

Statement of Qualifications

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STATEMENT OF QUALIFICATIONS

Who We Are: TRC Raviv Associates, Inc. (TRC Raviv), founded in 1981, is an environmental and engineering consulting firm located in Millburn, New Jersey. TRC Raviv specializes in the evaluation, investigation and remediation of sites impacted by soil and ground water contamination. We are recognized as one of the premier New Jersey environmental and engineering firms for our technical and regulatory expertise and experience in many landmark environmental cases. With a professional staff of highly qualified scientists and engineers in one location, every client can rely on project team continuity and consistent, high quality service.

Range of Services: TRC Raviv has provided a broad range of environmental services on more than 2,000 projects in New Jersey and elsewhere for a diverse group of clients including manufacturing, petrochemical and pharmaceutical companies, real estate developers, lending institutions, insurance companies, law firms and municipal organizations. Our work has earned us a reputation for providing practical, cost-effective solutions for a wide array of environmental problems.

TRC Raviv provides complete environmental and engineering consulting services ranging from site assessment to site closure. Our services include civil and environmental engineering; soil and ground water remediation; and underground storage tank (UST) closures/upgrades. TRC Raviv has been retained by leading law firms to provide expert testimony and technical support on a wide variety of environmental litigation cases. Descriptions of TRC Raviv services are provided below.

Our People: TRC Raviv's highly experienced staff in the fields of hydrogeology, soil science, environmental science, and engineering is fully versed in the regulatory requirements that drive environmental investigation and remediation projects. Much of our expertise involves work with National Priority List (NPL) Superfund sites, as well as compliance with New Jersey's Industrial Site Recovery Act (ISRA) and Resource Conservation Recovery Act (RCRA).

Several TRC Raviv senior staff members have held high positions with the New Jersey Department of Environmental Protection (NJDEP), and continue to serve on regulatory advisory committees. With this expertise, TRC Raviv can successfully negotiate streamlined approaches to remedial programs which benefit our clients by controlling costs and expediting regulatory approvals. Profiles of senior staff members are provided in a later section and our Organizational Chart is included as Appendix A.

Focus on Clients: The majority of our clients are referrals from other satisfied clients or repeat business from long-term clients. Regardless of project size, with TRC Raviv the client can expect to be provided with an unsurpassed level of service that is designed to achieve project goals on time and within budget. A select list of clients is provided in Appendix B. Case histories illustrating our expertise in negotiating cost-effective solutions for clients are provided in Appendix C.

ENVIRONMENTAL SERVICES

Phase I Environmental Site Assessments

TRC Raviv prepares Phase I Environmental Site Assessment and Preliminary Assessment Reports (PARs) for commercial and industrial properties in accordance with the American Society for Testing and Materials (ASTM) Standard, as well as the NJDEP's *Technical Requirements for Site Remediation*, N.J.A.C. 7:26E *et seq.* The purpose of these assessments is to identify potential areas of environmental concern (AOCs) by evaluating activities involving hazardous substances; current and historical site use; existing environmental reports and data; and other historical information. In addition, TRC Raviv performs a site inspection and conducts interviews with pertinent individuals including state and local regulatory officials. Based on an analysis of the information collected, TRC Raviv's Environmental Site Assessment Reports include recommendations for Phase II Site Investigation (SI) sampling of soil and/or ground water, or, if no relevant AOCs are identified, TRC Raviv will recommend that no further actions are necessary.

TRC Raviv has performed hundreds of Phase I Environmental Site Assessment Reports and PARs for a variety of clients including lending institutions, real estate developers, and buyers and sellers of industrial and commercial properties. Our Site Assessment Group provides our clients with a high quality, thorough and detailed assessment designed to limit future environmental liability, satisfy due diligence and innocent purchaser defense requirements, and complete the first step of New Jersey's site remediation process.

Summary of Phase I Environmental Site Assessment Services

- Review Available Environmental Information
- Conduct Interviews
- Contact Regulatory Agencies
- Conduct File Reviews
- Interpret Historical Aerial Photographs
- Evaluate Sanborn Fire Insurance Maps
- Review Environmental Database Search Reports
- Prepare Cost-Effective Phase II SI Workplan
- Identify Asbestos-Containing Materials
- Describe Physical Setting and Geology
- Evaluate Potential Off-Site Impacts
- Prepare Site Plans
- Provide Owner and Operator History
- Identify Areas of Concern
- Assess Regulatory History
- Perform Environmental Site Inspection

Underground Storage Tanks

TRC Raviv offers turnkey services in all aspects of underground storage tank management. Our staff is highly trained and qualified to provide all necessary services ranging from evaluation and testing of existing tanks to tank removal and replacement. To comply with state and federal underground tank requirements, TRC Raviv can develop, implement, and maintain an underground tank program for our clients to avoid regulatory enforcement problems, minimize risks and reduce the potential for future liability. Tank management programs typically include registration, leak detection, corrosion protection, and spill and overflow containment. TRC Raviv is also fully qualified and capable of managing upgrades of existing tanks to meet new state and federal requirements.

As a company, TRC Raviv is certified by the State of New Jersey to perform subsurface evaluations, and most of the staff has been certified by the New Jersey Department of Environmental Protection (NJDEP) as subsurface evaluators. TRC Raviv's senior staff members have been teaching the NJDEP-required UST Regulatory Training Course at Rutgers University since 1991, as approved by the NJDEP's Underground Storage Tank Certification Program. We have also developed and conducted in-house above ground and underground storage tank management training programs for our industrial clients.

Summary of Underground Storage Tank Services

- Regulatory Evaluations
- Tank and Line Integrity Testing
- Tank Closure Plans
- Tank Removal
- Monitoring Well Installation
- Soil and Ground Water Sampling
- Soil Remediation
- Product Recovery Systems
- Ground Water Treatment Systems
- Innovative Treatment Technologies
- Tank Installation
- Corrosion Protection
- Permitting and Registration
- Leak Detection Systems
- Secondary Containment
- Vault Systems
- Tank Management Programs
- Training

Soil and Ground Water Investigations

Since 1981, TRC Raviv has conducted more than 1,500 investigations of soil and ground water contamination involving a variety of contaminant sources ranging from small spills of hazardous materials to Superfund sites. TRC Raviv offers a complete line of services related to the characterization and delineation of soil and ground water contamination. Our staff includes hydrogeologists, engineers, and soil scientists who have extensive experience evaluating soil and ground water contamination, assessing the need for remedial action and developing remedial systems where warranted.

The investigation of contaminant sources is often complex and requires a review of current and historical activities. Subsurface investigations require understanding the behavior of contaminants in the soil and ground water matrices. TRC Raviv incorporates innovative strategies early in the project to reduce the number and complexity of investigative phases required to complete contaminant delineation and develop cost-efficient remedial alternatives. Some of these strategies are listed below.

- Determine if historic fill material is present beneath the site. The NJDEP has provided reduced sampling requirements and presumptive remedies for historic fill material.
- Use real time ground water delineation techniques (e.g., hydropunch sampling) to select optimal monitoring well locations. Minimizing the number of permanent monitoring wells can reduce long-term monitoring costs.
- Collect biogeochemical ground water quality data to determine the extent of naturally occurring biodegradation in the subsurface. Documenting and sometimes enhancing the natural attenuation of ground water contamination can significantly reduce remediation costs.
- Sample for ground water quality parameters that can affect potential ground water treatment technologies. Collection of these data early in the project can assist in the evaluation of the feasibility and costs of various alternative remedies.

