request for technical assistance received from Sharon Fuerst, RPM, on January 8, 1990, asked for a review and comments on the ground-water portions of the report.

Comments were provided in a letter dated January 12, 1990. The principal comments focused on the design assumptions of the ground-water extraction system. The contractor assumed removal of one pore volume of water ignoring sorption of the contaminants on the aquifer material. NAPLs were also not addressed and an adequate aquifer test had not been conducted to obtain aquifer characteristics. It was also stated that a drain collection system should be considered. Numerous suggestions on how the report could be restructured and rewritten were made.

Industrial Transformers Site (90-R06-004)

There are two aquifers at the Industrial Transformers site in Houston, TX. The upper aquifer is encountered at a depth of 30-40 feet below the surface. It has a saturated thickness of about 4 feet and has a sand content of 50 to 70 percent. The second aquifer is separated from the upper by about 50 feet of stiff clay. Both aquifers are contaminated with trichloroethylene (TCE) and will require remediation via an extraction and treatment process.

In order to provide a complete design investigation, Region VI has had discussions with the RSKERL on March 26, 1990, concerning laboratory and batch studies to evaluate the sorption and desorption behavior of TCE on at least two samples from each aquifer.

On April 23, 1990, the Technology Support Center informed the Region of several levels of investigations which might be discussed further including the costs involved with each and the relative confidence of resulting information. RSKERL continues to wait for a response before additional technical assistance is initiated.

North Cavalcade Street, GW OU (90-R06-005)

See 88-R06-005

The 21 acre North Cavalcade Street site is located in northeast Houston, TX. The site was developed in 1946 when the Houston Creosoting Company began a wood preserving facility. In 1955 pentachlorophenol was added to the preservation services. The facility ceased operations in 1961. Between September 1985 and November 1987, EPA sampled all environmental media and found PAHs, VOCs, and components of creosote in soil, ground water, and sediments.

The Regional request dated September 25, 1990, was for RSKERL to review the "Work Plan for Groundwater Operable Remedial Design of North Cavalcade Superfund Site, Harris County, Texas."

On October 16, 1990, RSKERL provided comments on a document entitled "Remedial Design, North Cavalcade Superfund Site, Houston, TX, Work Plan for Groundwater Operation Unit." The response discussed the differentiation between the soil and ground-water operable units, the location of DNAPLs, and the location of monitoring wells.

Region VII

Hastings NE Site (88-R07-001)

See 90-R07-002, 90-R07-003, and 90-R07-004

At this site in south-central Nebraska, the soil and ground water have been contaminated with TCE, PCE, CCl_4 , and EDB from several diverse sources including two city landfills and grain storage facilities. Pleistocene sand and gravel extend to a depth of approximately 200 feet and the saturated thickness of this aquifer is approximately 100 feet. Some municipal wells have been abandoned because of high levels of contaminants. To the east and adjacent to the City (downgradient), is the 76 square mile abandoned Naval Ammunition Depot (a part of the Superfund Site) where the Corps of Engineers is in charge of clean-up activities.

In November 1988, the RPM for the site requested assistance from the TSC in evaluating the contractor's modeling and data collection efforts and to recommend other site characterization work. The TSC conducted a review of several documents from which water quality data was extracted to prepare plume maps. A site visit was made with a consultant (Dr. Jim Hendry) and Darrell Sommerhauser (Region VII) on November 15, 1988. Dr. Hendry did some conceptual modeling for estimates of plume size and shape. A meeting was held May 18, 1989, with Sommerhauser, Hendry, and the Region's contractors, PRC and CH₂M Hill, to plan future activities.

Gamma-ray logging of monitoring wells was conducted by the TSC to define the geology. The logs were made available to the RPM. Tritium measurements for dating water from the site were done by RSKERL but results were inconclusive because of detection limits.

Scott Lumber Company (89-R07-001)

The Scott Lumber Company is a nine acre site located in Alton, MO. It is an abandoned creosote wood treatment facility contaminated with polycyclic aromatic hydrocarbons with concentrations up to 63,000 ppm in the soil. The prime Emergency Response Clean-up Service Contractor (ERCS), through a subcontract, was to provide a bioremediation technology capable of degrading creosote in soil and sludge.

ERCS was choosing a subcontractor to perform on-site bioremediation and had reduced the number of prospective bidders to two. On October 24, 1988, Region VII requested RSKERL to assist in the selection by reviewing these two remediation proposals. On November 18, 1988, the proposals were reviewed, rated, and returned to the Region as requested.

Waverly Site (89-R07-002)

The Waverly Site at Waverly, NE, has a contaminated ground-water plume containing chlorinated solvents, including carbon tetrachloride and trichloroethylene. In November 1988, the Region requested that RSKERL identify alternative treatment techniques that had been used for ground-water remediation with such contaminants. 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.

NEIS Site (89-R07-004)

The National Industrial Environmental Services, Inc. (NEIS) hazardous waste disposal facility near Wichita, KS, was in operation from February 1977 through January 1982 when the State of Kansas closed the site and began remediation operations.

On February 28, 1989, Region VII requested RSKERL to provide 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 the Region on May 5, 1989, found several major limitations to the use of bioremediation and recommended a careful investigation of this approach prior to implementing either a laboratory or pilot scale study.

Hastings, Tritium (90-R07-002)

See 88-R07-001, 90-R07-003, and 90-R07-004

At this site in south-central Nebraska, the soil and ground water have been contaminated with TCE, PCE, CCl_4 , and EDB from several diverse sources including two city landfills and grain storage facilities. Pleistocene sand and gravel extend to a depth of approximately 200 feet and the saturated thickness of this aquifer is approximately 100 feet. Some municipal wells have been abandoned because of high levels of contaminants. To the east and adjacent to the City (downgradient) is the 76 square mile abandoned Naval Ammunition Depot (a part of the Superfund Site) where the Corps of Engineers is in charge of clean-up activities.

This request for assistance was to review more current tritium data obtained from a commercial laboratory. This information was sent to Dr. Hendry on March 26, 1990, and was also reviewed by a member of the RSKERL Technical Support Team.

It was determined that the detection limits were too high for meaningful results. The RPM is interested in collecting additional samples for analysis by a laboratory to be determined by Dr. Hendry so he can provide details on counting procedures.

Hastings NE Site/Colorado Avenue Subsite (90-R07-003)

See 88-R07-001, 90-R07-002, and 90-R07-004

At this site in south-central Nebraska, the soil and ground water have been contaminated with TCE, PCE, CCl_4 , and EDB from several diverse sources including two city landfills and grain storage facilities. Pleistocene sand and gravel extend to a depth of approximately 200 feet and the saturated thickness of this aquifer is approximately 100 feet. Some municipal wells have been abandoned because of high levels of contaminants. To the east and adjacent to the City (downgradient) is the 76 square mile abandoned Naval Ammunition Depot (a part of the Superfund Site) where the Corps of Engineers is in charge of clean-up activities.

Pursuant to a request from the RPM on March 20, 1990, the TSC reviewed a proposal for an SVE pilot study on the Colorado Avenue subsite and subsequently reviewed the results of the pilot scale test.

Hastings Well No. 3 Site (90-R07-004)

See 88-R07-001, 90-R07-002, and 90-R07-003

At this site in south-central Nebraska, the soil and ground water have been contaminated with TCE, PCE, CCl_4 , and EDB from several diverse sources including two city landfills and grain storage facilities. Pleistocene sand and gravel extend to a depth of approximately 200 feet and the saturated thickness of this aquifer is approximately 100 feet. Some municipal wells have been abandoned because of high levels of contaminants. To the east and adjacent to the City (downgradient) is the 76 square

mile abandoned Naval Ammunition Depot (a part of the Superfund Site) where the Corps of Engineers is in charge of clean-up activities.

Well #3 is a subsite of the Hastings Ground Water Contamination Site in Hastings, NE. At this site soil and ground water are contaminated with carbon tetrachloride as a result of its use as a grain fumigant in former grain storage operations. A Record of Decision was signed in September 1989, to use soil venting to remediate the soils. Region VII utilized its ERCS contractor to develop a work plan for the soil venting design, and on May 30, 1990, requested that the RSKERL Technology Support Center review the document.

In a reply dated June 25, 1990, RSKERL strongly recommended that Region VII conduct a field test to determine critical design parameters such as: the number and spacing of injection and extraction wells, screened intervals of wells, applied vacuum and flow rates, and method of vapor treatment. The soil venting system was originally to be designed using field test data from another subsite (Colorado Avenue) conducted by a responsible party located nearby. However, the field test data from this subsite also was not sufficient to design a soil venting system.

On July 16, 1990, two TSC members met with the RPM, Superfund Branch Managers, and the ARC's contractor at the Regional Office. Plans for the field test mentioned above were discussed. RSKERL will continue to be available for data interpretation and to work with the contractor as requested.

Hayford Bridge Road (90-R07-006)

The Hayford Bridge Road Site, formerly known as the Findett Site, is located in St. Charles, MO. The site consists of the Findett facility which currently formulates or blends organic chemicals, and the Cadmus facility which recycles a spent metal catalyst. The surrounding properties are also contaminated. In 1988, a Record of Decision (ROD) was signed in which the remedial action was selected for the first operable unit at the site.

The Findett Corporation agreed to implement the following remedial actions for the first operable unit (OU): shallow ground water will be pumped to hydraulically contain contaminated ground water; and contaminated soil on the Findett facility will be removed for offsite treatment or disposal. The soil was excavated and "temporarily stored" on the unlined and unbermed soil surface. The site is located in the floodplain of the Mississippi River which, before the area had more adequate levee protection, inundated the area with flood water when the river rose out of its banks. This flooding and resultant sediment deposition may have effected the prior pattern of soil contamination.

On July 12, 1990, the Region requested assistance from RSKERL to determine the impact of flooding on the original interpretation of the sources of contamination. On

August 6, 1990, RSKERL responded with a written review to the RPM. Essentially the review stated that it appears that spillage and disposal activities have occurred at both the Findett and Cadmus properties in the past as evidenced by hot spots in the soil. It was also pointed out that flooding most likely impacted the distribution of surface contaminants, but the level of uncertainty of data interpretation is too great to confirm that flooding transported contaminants from the Findett property to the Cadmus property or vice versa.