Summary of Soil and Ground Water Investigation Services

- Site Evaluation
- Soil Borings and Soil Sampling
- Soil Gas Surveys
- Test Pit Investigations
- Database Management
- Monitoring Well Installation and Ground Water Sampling
- Ground Water Sampling
- Aquifer Testing and Ground Water Modeling
- Fate and Transport Determinations
- Trend Analysis

CIVIL AND ENVIRONMENTAL ENGINEERING

TRC Raviv's civil and environmental engineers provide specialty services in the following disciplines:

- **Soil and Ground Water Remediation**

Once the characterization and delineation of the extent of contamination has been completed, and the need for remediation has been determined, TRC Raviv can provide turn-key design, construction and operation and maintenance services for a variety of remedial technologies.

- **Brownfields and Site Engineering**

TRC Raviv provides full engineering services for the redevelopment of older industrial sites, contaminated sites, or sites that require special considerations prior to re-development. Our engineers can develop the site plans, design the site infrastructure, handle all permitting and regulatory issues, and integrate the redevelopment with the remediation of the site.

- **Geotechnical Engineering**

TRC Raviv provides both traditional and environmental geotechnical engineering services. Services range from the design of foundations, retaining walls, pavements, embankments, and rock slopes, to the design of site dewatering systems, encapsulation systems, soil stabilization, and the use of stabilized dredge spoils.

- **Landfill Engineering**

TRC Raviv provides complete investigation and design services for the closure of old landfills, and the on-going operation of environmental protection systems for existing landfills. Our engineers have designed landfill closures to incorporate future development on top of the closed landfill.

- **Pollution Prevention**

TRC Raviv develops spill and pollution prevention plans and engineering designs for tank farms, loading facilities, and storage facilities. These plans and designs provide environmental protection and satisfy the requirements of regulatory agencies.

Each of these Environmental Engineering Services are discussed in the following sections.

Soil and Ground Water Remediation

TRC Raviv has more than 20 years of experience in remediating contaminated soil and ground water, and has designed and operated many conventional and innovative remediation systems. Our engineers are dedicated to staying abreast of the latest developments in soil and ground water remediation and regulatory issues.

TRC Raviv engineers can provide turn-key remedial services. For many clients, TRC Raviv manages all aspects of the remediation project from the initial investigation phases through remedial action selection, design, construction, and system operation to final closure. TRC Raviv can provide guaranteed fixed-cost remediation plans in which there is no risk of cost overruns.

TRC Raviv has licensed wastewater treatment plant operators and mechanical technicians who provide complete operation and maintenance services for remediation systems. We own a variety of portable, trailer mounted systems that can be used for pilot testing or full-scale operations. These systems include high and low vacuum pump systems, an air sparging system, conventional pumping systems, a vapor-phase carbon regeneration system, and a warehouse full of pumps and other mechanical equipment.

Summary of Soil and Ground Water Remediation Services

- Cost-Effective Remedial Strategies
- Turn-Key Design and Construction
- Fixed-Cost Site Remediation
- Construction Management
- Operation and Maintenance Services
- Pilot Testing
- Regulatory Compliance
- Permitting
- Licensed Wastewater Treatment
- Plant Operators

Technologies

- Monitored Natural Attenuation
- Free Product Recovery
- Pump and Treat
- Vacuum Extraction
- Air Sparging
- Bioremediation
- Thermal Oxidation and Desorption
- In-Situ Oxidation
- Soil Fixation/Stabilization
- Soil Vapor Extraction
- Reaction Walls
- Hydraulic Barriers
- Containment Systems

Brownfields and Site Engineering

Brownfield sites are inactive commercial and industrial sites which contain historic soil and ground water contamination. Often these sites are vacant and unproductive properties but are located in areas where the site could be returned to beneficial use. TRC Raviv civil and environmental engineers specialize in developing and integrating the site plans and remediation plans for the redevelopment of Brownfield sites. These projects often involve redesigning the entire infrastructure for the site. At TRC Raviv, engineers work with in-house regulatory specialists to develop value-engineered solutions that meet regulatory requirements.

TRC Raviv provides engineering design and construction management services, which includes developing engineering cost estimates, obtaining construction bids, and providing owners with recommendations for contractor selection. During construction, TRC Raviv can manage the technical, budgetary, and field supervision aspects of a Brownfields redevelopment project.

Summary of Brownfield and Site Engineering Services

- Site Plans and Infrastructure Design
- Global Site Remediation Design
- Full Engineering and Regulatory Permitting Services
- Regulatory Guidance
- Real Estate Transaction Guidance
- Risk Assessment
- Project Management
- Construction Inspection Services
- Expert Testimony

Geotechnical Engineering

TRC Raviv provides traditional geotechnical engineering services including the design of foundations, retaining walls, embankments, and pavements. These projects usually involve performing subsurface investigations using borings and monitoring wells, followed by laboratory testing of representative soil and ground water samples. Based on these field and laboratory investigations, TRC Raviv works with the client to develop value-engineered solutions to site development.

TRC Raviv specializes in environmentally focused geotechnics which includes the design and construction of environmental encapsulation systems, lagoon closures, and sludge stabilization. Encapsulation systems include the use of compacted fills, clay and synthetic liners, slurry walls, sheet piling, hydraulic barriers, deep soil mixed in-place barriers, and reaction walls.

TRC Raviv has designed several projects employing the use of stabilized dredge spoils. Stabilized dredge spoils have recently become economically attractive for use in the construction of compacted fills and encapsulation systems for landfills and contaminated sites. Many projects are located in industrialized areas of New Jersey, where landfills or Brownfield sites are being redeveloped for beneficial re-use.

Summary of Geotechnical Engineering Services

- Soil, Rock, and Ground Water Investigations
- Foundations
- Pavements and Roadways
- Retaining Walls
- Embankments
- Rock Slope Stability
- Construction Dewatering
- Field Inspection Services
- Laboratory Testing
- Encapsulation Systems
- Lagoon Closures
- Sludge and Soil Stabilization
- Clay Liners
- Geosynthetic Liners
- Slurry Walls
- Hydraulic Barriers
- Reaction Walls

Landfill Engineering

TRC Raviv provides complete landfill engineering services. Whether the project is for the closure of an old landfill, or the on-going operation of an active landfill, TRC Raviv provides engineered solutions. Landfill projects often include the design and permitting of capping, gas venting, and leachate collection systems. TRC Raviv has also performed several landfill redevelopment projects that involve the closure and subsequent beneficial re-use of the landfill for recreational, commercial, or industrial purposes.

Summary of Landfill Engineering Services

- Subsurface Investigations
- Landfill Closures
- Landfill Redevelopment
- Leachate Collection Systems
- Gas Collection Systems
- Modeling and Risk Assessment
- Permitting
- Operation & Maintenance

Pollution Prevention

TRC Raviv develops spill and pollution prevention plans for large and small sites. Our engineers have designed containment systems for multi-million gallon petroleum storage tanks for major oil companies. We have also designed spill containment structures for smaller facilities, including truck loading terminals and smaller storage tank areas. TRC Raviv has assisted our industrial clients in evaluating and upgrading existing spill containment systems, and developing standard operating procedures (SOPs) for spill prevention systems for compliance with current regulatory requirements.

TRC Raviv also provides construction management, engineering field supervision, and engineering certification of containment system construction.

Summary of Pollution Prevention Services

- Spill Prevention Control Countermeasure (SPCC) Plans
- Discharge Prevention Control and Countermeasure (DPCC) Plans
- Stormwater Pollution Prevention Plan (SPPP) Plans

REGULATORY COMPLIANCE

New Jersey's Industrial Site Recovery Act (ISRA)

The New Jersey State Legislature enacted the Environmental Cleanup Responsibility Act (ECRA) in 1983. The Act was amended in 1993 and is now known as the Industrial Site Recovery Act (ISRA). Compliance with ISRA requires an assessment of all subject industrial establishments prior to selling a property, transferring a business, or ceasing operations. TRC Raviv has handled more than 500 ECRA/ISRA cases and is intimately familiar with the regulations, policies, and technical requirements associated with the program.