Region VIII

Union Pacific Railroad/Laramie Tie Treating Plant (88-R08-001)

The Union Pacific Tie Plant site in Laramie, WY, is an abandoned wood treating facility that was operated for over 50 years prior to its closure in the 1970s. This operation resulted in creosote and pentachlorophenol contamination of the soil and ground water 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 was 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, 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 the 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.

On November 21, 1989, the Laboratory provided review comments for 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.

During the week of April 23, 1990, the Regional RPM visited the Laboratory to discuss future participation of the Technical Support Team.

In response to a request from Felix Flechas of Region VIII, dated August 17, 1990, RSKERL prepared an extensive review of two documents which comprise the "In Situ Treatment Process Development Program, Milestone IV Report." The reviewers found the report to be well written and easily readable, as well as summarizing a great deal of activity concerning remediation strategies at the site. The reviewers also suggested that the studies were thorough and appeared to be well designed and that the conclusions made in the report were, for the most part, supported by the data.

Champion Creosoting, Libby (88-R08-002)

RSKERL staff are providing technical support for the remedial design of an in-situ bioremediation system, land treatment design of the contaminated surficial soils, and the subsurface dense oil investigatory efforts currently ongoing at Champion International (wood-preserving) Superfund site at Libby, MT.

Technical review comments on the upper aquifer bioremediation system were provided September 5, 1989, while the review and recommendations on the bench scale heavy oil treatability study were completed March 27, 1990. On April 9, 1990, technical review comments and recommendations were provided to the Region concerning a proposed bench-scale study designed to develop an understanding of the mobility and biodegradability of the creosote mixture (DNAPL) in the lower aquifer.

On May 28, 1990, three members of the RSKERL Technology Support Center met at the Regional Office with representatives of Champion International, Woodward

Clyde consultants, Jacob Engineering, Region VIII, and the Montana Department of Health and Environmental Sciences to plan specific details of the lower aquifer bench scale test designed to provide information on the mobility and biodegradation of the creosote mixture of contaminants (DNAPL). A full scale in-situ bioremediation system is currently in full operation in the upper aquifer, as well as land treatment and pump-and-treat activities.

On June 26, 1990, three members of the RSKERL TSC visited the Libby site to observe the field and laboratory operations and to participate in a follow-up meeting concerning the lower aquifer. Also attending the meeting were the consultants carrying out the work, the Montana Department of Health and Environmental Sciences, and the Regional RPM. The Libby site has been selected as a candidate for the Bioremediation Field Initiative.

F.E. Warren Air Force Base (90-R08-001)

This facility in Cheyenne, WY, has been in operation since 1867 and has served several functions. It was a major training facility during and after World War II until it was transferred to the newly formed Air Force in 1947 and finally the Strategic Air Command in 1958. Equipment cleaning and maintenance operations using solvents, predominately TCE, apparently led to extensive ground-water contamination. Other ground-water contamination is due to spent battery acid disposal and gasoline/fuel oil releases. The Air Force has been investigating the site under the AF Installation Restoration Program (IRP) and identified 27 areas which may require remedial action. Although the IRP identified the Ogallalla Formation as the aquifer of concern, work thus far has been limited to the shallow ground water.

In a memorandum dated July 27, 1990, the Regional RPM pointed out that a Federal Facility Agreement is being developed to formalize EPA and State of Wyoming involvement at this and other Federal sites. The agreement, which is expected to be signed before the end of FY90, will provide a mechanism in which the AF must obtain EPA and State concurrence before conducting site activities. In this regard the Region requested RSKERL to review and comment on the RI/FS with the understanding that additional work will be carried out on the lower aquifer at some later date.

In a response of August 9, 1990, RSKERL informed the RPM that a preliminary review has been made and that the material has been forwarded to Geodysey, Inc., an RSKERL technical support contractor, for more detailed comments.

On August 29, 1990, an RSKERL TSC member made a site visit at the request of the Federal Facility Remedial Branch in the Region. Also involved in the site visit were two TSC consultants from Geodysey Inc. RSKERL has been requested by the Region to continue to provide oversight as site investigations continue.

Region IX

Baxter International (88-R09-002)

The J. H. Baxter site in Weed, CA, is an operating wood treating facility having soil and ground-water contamination with creosote, pentachlorophenol, and metals. The first request for assistance at this site came in FY 88 when the RPM asked for continuing technical support with respect to proposed bioremediation of the soil and ground water. Since then several specific support activities have been completed.

In March 1988, two RSKERL scientists met with the RPM in Dallas to plan and design the lab- and pilot-scale phases of the bioremediation studies. In September 1988, the RSKERL scientists assigned to the project made a site visit to observe and suggest improvements to the ongoing studies.

In February 1989, a meeting with the RPM was held at RSKERL to discuss laboratory results, preliminary pilot results, and proposed ground-water extraction studies. In March 1989, the two RSKERL scientists met with the RPM and the PRP consultant at Mississippi State University to discuss all aspects of soils and ground-water remediation at the site. In April 1989, review comments were provided to the RPM concerning the proposed pilot project for ground-water pumping.