The NJDEP has developed a multi-phased approach for achieving ISRA compliance that can be both time-consuming and costly. As a result, TRC Raviv's ISRA group, headed by a former NJDEP ISRA Bureau Chief, continually strives to streamline the ISRA process by combining and reducing phases whenever possible. The identification and evaluation of potential remedial options early in the investigative process can ensure the timely selection of the most cost-effective remedial alternative. We have successfully used these strategies to the benefit of our clients, and they have been accepted by case managers at the NJDEP. Our goal is to facilitate the ISRA compliance process and control costs.

Summary of ISRA Services

- Pre-ISRA Environmental Inspections
- Applicability Applications
- Remediation Agreement Applications
- Preliminary Assessment Reports
- Site Investigations
- Remedial Investigations
- Remedial Action Work Plans
- Monitoring Well Installation
- Soil and Ground Water Sampling
- Soil Remediation
- Ground Water Treatment Systems
- Cleanup Supervision
- Final Remedial Action Reports
- Negative Declaration Applications

Hazardous Waste Management (RCRA)

TRC Raviv offers a full range of services for hazardous waste management and Resource Conservation and Recovery Act (RCRA) compliance, ranging from waste classification and management to permitting and enforcement compliance. Our staff has worked on RCRA permitting and compliance issues since the inception of the RCRA program in 1980. TRC Raviv is thoroughly familiar with the current requirements of the federal regulations implementing RCRA and the Hazardous and Solid Waste Amendments (HSWA). Our staff members have negotiated streamlined strategies for large RCRA Corrective Action sites. TRC Raviv can assist clients with RCRA-related issues involving hazardous waste management, corrective action, land ban, the toxic characteristic leaching procedure (TCLP), and state and federal hazardous waste regulations. Our experience is essential to ensuring cost-effective regulatory compliance.

Summary of RCRA Services

- Manifesting
- Treatment, Storage and Disposal Permits
- Land Treatment Permits
- Underground Tank Permits
- Underground Injection Control
- Minimum Technology Standards
- Land Ban Requirements
- Waste Testing and Analysis
- Waste Classification
- Part B Permits
- Exemptions
- Delisting Petitions
- Facility Compliance Inspections
- Enforcement/Compliance Assistance
- Annual/Biennial Reports
- TCLP Testing
- Waste Minimization
- Corrective Action
- RCRA Facility Assessments
- RCRA Facility Investigations
- Corrective Measures Studies
- Corrective Measures Implementation
- Ground Water Monitoring Assessment
and Remediation Plans
- RCRA Closure Design
- RCRA Closure Financial Requirements
- RCRA Monitoring Strategies Analysis

Superfund (CERCLA/SARA)

TRC Raviv's staff has experience at more than 50 Superfund sites in New Jersey, New York, Pennsylvania, Puerto Rico and the U.S. Virgin Islands. We have served as the principal investigators, and have monitored private and publicly-funded cleanups for potentially responsible parties (PRPs). Our clients include industries, PRP Groups, law firms, municipalities, and citizen groups.

Our specialists understand the complexity of the federal Superfund law and have the technical background to evaluate complicated sites and develop practical solutions. We have effectively utilized our extensive experience investigating soil and ground water contamination to solve the many types of problems inherent at Superfund sites. TRC Raviv can provide services for every phase of Superfund site evaluation including the identification of other PRPs, remedial investigations, feasibility studies, the evaluation of remedial alternatives, remedial design, construction oversight, and operation, maintenance and monitoring of remediation systems.

TRC Raviv is always prepared to use its extensive expertise in a variety of adjudicatory forums, including state and federal courts, to support and defend its findings.

Summary of Superfund Services

- Remedial Investigations (RI)
- Feasibility Studies (FS)
- Remedial Design and Implementation
- Operation and Maintenance
- Responsible Party Investigations
- Litigation Support
- Expert Reports
- Expert Testimony

Ecological Evaluations and Natural Resource Damage Assessments

Regulatory agencies have recently begun to impose increased requirements for ecological evaluations at industrial facilities and environmental remediation sites. Information generated during an ecological evaluation can potentially be used by regulatory agencies for natural resource damage assessments (NRDAs). New Jersey has launched the country's first state Natural Resource Damages Program, indicating they will fine responsible parties for impacted or lost natural resources. The technical and regulatory issues associated with ecological evaluations and natural resource damage assessments can be very complex, with significant implications for future environmental liability, and typically require an inter-disciplinary approach.

TRC Raviv's trained scientists, engineers and regulatory experts provide a unique combination of technical and regulatory expertise to successfully address ecological and natural resource damage assessments. One of TRC Raviv's Senior Staff members was retained by an industry consortium to draft a position paper on the regulatory aspects of the NJDEP's Program. The experienced staff at TRC Raviv has successfully completed ecological evaluations at a number of environmental compliance/remediation sites, and has provided valuable input related to large natural resource damage assessments cases. TRC Raviv performs Baseline Ecological Evaluations (BEEs) and Ecological Assessments, as required by the New Jersey *Technical Requirements for Site Remediation*, using USEPA and NJDEP guidance documents, geographic information system (GIS) electronic database maps, and the most current available technical resource information.

Summary of Services

- Baseline Ecological Evaluations
- NRDA Evaluations
- Preparation of GIS Electronic Database Maps
- Review of Federal and State Wetland Maps
- Environmentally Sensitive Natural Resources Identification
- Ecological Evaluation Inspections
- Ecological Impact Analysis and Risk Assessment
- Environmental Fate and Transport Evaluation
- Bioassay Test Design and Data Evaluation
- Surface Water and Sediment Sampling

GROUND WATER SUPPLY

An adequate, safe, ground water supply is a key resource for the development of municipal, industrial, commercial, and residential projects. Our water supply clients have included municipal and county utilities, private water companies, industries, and developers. TRC Raviv staff have conducted ground water supply development projects for more than 20 years.

Our staff hydrogeologists and engineers are thoroughly familiar with the technical aspects of ground water exploration and resource management. We have developed water supplies under a wide variety of geologic conditions, and have assisted well field operators to maximize individual well yields, minimize pumpage costs and manage well fields optimally. Our staff are thoroughly familiar with the permitting requirements of the NJDEP's Bureau of Water Allocation and have worked closely with geologists in the New Jersey Geologic Survey to address their concerns regarding watershed management.

Based on our extensive ground water expertise, we can provide the following technical services to meet the water resource needs of our clients.

Summary of Ground Water Supply Services

- Regional Aquifer Assessments
- Site Selection and Evaluation
- Aerial Photograph Analysis
- Ground Water Exploration Programs
- Well Design
- Well Installation
- Drilling and Construction Supervision
- Geophysical Surveys
- Redevelopment and Well Yield Enhancement
- Hydrogeologic Fracture Trace Analysis
- Production Well Pumping Tests
- Ground Water Yield Analysis
- Watershed Yield Analysis
- Ground Water Modeling
- Water Diversion Permits
- Storage/Distribution Systems
- Water Resource Management
- Well Field Management

LITIGATION SUPPORT

In today's society, litigation plays an ever-increasing role in environmental matters, due in part to the increased emphasis on enforcement by regulatory agencies. Often the key to successful environmental litigation is having a more complete and accurate understanding of the environmental "facts" than the opposition. TRC Raviv has the technical expertise and the litigation experience to evaluate complex environmental circumstances, collect the correct data to quantify unknowns, and assemble the information in a readily understandable format. The company has represented potentially responsible parties, property owners, industries, insured parties, insurance companies, municipalities and citizens' groups and has served as a special technical advisor to numerous law firms.