In January 1990, two members of the Technical Support Team visited the site to discuss the results of the pilot project studies, the proposed ground-water extraction and treatment system, and the initial design of a field scale soil bioremediation (land treatment) demonstration. Taking part in these discussions were the RPM, two Regional support contractors, two State agencies, three PRPs and their support contractor. In February 1990, the feasibility study report was reviewed and comments provided to the Region. In general, the reviewers felt that the report provided the degree of support needed for selection of remediation technologies. In March 1990, a PRP support contractor visited the Laboratory to discuss criteria for the final design plans for the field demonstration project. In May 1990, a meeting was held with the RPM to discuss future activities at the site.

In June 1990, a meeting was held with the RPM and support contractor to discuss the initiation of the field demonstration project and plans for an extraction well system to gain complete hydraulic control of the system. Future activities include review of the final design plan and a site visit during the construction phase of the field demonstration project.

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. On June 27, 1988, 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 chemical and physical properties, toxicity data, common background values, fate and transport discussions and MCL, AWQC and risk values. The report is used by all of the regulating agencies involved in the development of risk assessments for site remedy selections.

On July 11, 1988, RSKERL responded to the request by reviewing the chemical fate and transport sections of the report. The response stated that the report was well done and had only minor comments on a few of the 22 chemicals profiled.

Watkins-Johnson Site (89-R09-001)

Ground water at the Watkins-Johnson Site at Scotts Valley, CA, is contaminated with TCE and PCE. The Regional request for technical support, received in October 1988, was for a review of the ground-water flow and solute transport modeling report. The report was reviewed by several members of the RSKERL Technology Support Center 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.

San Fernando Valley Site (89-R09-002)

The San Fernando Valley, CA, site is actually four sites being handled as one 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, Director, OERR, requested that the RSKERL Technology Support Center review and evaluate the available studies and comment on the appropriateness of the recommendations. An RSKERL multidisciplinary team, including both Support Center and research staff, reviewed the Burbank Operable Unit Proposed Plan and associated documents which called for pumping for plume control, treating and reuse of the water for drinking water supplies. Review comments were provided March 28, 1989, which discussed the effectiveness of a pump-and-treat system at the site, proposed ground-water models, alternative treatment technologies, contaminant sources, and the difficulty of achieving total remediation at a site of this scale with today's technology.

San Gabriel Site (89-R09-003)

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

On March 30, 1989, Henry Longest, Director, OERR, requested RSKERL to review and evaluate studies made at the site. Essentially, a review of the GIS approach applied to the basin was provided.

Brown and Bryant Site (89-R09-004)

See 90-R09-003

The Brown and Bryant 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 July 17-20, 1989, and discussions were held with OSC on additional site characterization necessary. RSKERL brought in GeoTrans to aid in the hydrogeological investigation and contacted EMSL-LV regarding geophysical assistance. Region IX formally requested assistance from EMSL-LV.

Field work was conducted the week of October 23, 1989. RSKERL, along with GeoTrans, has continued working with E&E (the OSC's contractor) on specifications for additional drilling and monitoring well installation.

In early March 1990, RSKERL and GeoTrans were involved in a major effort at the site which included coring and the installation of additional monitoring wells. Additional assistance, at a later date, will involve slug tests and pump tests.

Site characterization work, going on since February 1990, has shown a more complex hydrogeologic situation than was indicated in the PRP's report. The perched aquifer is not underlain by a well defined clay layer as described. Recent exploratory auger holes and gamma-ray logging on existing wells have shown that water in the perched aquifer could migrate downward to the regional aquifer through discontinuous beds of silt, sandy clay, and tight sand. Because of this, the Region revised the work plan for the site. Four off-site monitoring wells were installed, three downgradient and an upgradient background well. During the week of April 30 through May 4, 1990, the RSKERL TSC logged the new wells and conducted aquifer tests at the site. On May 23, 1990, a member of the TSC along with GeoTrans met in San Francisco, with Region IX representatives, at the offices of Ecology and Environment, the Regional technical support contractor. The purpose of the meeting was to evaluate the status and results of site characterizations and plan remediation measures which will be carried out on a pilot scale in the near future.

No further assistance is anticipated.

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. In a letter dated August 29, 1989, the Region requested assistance in the form of a review of the Draft Work Plan for Bioremediation Treatability Studies at the Montrose Superfund Site. Specifically, the request concerned the following:

- Will the stated objectives fulfill the data requirements of a CERCLA feasibility study and will tests provide sufficient information to support the evaluation of remedial alternatives?
- Will the recommended tests meet the stated objectives, and if not, what additional tests should be performed?
- Is the technical approach sound and are there any recommended changes?
- Are the analytical methods and sampling procedures adequate?
- Are the field and QA/QC procedures adequate?

On September 29, 1989, RSKERL provided final recommendations to formulate the laboratory treatability study being conducted by ECOVA Corporation for the Montrose Chemical Company. Although the conclusion was made that the objectives of Phase I will not fulfill the data requirements of a CERCLA feasibility study, the reaction to the work plan was that it was adequate for the goals of the project with suggested modifications.

A revised treatability work plan was received for review on May 10, 1990, and has been reviewed. The review comments were provided to the Region by telephone on May 23, 1990.

Other studies are currently under way at the site by the PRP contractor. A part of these ongoing studies, "Draft Final Report Phase I - Bioremediation Treatability Studies," was reviewed by RSKERL and comments and evaluation were provided to the Region on September 28, 1990.