TRC Raviv Senior Staff have served as experts on landmark environmental lawsuits. With more than two decades of experience in environmental litigation, TRC Raviv can provide a wide variety of litigation support needs including preliminary investigations, historical site reviews, potential responsible party identification, discovery, pre-trial preparation, trial support, settlement negotiations, and the preparation of expert reports and expert testimony. We are well equipped to supply the high-level technical expertise necessary for litigation and will present and defend our findings and conclusions in an effective and professional manner.

Summary of Litigation Support Services

- Environmental Inspections
- Site Investigations
- Potential Responsible Party Identification
- Discovery
- Pre-Trial Preparation
- Public Hearings and Meetings
- Administrative Hearings
- Insurance Cost Recovery
- Expert Testimony
- State Court
- Federal Court
- Settlement Negotiations
- Expert Report Preparation
- Exhibit Preparation
- Trial Support

PROFILES OF SENIOR STAFF

JOHN J. TRELA, Ph.D., PRESIDENT

Dr. Trela has more than 25 years experience as a specialist in hazardous waste management, soil and ground water remediation, litigation support, regulatory compliance, and the environmental aspects of real estate transactions. He provides technical direction for individual projects and consults with clients and TRC Raviv's professional staff. His combination of technical knowledge and in-depth understanding of regulatory requirements enables TRC Raviv's staff to focus on the major areas of concern in each investigation and work toward sensible solutions. Before joining TRC Raviv, Dr. Trela was Assistant Commissioner of the NJDEP's Hazardous Waste Management Program with responsibility for all hazardous waste programs in New Jersey. Among his responsibilities were the Program's operations and direct oversight of a \$2.5 billion public and private cleanup program.

He also served as Director of the NJDEP's Division of Hazardous Waste and as Chief of the NJDEP's Bureau of Ground Water Quality Management. During his tenure with the NJDEP, Dr. Trela developed and implemented many new and innovative programs. Most notable among these are the responsible party hazardous waste site cleanup program and the NJPDES ground water permit program. He authored the New Jersey Ground Water Standards and served as the chairperson of an NJDEP task force committee responsible for developing statewide cleanup standards.

Dr. Trela is an expert on soils and ground water investigations and remediation under a broad spectrum of regulatory programs such as RCRA, CERCLA, ISRA, Spill Fund cleanups, and NJPDES ground water permits. He has published and lectured extensively on environmental cleanup and hazardous waste management issues. His reputation as an effective witness has led to his frequent appearances before legislative bodies, in court and in administrative forums. Dr. Trela has served as an advisor to the USEPA, the Coalition of Northeast Governors, New Jersey Institute of Technology and the Wharton School of the University of Pennsylvania.

KENNETH B. SIET, VICE PRESIDENT, MANAGER, REGULATORY COMPLIANCE

Before joining TRC Raviv, Mr. Siet was employed by the NJDEP for 8 years, most notably as Chief of the Bureau of Ground Water Pollution Abatement, where he was responsible for the development of many of the ground water and soil regulations that are in effect today. He continues to participate in the preparation of regulatory guidelines while serving on RCRA and CERCLA advisory committees at the USEPA and NJDEP. Mr. Siet is thoroughly familiar with New Jersey's environmental regulations and is able to provide clients with an in-depth understanding of the regulatory requirements pertaining to their sites. His expertise has been invaluable in helping clients develop comprehensive, cost-effective approaches to compliance. He is particularly adept at assisting clients with issues relating to ground water, major oil refineries, Superfund, and RCRA corrective action. He has testified as an expert witness on environmental issues in both state and federal court.

DAWN M. POMPEO, DIRECTOR, DUE DILIGENCE & ISRA COMPLIANCE

Ms. Pompeo has over 15 years experience involving environmental compliance and real estate transactions. Before joining TRC Raviv, Ms. Pompeo was employed by the NJDEP as a Bureau Chief in the ECRA Program. As a result of Ms. Pompeo's familiarity with the technical and administrative aspects of the NJDEP's current ISRA program, she is able to provide TRC Raviv's clients with investigative strategies and remedial alternatives designed to streamline the NJDEP ISRA compliance process. Under Ms. Pompeo's supervision, TRC Raviv adeptly conducts environmental investigations and presents the results in straightforward technical reports that are easy for the client and the NJDEP to review. Her extensive experience helps TRC Raviv's clients to comply with the regulatory and technical requirements of the ISRA program in a timely and cost-effective manner. Ms. Pompeo's expertise allows her to evaluate properties for potential environmental liabilities that our clients face as part of real estate transactions. She is able to effectively and efficiently assist clients with satisfying their due diligence and innocent purchaser defense requirements related to property acquisition.

DANIEL A. NACHMAN, CHIEF HYDROGEOLOGIST

Mr. Nachman joined TRC Raviv in 1996 after 17 years with Geraghty & Miller, Inc. At TRC Raviv, he is responsible for the technical and regulatory aspects of investigative and remedial projects, directs the firm's ground water supply efforts, and serves as an expert witness for environmental litigation.

With Geraghty & Miller, Mr. Nachman directed a wide range of ground water supply and contamination investigations in New Jersey, New York, Pennsylvania, Puerto Rico, and the U.S. Virgin Islands. He supervised Remedial Investigation/Feasibility Study (RI/FS) projects at a variety of petroleum, chemical, electronic, and pharmaceutical facilities, and developed ground water supplies for municipalities, private water companies, and industries. He managed Geraghty & Miller's New Jersey and Puerto Rico offices and was the first director of that firm's RCRA program.

He has been the director and principal negotiator for cleanup projects under a broad range of federal and state regulatory programs, including CERCLA, RCRA, ECRA/ISRA, and the New Jersey Spill and Water Pollution Control Acts. Mr. Nachman has lectured at various courses and seminars and has made presentations in English and Spanish on behalf of clients at public hearings. Mr. Nachman is currently the principal lecturer at an annual 4-day course in Hydrogeology that the firm has presented through Rutgers University since the late 1980s. He has served as an expert in various aspects of environmental litigation.

MARC FAECHER, VICE PRESIDENT, GENERAL COUNSEL FOR TRC RAVIV ASSOCIATES, INC. AND VICE PRESIDENT OF TRC COMPANIES, INC.

Mr. Faecher assists clients in the acquisition and development of environmentally impaired properties using TRC's Exit Strategy® environmental liability elimination program, coupled with TRC's full-service, turn-key expertise in environmental remediation, engineering, risk management and real estate development. He routinely works with corporations and developers throughout the greater NY/NJ Greater Metropolitan area in structuring programs designed to manage cleanup liability and to redevelop underutilized Brownfield sites.

Prior to joining TRC, Mr. Faecher was a partner in a major New Jersey law firm where he regularly represented clients before the New Jersey Department of Environmental Protection and the U.S. Environmental Protection Agency in permitting and enforcement actions. Mr. Faecher also handled pollution remediation matters, including compliance with the Industrial Site Recovery Act (ISRA) and the recovery of cleanup costs via contribution litigation, insurance coverage litigation and through State and Federal Brownfield and Innocent Purchaser Grant programs.