FMC Site (90-R09-002)

The FMC pesticide formulation facility is located on the south side of Fresno, CA. The formulation of dry pesticides began in 1946 and the addition of liquid pesticides began in 1959 when the facility was purchased by FMC.

The facility has a complex history of pesticide handling and waste management disposal practices. Since 1978 the site has been investigated by various state and federal agencies, and from February 1987 through March 1988, Phase I of an RI/RS was conducted by FMC. Phase II of the RI was conducted during the first half of 1989 and consisted of additional ground-water and soil contamination investigations.

Phase I of the RI resulted in the analyses of over 100 listed chemicals in ground water and soil at the site. The chemicals are representative of a variety of pesticide classes, halogenated aliphatic compounds, volatile aromatic compounds, trace metals, and semivolatile compounds.

On June 4, 1990, Tom Dunkelman, the Regional Project Manager, requested technical assistance from the RSKERL Technology Support Center. Specifically the request involved the evaluation of a ground-water model used in risk assessment and comments on a soil remediation proposal.

Comments were faxed to the Region July 31, 1990. Concerns over model assumptions were expressed, particularly with the batch flushing method proposed.

Brown and Bryant Site (90-R09-003)

See 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' downgradient.

The Brown & Bryant RI/FS has been chosen by Region IX to be completed in-house using as many EPA staff as possible. In a memorandum dated July 12, 1990, the Region requested RSKERL technical assistance in reviewing and commenting on the draft workplan.

US Ecology Site (90-R09-004)

In a letter dated February 20, 1990, Matthew Hagemann, Hydrologist in Region IX, requested technical support from RSKERL at The US Ecology site in Beattey, NV. This support was provided by Dr. Richard Johnson, a TSC consultant at the Oregon Graduate Institute in Beaverton, OR.

Specifically, Dr. Johnson's involvement was directed to determining the source and mechanism of transport of soil gas which had been identified as the possible source of ground-water contamination. The first draft of the report has been completed.

Region X

Wyckoff/Eagle Harbor (88-R10-001)

See 90-R10-004

The Wyckoff Company Site, an active wood treating facility since 1910, is located on Bainbridge Island occupying approximately 40 acres at the mouth of Eagle Harbor adjacent to Puget Sound. Both soil and ground water at the site are contaminated with creosote and PCP. The ground water also contains both floating and sinking pure-phase products. In March 1988, the Region requested a review of the proposed ground-water restoration feasibility study and for RSKERL to attend a subsequent meeting to discuss preliminary results of the study.

As a result of the meeting, a final remediation plan was prepared. Review comments of the final plan were submitted to the RPM in June 1988. The review stated that the biological system proposed was acceptable for contaminants at the site, but did recommend however, that scale-up studies should be conducted prior to the final design due to the high flow rates involved. It was also recommended that a standby carbon column be included as a precautionary method due to the anticipated high variability in influent concentrations.

Frontier Hard Chrome Site (89-R10-001)

In May 1989, the Region requested assistance in evaluating procedures to establish remediation criteria for the Frontier Hard Chrome Site at Vancouver, WA. The site's soil and ground water is contaminated with chromium, lead, nickel, and cyanide, although the contaminant of primary concern is chromium. A ROD has been issued for the remediation of the site which establishes a tentative clean-up level. The goal of these procedures is to estimate leachate contaminant concentrations at equilibrium between soil and water. The request to RSKERL was that an expert be provided to act in an advisory capacity during the development of the protocol and during the evaluation of results. Dr. Carl Palmer of the Oregon Graduate Center is providing this assistance through the RSKERL technology support contract.

Lakewood Ponders Corner Site (89-R10-002)

In response to an April 18, 1989, request from Region X for technical assistance, RSKERL reviewed the design and operation of a soil vacuum extraction (SVE) system at the Ponders Corner, WA, site. The contamination of soil and ground water

resulted from the 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 first soil unit is an imported fill which varies in thickness from a few feet to over 15 feet. The second unit is composed of sand and gravel from recessional outwash deposits which vary in thickness from 1 to 58 feet. The third soil unit consists of sand and gravel with a high silt and clay content, varying from 8 to 92 feet in thickness, and having a low permeability.

In general, the SVE performance was limited by unclear remedial objectives, poor subsurface characterization, and a 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.
- Determine the depth to the water table under 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 testing and the PCE rebound in vapor during periods of inactivity. The use of extraction wells to monitor soil air concentrations was discouraged.

Time Oil Site #2 (89-R10-004)

The Record of Decision for the Time Oil Site in Tacoma, WA, called for the implementation of a soil vacuum extraction (SVE) system 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, on September 28, 1989, RSKERL Superfund Technology Support Center reviewed a 65% complete SVE design submitted by the Corps, 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 were used to assess potential limitations on the enhanced volatilization of contaminants present in soil at the site due to the presence of waste oil.

In a meeting held on October 4, 1989, 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. It is expected that RSKERL will continue to be involved as project plans are developed.

United Chrome Site (90-R10-001)

The United Chrome Products site is a former industrial hard chrome plating facility located in Corvallis, OR. Between 1956 and 1975 an onsite dry well was used to dispose of floor drippings and washings. As a result, there is considerable chromium contamination of the soil beneath and around the building in the upper and lower aquifer of the area. A pump and treat system was installed in 1988, and to date 9,000 pounds of Cr+6 have been removed from 800,000 gallons of contaminated ground water.