Mr. Faecher is a member of the environmental sections of the New Jersey and American Bar Associations. He is admitted to practice before the New Jersey State and U.S. District Courts, U.S. Court of Appeals for the Third Circuit and in the District of Columbia. Mr. Faecher received his J.D. Degree from the American University, Washington College of Law and a Bachelor of Arts Degree from Muhlenberg College.

NIDAL M. RABAH, Ph.D., P.E., DIRECTOR OF ENGINEERING

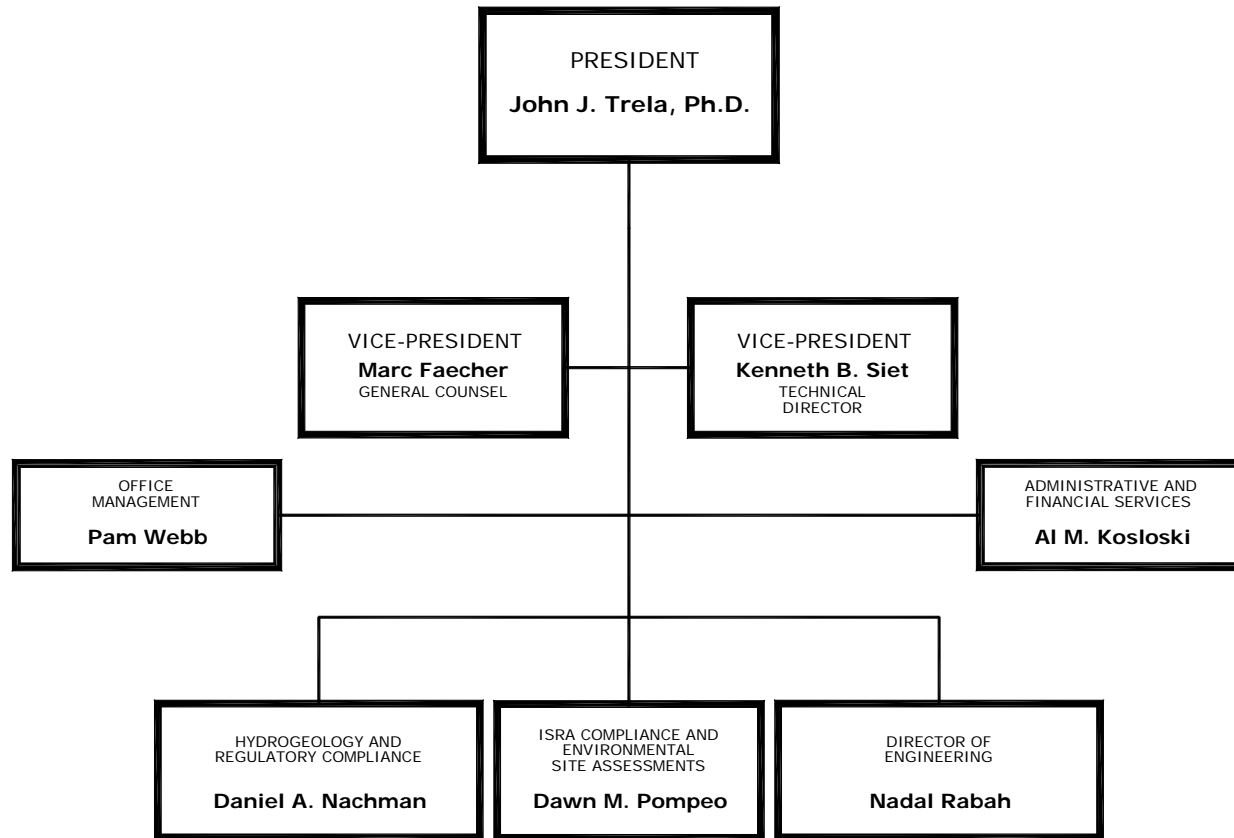
Dr. Rabah has more than 20 years of experience in environmental engineering and planning, soil and groundwater remediation, water resources engineering and planning, and litigation support. He is a licensed Professional Engineer and a Certified Project Management Professional. Prior to joining TRC Raviv in 2005, Dr. Rabah served as the Director of Engineering at the Remedial Technology & Engineering, Inc. (RTE) and an Associate of PMK Group where he oversaw the development and implementation of remedial strategies, design and technologies. He also served as the Manager of the Engineering Group at Dames & Moore, Inc. in New Jersey.

Dr. Rabah has in-depth experience in the planning and management of large-scale, multi-faceted remedial investigation/feasibility study and engineering and environmental construction management projects. He has led complex multi-million dollar environmental remediation and Brownfield Redevelopment programs at numerous industrial, commercial and public facilities, utilities & MGP facilities, airports, fuel depots, and landfills under various state and federal regulatory programs. He has extensive experience in the design, implementation and operation & maintenance (O&M) of a wide-range of soil, groundwater and free product remedial technologies and systems. He is experienced in groundwater flow and transport modeling.

Dr. Rabah managed large international infrastructure development and capacity building projects including water, wastewater, and solid waste strategic and master plans that were sponsored by international institutions such as the World Bank, UN Development Program, and US Agency for International Development. He also served as a Technical Expert on many projects and environmental litigation cases in New Jersey, New York and Connecticut. He developed technical strategies, evaluated the fate and transport of contamination, used modeling and forensic analyses for plume age dating, prepared exposure and cost estimates for settlement negotiations and liability allocation, and provided expert testimony in depositions.

APPENDIX A
Organizational Chart

TRC Raviv Associates, Inc.



APPENDIX B

Select List of Clients

SELECT LIST OF CLIENTS

Aetna Insurance Co.
AIG Insurance Co.
Air-Liquide America Corp.
AKZO Nobel Coatings, Inc.
American Can Co.
American Honda Motor Co., Inc.
Amway Corp.
Anchor Glass Container Corp.
Bellemead Development Corp.
Berlex Laboratories
BICC Cables Corp.
Brodsky Organization
Cambrex Corporation
CBS, Inc.
Chesebrough Pond's USA
Chevron USA
Chrysler
Colgate – Palmolive
CON-LUX Coatings, Inc.
CPS Chemical Co., Inc.
Crown Cork & Seal Co., Inc.
EM Industries, Inc
Exxon Corporation
Flemington Bituminous Corp.
General Mills, Inc.
Givaudan-Roure Corporation
Guinness America, Inc.
Hatco Corporation
Hayward Industries, Inc.
Lockheed Sanders, Inc.
Mallinckrodt – Baker, Inc. (J.T. Baker, Inc.)
Meadox Medicals, Inc.
Midlantic National Bank
Minnesota Mining & Manufacturing (3M)
Mobil Oil Company
Mutual Benefit Life Insurance Co.
National Starch & Chemical Co.
Newport Associates Development Corp.
North Jersey District Water Supply Commission
Pamarco, Inc.
Phelps Dodge Copper Products Corp.
Prince Manufacturing, Inc.
Princeton Gamma Tech
Rolls-Royce Motor Cars, Inc.
Sketchley Public Limited Co.
The International Group
The Lefrak Organization
The West Company
Tilcon New Jersey
Tropicana Products, Inc.
United Water New Jersey
U.S. News & World Report
USX (U.S.Steel)
Warner Lambert Co.

APPENDIX C

Case Histories

**SUPERFUND SITE
SOIL AND GROUND WATER REMEDIATION
COST RECOVERY**

SITE / LOCATION: Chemical Manufacturing/Solvent Recovery Facility
Middlesex County, New Jersey

PROJECT HIGHLIGHTS:

- *Site-wide remedial investigation of soil and ground water*
- *Horizontal and vertical delineation of DNAPL source area*
- *Design and implementation of a Pump and Treat ground water remediation system involving air stripping with activated carbon control technology*
- *Design and implementation of a treated ground water recharge basin and injection wells*
- *Development of regional ground water flow, and fate and transport model to optimize remedial action design and predict future contaminant concentrations of the fugitive, downgradient plume impacting a major watershed recharge area*

PROJECT SUMMARY:

In 1969, the facility began producing and recovering valuable chemicals from off-site process products and residuals. In September 1983, the site was listed on the National Priority List (NPL) with the EPA after volatile organic compounds (VOCs) were detected in a major potable ground water supply area located hydraulically downgradient of the site. The major contaminant of concern, chlorobenzene, was detected in the vicinity of a production well which prompted immediate remedial action including the installation of high-yielding recovery wells within the potable well field recharge area upgradient of the production well to intercept the dissolved phase VOC plume.

TRC Raviv conducted soil and ground water investigations that revealed a source area of limited extent. In one of its first successful applications in New Jersey, hydropunch sampling was completed at specific depth intervals to delineate the source area both horizontally and vertically. Recovery wells were later installed at the areas exhibiting the highest VOC concentrations.

TRC Raviv demonstrated through pumping tests and pilot testing that significant cost savings could be achieved by containing the source area on-site rather than operating high-yielding downgradient recovery wells. As a result, a ground water recovery program with on-site treatment was implemented which reduced the recovery rate and increased the mass recovery of the VOCs by ten-fold.

TRC Raviv designed a ground water treatment system consisting of two parallel trains. Components include state-of-the-art, low profile, easily maintained, air strippers supplemented by vapor phase activated carbon for reducing air emissions. The availability of the facility's on-site steam generation was utilized to regenerate activated carbon vessels, reducing maintenance costs. Treated ground water was injected within a recharge basin with injection wells designed by TRC Raviv, upgradient but within the capture zone of the recovery wells to reduce the discharge limitations.

A ground water flow and fate and transport model were utilized to show the regulatory agencies that future VOC concentrations downgradient of the on-site recovery system would degrade before impacting the potable supply wells. Hence, ground water recovery from the high-yielding wells downgradient of the site was terminated, resulting in a significant cost savings for the company.

Miscellaneous tasks included recovery of costs for ground water impacts from another Superfund site located hydraulically upgradient of the site. A specialized remedial investigation by TRC Raviv revealed compelling evidence that prompted settlement of the legal case.

**BROWNFIELDS REDEVELOPMENT
SOIL AND GROUND WATER INVESTIGATION AND REMEDIATION
DNAPL (COAL TAR PRODUCT) RECOVERY
CLASS IIIB AQUIFER DESIGNATION
NJPDES PERMITTING
COST RECOVERY**

SITE / LOCATION: Former Manufactured Gas Plant
Hudson County, New Jersey

PROJECT HIGHLIGHTS:

- *Site-wide remedial investigation of soil and ground water*
- *Horizontal and vertical delineation of DNAPL source area*
- *Design and implementation of coal tar recovery pilot testing program involving a unique methodology of product upwelling*
- *Design, implementation and operation of a coal tar recovery system for an interim remedial measure (IRM)*
- *Determination of a Class IIIB aquifer designation for on-site saline water-bearing zones for development of site-specific, alternative ground water quality criteria*

PROJECT SUMMARY:

The 300-acre property is located along the western shore of the Hudson River at its confluence with Upper New York Harbor. Historically, the property was occupied by a former coal gasification or manufactured gas plant (MGP site), rail yards, warehousing and shipping docks, and in later years, a former gasoline service station. The current shoreline of the property has been created by historic backfilling; much of the property was below water prior to filling activities in the first half of the 20th century. Contaminants detected at the site include historic fill with elevated base neutrals (including polynuclear aromatic hydrocarbons [PAHs] and metals); coal tar product from the MGP; and petroleum-based constituents from the former service station and other historic operations on the property.

In the early 1980s, the barren property was recognized as a potential site for commercial and residential redevelopment. Today, despite the historic contamination, creative remedial measures have been implemented allowing redevelopment to go forward. Currently, the property includes a major regional shopping mall, office centers and high-income residential communities, and is one of the largest brownfields projects ever undertaken in New Jersey.

TRC Raviv Associates, Inc. (TRC Raviv) has been involved with the project since the early planning phases of the redevelopment. Initially, swift and comprehensive soil and ground water investigations were conducted in high priority areas prior to construction of infrastructure and buildings. Several areas required prompt remedial action prior to construction activities, including removal of a former subsurface gasholder containing liquid coal tar and a bioremediation system beneath the foundation of a major store.

More recent remedial efforts have focused on the coal tar product plume, which is the primary source of dissolved contamination in ground water. Investigations have revealed two areas containing coal tar product in both residual and free product phases. The extent of the coal tar product has been delineated horizontally and vertically within the complex lithology. Coal tar recovery pilot testing has taken advantage of a unique methodology. The major coal tar plume consists of a DNAPL with a specific gravity similar to seawater, which is known to upwell in areas where excessive ground water pumping (in water supply wells) occurs. The pilot testing induced coal tar flow, creating an upwelling of product in a well by reducing the water table elevation with a separate pump. The pilot testing results indicated that coal tar recovery could be increased by more than an order of magnitude when induced pumping was employed. The dissolved phase contamination in ground water was also delineated to reveal potential discharge points.

The latest focus of TRC Raviv's remedial investigation has involved the evaluation of the natural contamination of the water-bearing zones by saline waters of the Hudson River and potential pathways to the sensitive receptor, the Hudson River. Inexpensive analytical tests were included with the site-wide sampling events to delineate the non-potable saline ground waters at the site. Remedial investigation programs were tailored to evaluate potential contaminant migration pathways including subsurface utilities that transect the site, and direct ground water discharge to the Hudson River. The results of this latest remedial investigation satisfied requirements for a Class IIIB aquifer designation proposal. The Class IIIB aquifer designation will allow for development of site-specific, alternative remedial standards that will result in substantial cost savings in the remedial action effort.

An IRM remedial action has been installed and operating continuously for more than two years, recovering coal tar free product from the major coal tar plume. Current remedial efforts include the design of a more aggressive coal tar recovery system and development of Class IIIB site-specific, alternative remedial standards.

On-going miscellaneous tasks conducted by TRC Raviv at the site include NJPDES "discharge to surface water" permitting for construction dewatering activities and supervision of construction activities for compliance with a site-wide remedial plan.

LANDFILL CLOSURE BROWNFIELDS REDEVELOPMENT

SITE / LOCATION: Municipal Landfill
Middlesex County, New Jersey

PROJECT HIGHLIGHTS:

- *Remedial investigations of landfill materials, underlying soils, landfill leachate and gas, ground water, surface water, and sediments*
- *Obtained NJDEP approval of remedial action for the complex landfill closure and site re-development as a shopping center*
- *Project design includes filling 10-acres of wetlands, dynamic compaction of landfill materials, placing 2-million cubic yards of fill (stabilized dredge spoil), installing a landfill leachate and gas collection system, and construction of a shopping center with the buildings, asphalt pavement, and utilities supported by the capping system*

PROJECT SUMMARY:

The municipal landfill occupies 60 acres and is surrounded by wetlands and tidal water bodies. TRC Raviv Associates, Inc. (TRC Raviv) was retained by the developer to perform the environmental and civil engineering for the proposed landfill closure and brownfield redevelopment. This included extensive environmental and geotechnical investigations of the landfill materials, soil, ground water, and adjacent environmentally sensitive areas (i.e., wetlands, surface water). By combining the environmental and engineering investigations and designs, TRC Raviv developed a comprehensive redevelopment plan with substantial cost savings to the client.