Region X has requested technical support from RSKERL-Ada and RREL-Cincinnati in evaluating the feasibility of chemical enhancement of the pump-and-treat process in order to decrease clean-up times. RSKERL Technology Support Center personnel met in Corvallis on January 25, 1990, with Region X personnel, PRP, PRP Contractor and CH₂M-Hill, the site remediation contractor. The purpose of this meeting was to review the current status of the remediation and results from preliminary Oregon State University research on chemical enhancement and determine direction of future efforts. RSKERL suggested and agreed to make available Dr. Carl Palmer, a TSC consultant of Oregon Graduate Institute, to prepare a feasibility report on the possibilities for chemical enhancement of pump-and-treat at the United Chrome Site. This report would consider four major areas of concern: 1) delivery of the reactive agent to where it is needed within the aquifer, 2) the interaction between the reactive agent and the contaminant, 3) the removal of the contaminant and the reactive agent from the subsurface, and 4) the treatment of the extracted water and disposal of the

resulting sludge. Dr. Palmer's report was delivered to Ada and transmitted to Region X and RREL on April 20, 1990.

On June 19, 1990, members of the RSKERL TSC participated in a conference call which included the Cincinnati and Edison Laboratories, as well as Region X staff. The discussion involved Dr. Palmer's report and the development and funding of additional laboratory studies necessary to evaluate chemical enhanced extraction at United Chrome.

Bunker Hill Site (90-R10-002)

This NPL Site at Kellogg, ID, is a smelter operation where lead and zinc have contaminated soils. The top layer of soil has been removed and replaced with clean soil. There is concern about recontamination of the clean soil by the lower layers.

Following a request by the Region, Dr. Robert Puls, RSKERL, and a consultant to RSKERL, Dr. Carl Palmer, Oregon Graduate Center, were asked to review background information concerning the site. Subsequently, Dr. Palmer attended a meeting on December 19, 1990, with CH₂M Hill and State of Idaho personnel. The issues concentrated on the sources of contamination, mechanisms of contamination, and a potential remediation design. The area of major concern, as mentioned above, was the recontamination of the replaced soil as well as the processes which may be contributing such as capillary movement upward of the metals with the soil water and the role of plants in mobility of the metals.

RSKERL will review collected material as it becomes available.

Wyckoff Eagle Harbor (90-R10-004)

See 88-R10-001

This request for assistance is related to the Wyckoff Eagle Harbor Superfund Site in Bainbridge Island, WA. The site is an old wood treating plant which used creosote and pentachlorophenol to treat poles. Significant amounts of contaminants have been detected under the site and continue to seep into Puget Sound along the shoreline. Since January 1990, an extraction system has been used to pump about eight million gallons of contaminated water from the aquifer, from which about 12,000 gallons of oil has been extracted.

In spite of this apparent success, there continues to be seepage along the shoreline in several areas. This request for assistance is concerned with the possibility of using recovery trenches to increase the interception of the oil phase before it seeps into the sound. The response to this request is being prepared.

RCRA

Hunt Refining (RCRA-04-01)

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

In October 1988, Region IV requested that RSKERL review and evaluate the data presented in the PNR document to see if the conclusions drawn were supported by the data presented. Review comments were provided to the Region in December 1988, followed by a meeting in Atlanta with the Region and State of Alabama in January 1989. In general, the reviewers found that the conclusion that complete degradation or transformation of organics was occurring in the treatment zone was not adequately supported by the data presented.

Cavenham Forest Industries (RCRA-04-02)

Cavenham Forest Industries is a wood treating facility at Gulfport, MS, which has ceased operations. Currently, post closure is under way for the RCRA regulated units and investigations are beginning for the non-regulated Solid Waste Management Units (SWMU). Because of the potential harm from one of these units, the Old Pond, Cavenham has requested approval from EPA to conduct interim corrective measures. These include the bioremediation of contaminated soil and ground water.

The Region requested that RSKERL review the Interim Measures Workplan in a memorandum dated July 12, 1990. Review comments, dated July 24, 1990, centered on the proposed bioremediation of soil and ground water at the Old Pond that was used for storm water storage. Concerns were raised that the inward gradient imposed by a slurry wall would not allow the introduction of large volumes of nutrients and electron acceptor laden water required for bioremediation.

Universal Fasteners (RCRA-04-03)

Universal Fasteners is a metals contamination site in Kentucky created by an improper disposal of plating wastes. A question exists as to whether or not the monitoring wells are properly located to monitor the ground water. The January 1, 1990, request was for RSKERL to use its computer program to create pattern diagrams using major cations and anions. Before the diagrams could be created it was necessary to perform a cation-anion balance to test for confidence in the data. In addition to developing the pattern diagrams, the request for assistance included an

interpretation of the results of the data from 4 wells at the site. The response, submitted to the Region on March 30, 1990, included pattern and Piper diagrams generated from the supplied data.

Further assistance is expected as additional data is generated.

Southern Wood Piedmont (RCRA-04-04)

The Southern Wood Piedmont (SWP) is a wood treating facility in Baldwin, FL, which operated between 1953 and 1987. Utility poles and cross ties were pressure treated with creosote, pentachlorophenol, copper, chromium and arsenic. The facility has been closed and buildings and equipment removed. A RCRA cap has been installed as required under post closure. A ground-water monitoring system has been installed along with ground-water extraction wells.

On July 14, 1990, the Region requested RSKERL to review a proposed bioremediation plan for the West Ditch area of the site utilizing the existing pumping wells. The RSKERL Technology Support Center responded to this request with a memorandum dated August 7, 1990. Generally the comments indicated that the proposal was well written indicating that the contractor (ERI) has expertise in bioremediation. Major difference occurred regarding the proposed use of "bioaugmentation" or the introduction of specific microbes versus the use of indigenous bacteria.

Egbert Corporation Site (RCRA-05-01)

The Egbert Corporation previously manufactured clutch and brake parts, and heavy construction equipment at its facility in Bedford, OH. 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, perchloroethylene, and isopropyl alcohol. Storage of waste on this pad was discontinued in May 1986. Under a RCRA closure plan, the Egbert Corporation had proposed using soil vacuum extraction (SVE) to remediate the silty clay soils contaminated with YCE and PCE. A pilot test was proposed to evaluate the potential SVE system.

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

Little America Refining-LARCO (RCRA-08-01)

On August 20, 1989, a request was received from Lou Johnson, Chief, RCRA Implementation Branch, Region VIII, for technical assistance in a litigation case involving Little America Refining Company (LARCO) of Evansville, WY. Specifically, the case involves the performance of a soil vacuum extraction system

installed by LARCO to remove organic vapors from the soil of a residential subdivision. The Region requested RSKERL to evaluate the performance of the SVE system, based on existing designs and data, and possibly serve as an expert witness.

The RSKERL response, dated June 19, 1989, was in the form of detailed suggestions on how to assure that the system is operating optimally and advised that SVE at the site should be effective.

Conoco Refining-Denver (RCRA-08-02)

The Colorado Refinery-Denver Site has extensive contamination of the shallow ground water by hydrocarbons. 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 a remediation alternative at the site, and RSKERL was requested to review the plan. Comments describing the limitations of the plan were provided to Region VIII.

Cody Wyoming Refinery (RCRA-08-03)

Seepage from surface impoundments at the petroleum refining site in Cody, WY, included a complex mixture of inorganic and organic contaminants which provided tracers that ranged from those with little or no attenuation to those organic compounds that were strongly attenuated. The request for assistance, dated June 29, 1990, centered on a review of "Natural Microbial Degradation of Organic Contaminants in Seepage from a Refining Waste Water Pond" prepared by GeoWest consultants of Golden, CO. Specifically, the question concerned the degree to which "natural" degradation accounts for contaminant attenuation at the Cody site.

The response, dated February 21, 1990, showed that insufficient evidence existed to prove "natural" degradation and made recommendations as to how the question can be more appropriately approached. A follow-up teleconference was held to discuss these comments. Future assistance would take the form of a review and recommendations of additional information gathered to support the claim of natural degradation. Also, more detailed guidance by RSKERL would be requested to assist in the collection of the proper information for demonstrating natural degradation at this and other sites in the Region.

On April 24, 1990, Felix Fletchas, Region VIII, visited the Laboratory to discuss the site and to obtain additional assistance as to the type of information required to demonstrate if natural microbial degradation of organic contaminants is occurring in soils and ground water under the site. This information plus a detailed review of information as supplied by the PRP to support claims of natural degradation were provided to the RPM June 28, 1990. Review comments were integrated with information needs. If required, a follow-up teleconference will be held with the Region to discuss the information and review comments.

Maricopa, AZ (RCRA-09-01)

The Arizona Hazardous Waste Disposal Facility is located in Maricopa, AZ, and consists of a facility for the disposal of hazardous waste which is owned by the State of Arizona and operated by their contractor, ENSCO, from Little Rock, AR.

A June 23, 1989, request for assistance on this site was initiated by the Chief of the RCRA Compliance Branch in Region IX. The essence of the request was to review the request submitted by the facility to waive requirements for monitoring in the unsaturated zone based on modeling using a proprietary code. The waiver request and support documents were never sent to RSKERL. Following a discussion with the RPM in June 1989, the facility dropped their waiver request thereby concluding the need for technical assistance at this site.

CP Chemicals (RCRA-09-03)

Since 1958, Southern California Chemicals (SCC) has owned and operated the inorganic chemical manufacturing and recycling facility in Santa Fe Springs, CA. SCC is a division of CP Chemicals, Inc., a New Jersey Corporation. SCC presently operates as a RCRA Interim Status Hazardous Waste Management Facility. The facility operates a variety of waste management units as well as manufacturing and operational processes.

The initial Regional request, dated May 30, 1990, was for a review of a proposed soil desorption study for the RCRA regulated facility. The desorption study is one part of a larger RCRA Facility Investigation (RFI) Workplan. On June 21, 1990, the TSC provided review comments concerning a proposed soil desorption study which involves the transport of metals, particularly chromium.