TRC Raviv evaluated the environmental and geotechnical issues associated with future landfill settlement, and leachate migration and gas generation. To minimize post-closure settlements, a dynamic compaction program was designed to consolidate the existing landfill materials. A compacted stabilized dredge spoil capping system was designed to ensure the environmentally and structurally sound construction of buildings, pavement and utilities on the top of the closed landfill. It was determined that post-closure leachate collection would likely not be required.

The project received regulatory oversight by several different bureaus within the NJDEP, and was partially driven by regulatory permits. TRC Raviv managed the permit process for the project, and obtained the required permits on behalf of the client in a timely manner.

By utilizing our environmental, engineering and regulatory expertise, TRC Raviv obtained NJDEP approval of the Remedial Action Workplan which included filling 10 acres of adjacent wetlands, capping the landfill, construction of buildings, pavement and utilities on the capped landfill, and a short-term leachate and gas collection and treatment system. When implemented, the project will have substantial environmental and economic benefits to the host municipality.

**ISRA COMPLIANCE
SOIL REMEDIATION
GROUND WATER INVESTIGATION**

SITE / LOCATION: Petroleum Research and Development Center
Mercer County, New Jersey

PROJECT HIGHLIGHTS:

- *120 areas of concern have received No Further Action determinations*
- *Site-wide multimedia investigation of soil, ground water, surface water and sediments*
- *Active participation in marketing of property leading to eventual sale*
- *Investigation of chlorinated solvents in fractured bedrock*
- *Implementation of low-temperature thermal desorption for VOC-impacted soils*
- *Natural attenuation of ground water with the establishment of a CEA proposed*
- *Preparation of a Baseline Ecological Evaluation*

PROJECT SUMMARY:

The 440-acre site consisted of 20 buildings primarily engaged in research and development activities related to petroleum processing, energy conversion, and catalysis. TRC Raviv prepared a Preliminary Assessment Report that identified approximately 130 areas of concern. Several phases of investigative work were conducted by TRC Raviv in accordance with the NJDEP's *Technical Requirements for Site Remediation* without formal NJDEP workplan approval to assess the environmental conditions at the site in anticipation of a sale of the property, and to expedite the ISRA compliance process. As a result, our project team was able to accurately present the environmental quality and regulatory status of the facility to prospective purchasers.

Throughout the ISRA compliance process, TRC Raviv worked closely with the seller's Global Real Estate Team to market the property. TRC Raviv was responsible for presenting the environmental conditions of the site and explaining the nuances of the ISRA compliance process to a variety of potential buyers, their consultants, real estate brokers and attorneys. Numerous site inspections and meetings were conducted. TRC Raviv was instrumental in working with purchasers and their consultants who were seriously considering purchasing the property to satisfy due diligence requirements. The property was eventually sold in a timely manner prior to the completion of ISRA compliance.

One of the soil issues at the site was the persistent detection of beryllium in sediment and soil samples. To address this problem, TRC Raviv conducted a background investigation followed by a statistical analysis of the data to determine whether there was a statistical difference between on-site and background data sets. The statistical results indicated that the beryllium detected in on-site soils were naturally occurring. The NJDEP agreed, and no further investigation or remediation of elevated levels of beryllium was required.

To address soils below a drum storage pad contaminated with chlorinated solvents, TRC Raviv evaluated several remedial alternatives and selected on-site treatment via low-temperature thermal desorption. The low-temperature thermal desorption system utilized ex-situ steam stripping for the remediation of volatile organic compounds. The process involved loading the contaminated soil into two steel treatment processors in 10-ton batches. The time required to process each batch of soil was approximately 4 hours, as determined during a bench scale treatability study. A total of 77 tons of soil was remediated in this manner. The NJDEP issued a No Further Action Letter upon its completion. The low-temperature thermal desorption process was both cost-effective (approximately 50% less than disposal) and timely.

TRC Raviv prepared a Baseline Ecological Evaluation to evaluate potential adverse ecological impacts using site-specific data collected from on-site Environmentally Sensitive Areas and areas of concern. Based on the comparison of the contaminant concentrations to ecological screening criteria, TRC Raviv determined that the potential for contaminants of potential ecological concern to adversely affect biota were minimal. No further ecological evaluation was proposed to the NJDEP.

Following an initial ground water investigation at eight Areas of Concern, ten clusters of monitoring wells were installed in the overburden and bedrock aquifers at the site. Additional wells were installed to horizontally and vertically delineate dissolved volatile organic compound contamination. TRC Raviv calculated the fate and transport of three separate volatile organic compound plumes and presented a natural ground water remediation proposal with the establishment of a Classification Exception Area (CEA) to the NJDEP. Quarterly ground water monitoring has demonstrated that the concentrations are decreasing over time and confirmed the predicted fate and transport of the volatile organic compounds.

**ISRA COMPLIANCE (NJDEP)
TSCA COMPLIANCE (USEPA)**

SITE / LOCATION: Pharmaceutical Manufacturer
Morris County, New Jersey

PROJECT HIGHLIGHTS:

- *Saved client at least \$2.5 million and eliminated liability associated with off-site waste disposal by negotiating risk-based approval for capping PCB-impacted soil with concentrations greater than 100 ppm on-site. This remedy is the first approval of its kind in the nation under USEPA PCB regulations (the Amega-rule@) promulgated in August 1998*
- *Designed cap for in-place remediation of PCB-impacted soil to satisfy various regulatory requirements, wetlands issues, and proposed commercial redevelopment of the site*
- *Reduced remedial requirements by successfully demonstrating to the NJDEP that ground water was not impacted by PCB-impacted soils*
- *Obtained NFA letters for 21 Areas of Concern in 18 months*
- *Minimized remedial action in wetlands by performing an ecological evaluation*
- *Conducted local study of hydrogeology and upgradient off-site sources of ground water contamination with chlorinated solvents and demonstrated that on-site chlorinated solvents originated from an off-site source. Received a No Further Action determination from the NJDEP*
- *“Repackaged” Preliminary Assessment Report to comply with ISRA regulations*

PROJECT SUMMARY:

TRC Raviv prepared a Remedial Action Selection Report and Remedial Action Workplan for the client’s facility in Morris County, New Jersey. Following negotiations with regulatory agencies, TRC Raviv successfully obtained Remedial Action Workplan approval, which will transform the inactive, contaminated site to an environmentally sound and economically viable property.

A former landfill at the site was impacted with PCB concentrations as high as 1,300 ppm. TRC Raviv assessed the extent of environmental impacts to ground water, wetlands and soil, and demonstrated to the NJDEP that there was no impact to ground water from PCB-impacted soils. As a result, costly ground water monitoring and remediation requirements were not required. TRC Raviv performed an ecological evaluation and successfully demonstrated to the NJDEP that PCBs in the wetlands should remain in place, thereby further reducing remediation costs.

Based on the Remedial Action Selection Report and Remedial Action Workplan, capping was approved by the NJDEP and USEPA as the appropriate remedial approach for the site. USEPA approval to cap PCB-containing soil and waste is required under the Federal Toxic Substance Control Act (TSCA). TRC Raviv's design of the capping system coordinated complicated state and federal environmental and engineering requirements with proposed commercial redevelopment plans for the site. TRC Raviv received the first USEPA risk-based draft approval under the new Federal Toxic Substance Control Act regulations for leaving PCB-impacted soil with concentrations greater than 100 ppm on-site after instituting an engineering control. This approval saved the client at least \$2.5 million in soil excavation and disposal costs, and reduced the client's future liability associated with the off-site disposal of hazardous, TSCA-regulated waste.