Romic Chemical Corporation (RCRA-09-04)

The Romic Chemical Corporation is located in Palo Alto, CA. It is a full service RCRA permitted hazardous waste management facility involved in waste recycling, alternate fuel blending, waste incineration, and wastewater treatment. Sampling of ground water at the facility has revealed very high levels of a variety of chlorinated and non-chlorinated volatile organic chemicals including: vinyl chloride, freon 113, 1,1,1-trichloroethane, trichloroethylene, perchloroethene, benzene, toluene, 1,1-dichloroethene, acetone, 1,2-dichloroethene, 1,1-dichloroethane, chloroform, methyl isobutyl ketone, xylenes, methylene chloride, methyl ethyl ketone, 1,2-dichloroethane, chlorobenzene, and ethylbenzene.

The levels of vinyl chloride alone have exceeded 130 mg/l. The California Department of Health Services expressed a great concern about the potential for vinyl

chloride, an extremely volatile chemical and known human carcinogen, to volatilize from ground water or soil and impact workers, local residences, and people passing by.

Romic is currently a subject of a RCRA Corrective Action Order for site investigation and remediation. As a part of this order, Romic completed a soil-gas survey to evaluate vapor migration. On May 23, 1990, Region IX requested that the RSKERL Superfund Technology Support Center review the findings of this survey. In a response dated June 6, 1990, RSKERL concluded that, while the mechanics of the soil-gas survey were sound, it did not fully delineate the extent of vapor migration in onsite or offsite soils. Specific recommendations included in the RSKERL response included:

1. Conduct another, more comprehensive, soil-gas survey encompassing all areas of the site including soils underlying buildings, especially in areas of past storage or disposal of VOCs.
2. Determine a soil-gas concentration profile as a function of depth to gain an insight as to whether vapors are from water table offgassing or soils contamination.
3. Determine the location of utility lines and other possible preferential vapor migration pathways for soil-gas testing both on and off site.
4. Collect undisturbed soil samples in brass sleeves in highly contaminated areas to and below the water table to determine the distribution of contaminant mass in aquifer material. If most of the contaminant mass is at or near the water table, it may be possible to locally lower (e.g., combined air and water extraction wells) the water table for soil venting application.
5. Consider conducting a field or pilot scale test on site to evaluate VOC removal from soils.

As shown in Figure 1, the RSKERL Technology Support Center responded to 35 site specific technical assistance requests in FY 1988 with this number growing to 47 in FY 1989 and 63 in FY 1990. Many of these requests have resulted in activities at a site that continue intermittently over several years. A projection of this trend suggests that the TSC will be faced with responding to more than 80 new requests for assistance at Superfund sites during the coming fiscal year.

Subsurface remediation technology has probably received less than five years of serious scientific attention and at this point is not well developed; therefore, any ground-water remediation project is somewhat of a research project. The TSC works closely with RSKERL scientists in assuring that its approach to subsurface remediation is fully appreciative of the current scientific understanding of subsurface contaminant transport and fate processes. While TSC staff members are playing an increasing role in RSKERL research activities, researchers are also increasing their role in subsurface remediation technical assistance projects. Questions raised on many of these projects relate to active areas of research at RSKERL and the TSC provides a unique opportunity for early application of research results as well as providing field sites for research. Steps are being taken to increase the number of Superfund sites, like Traverse City and St. Joseph, MI, where the latest technical innovations which have shown promise for success at smaller scales can be demonstrated at field scale.

Work is under way to develop a first generation artificial intelligence system for subsurface remediation guidance. The logic structure of the system will be based on experience gained from RSKERL TSC activities as well as the research findings of RSKERL and its affiliates. The "Subsurface Methods for the Assessment of Remediation Technologies" (SMART) system will guide regulators in evaluating applicable remediation systems and assist in the selection of innovative remedial designs. In addition to being a user friendly guide for selecting appropriate site dictated remediation technologies, or combinations of technologies, SMART will serve as a focus for research needs as well as research products.

Mathematical modeling is playing an increasingly important role in the decision-making process at hazardous waste sites from estimating the risks associated with no remedial action to evaluating the performances of in-place remediation technologies. The Technology Support Center at RSKERL has established the RSKERL Center for Subsurface Modeling Support (CSMoS). CSMoS distributes and services all models and software developed at RSKERL and provides assistance and training on contaminant transport modeling applications in the saturated and unsaturated subsurface environment. CSMoS is composed of RSKERL scientists and supported by the International Ground Water Modeling Center (IGWMC), the National Center for Ground Water Research (NCGWR), and a number of leading ground-water modeling consultants.

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. Sub-contractors under the umbrella of the RSKERL TSC are available to conduct site specific treatability studies of in-situ technologies, such as soil vacuum extraction, soil and ground-water bioremediation, and pump and treat, for the Regions.

Site characterization, subsurface remediation, and predictive modeling are all founded in great measure on an understanding of the processes controlling contaminant transport and transformation in the subsurface environment. This understanding also serves as the foundation for those activities carried out by the interdisciplinary team of scientists and engineers of RSKERL's Technology Support Center. The experience and research findings of RSKERL are also applicable to other issues of paramount importance to EPA, and have been directed in an unstructured way to some of these issues. The Office of Solid Waste has identified RCRA corrective action technical support as a major OSW priority and efforts are under way to expand the TSC to address this program in a more comprehensive manner. The Well-Head Protection and Underground Injection Control (UIC) Programs within the Office of Water are also requiring additional technical support at the Regional and State level.