The 5-acre cap is designed to be protective of human health and the environment and to accommodate the proposed redevelopment of the site. A portion of the cap has been designed as a parking facility (asphalt cap), with the remainder designed as a geotextile soil cap that will incorporate the wetlands buffer zone. PCB-impacted soil from a 0.5-acre portion of impacted wetlands will be excavated and placed beneath the cap, followed by wetlands restoration.

Another aspect of this project was to restructure a pre-existing Preliminary Assessment Report and conduct supplemental soil and ground water remedial investigation activities to facilitate the ISRA compliance process. Within 18 months, a total of 21 areas of concern (AOCs), including ground water contamination with chlorinated solvents, were issued No Further Action (NFA) determinations by the NJDEP. The ground water NFA was issued based on the submission of regional information compiled by TRC Raviv, demonstrating an off-site source of the trichloroethylene (TCE) detected on the client's property.

ISRA/RCRA COMPLIANCE SOIL AND GROUND WATER REMEDIATION

SITE / LOCATION: Paint and Coatings Manufacturing
Middlesex County, New Jersey

PROJECT HIGHLIGHTS:

- *Performed all regulatory compliance activities (ISRA, RCRA and tank removals) associated with the sale of the facility, and negotiated with the NJDEP for the elimination of expensive sampling and monitoring requirements*
- *Obtained No Further Action (NFA) determinations for 31 Areas of Concern*
- *Implemented aggressive, high vacuum recovery and treatment of ground water impacted by solvents, primarily toluene*
- *Reduced soil disposal costs as part of the underground storage tank removal program, by implementing in-situ soil vapor extraction*
- *TRC Raviv's hydrologic assessment obviated the need for more extensive subsurface investigations*

PROJECT SUMMARY:

TRC Raviv Associates, Inc. (TRC Raviv) was retained to conduct the investigation, removal, and remediation of an underground solvent tank farm. The creative technique of using Resource Conservation Recovery Act corrective action management units allowed TRC Raviv to implement a cost-effective on-site remediation of hazardous waste without applying for overly burdensome RCRA permits. Soil was remediated using soil venting and returned to the excavation.

Compliance with NJDEP's ISRA program was triggered as a result of the sale of the facility. All of the required investigations and the remedial action design were conducted on an expedited basis. A total of 31 areas of concern were identified and no further action determinations have been obtained from the NJDEP for all areas except ground water.

TRC Raviv has performed complete turn-key engineering for the remediation of impacted soil and ground water for this project including the investigation, design, construction, permitting, and routine operation and maintenance of a high vacuum, combined ground water and soil vapor extraction system using a network of over 20 recovery wells. To date, about 600 gallons of organic compounds, primarily toluene, have been recovered from the subsurface. Ground water contaminant concentrations have been reduced an average of 85%, and in 3 of 8 key wells the levels have dropped over 99%. The cleanup of the ground water and soils is nearly complete and the remediation consists of "polishing" a few remaining areas.

Based on research and site-specific hydrogeologic data, TRC Raviv successfully demonstrated to the NJDEP that a full-scale geophysical investigation was not warranted at the site. Using ground water flow and quality data, TRC Raviv demonstrated that the high vacuum ground water recovery systems exert complete hydraulic control over both contaminant plumes. This demonstration eliminated the need to incur additional costs for geophysical investigations and additional well installation that otherwise would have been required by the NJDEP.

The original target time frame of the soil and ground water remediation was 5 years. However, it is projected that active remediation will be complete within 4 years. The regulatory exit strategy for this site includes a monitored natural attenuation program in conjunction with a deed notice and a capping system for small amounts of remaining contamination.

RCRA CORRECTIVE ACTION FACILITY INVESTIGATION

SITE / LOCATION: Former Chemical Plant
Guayanilla, Puerto Rico

PROJECT HIGHLIGHTS:

- *Implemented Supplemental RFI in Puerto Rico directing a multi-company team of Puerto Rican and U.S. scientists at former chemical plant and surrounding community.*
- *Negotiated deferral of USEPA requirement for active pump and treat Interim Remedial Measure. Instead collected and evaluated data in accordance with the most recent USEPA protocols to support natural remediation remedy for chlorinated VOCs.*
- *Coordinated bench-scale studies of natural and enhanced biodegradation processes with research group at Carnegie Mellon Research Institute to assess cost-effective remedial options to address site-specific conditions.*
- *Carried out bilingual communications with federal and Puerto Rico agency representatives to implement site activities and address regulatory concerns.*
- *Obtained permits and approvals from Puerto Rico regulatory agency for discharge of waters generated during well installation and ground water sampling.*

PROJECT SUMMARY:

TRC Raviv Associates, Inc. (TRC Raviv) was retained in 1996 by a major chemical company to assume responsibility for an on-going RCRA Facility Assessment on the south coast of Puerto Rico. Operations at the site were discontinued in 1978, followed by an extensive voluntary cleanup of contamination. The client entered into a RCRA 3008(h) Administrative Order in 1990 and conducted the first phase of the RCRA Facility Assessment from 1991 to 1995.

The former plant has been ranked as a high priority site under the USEPA's RCRA corrective Action program. TRC Raviv assisted the client in responding to the USEPA's requirements for a supplemental RCRA Facility Assessment and an Interim Measure. Utilizing the TRC Raviv Senior Project Manager's 7-year history with the site, we were successful in negotiating reasonable scopes of work for the supplemental RCRA Facility Assessment and Interim Measure, eliminating the USEPA's original demands to sample for certain parameters and in areas that had already been addressed. We designed the Interim Measure Workplan to be focused on the collection of data to evaluate a range of potential technologies for remediation, instead of implementing an aggressive pump and treat remedy as the USEPA originally intended.

TRC Raviv successfully and efficiently coordinated a multi-company team of local drillers and consultants, TRC Raviv scientists, an Ohio laboratory, a Pennsylvania laboratory, and a database management company in Louisiana. Our staff trained local drillers in the use of Hydropunch sampling equipment, and 37 Hydropunch borings were drilled to depths as great as 120 feet to fully delineate the extent of volatile organic compound (VOC) plumes in several strata below the site. Rapid evaluation and transmittal of the Hydropunch data to the USEPA led to informal and timely agreement on the design of the final ground water monitoring network; approximately 19 additional monitoring wells were installed to supplement the existing wells.

TRC Raviv also collected soil and ground water samples and sent them to Carnegie Mellon Research Institute for bench scale tests. The Carnegie Mellon Research Institute studies demonstrated that site conditions and intrinsic microorganisms were ideally suited to rapidly degrade 1,2-dichloroethane and vinyl chloride, the primary site contaminants.

Our staff successfully reactivated a federal NPDES permit to discharge waters generated by well installation, ground water sampling and pumping tests during the field investigation. Permit reactivation required additional submittals to the Puerto Rico Environmental Quality Board's water and air groups, and the refurbishing and repair of air stripping equipment that had been idle for several years. TRC Raviv successfully addressed all of the Puerto Rico Environmental Quality Board's concerns in a timely manner.

Our sampling program included a broad suite of parameters specified in the most current USEPA protocols for demonstrating natural degradation of chlorinated VOCs. We streamlined the reporting effort by combining the results of the supplemental RCRA Facility Assessment and Interim Measure into one report. The report integrated historic data, recent sampling results and bench-scale studies, and previous risk assessment analysis to present a strong case for a natural remediation remedy for the chlorinated VOCs in ground water.

The USEPA is currently evaluating the findings. We are assisting the client in preparations for public participation efforts that the USEPA has indicated will be necessary. Our senior staff will be presenting the results of our scientific and technical work in Spanish at local meetings to community residents and the Puerto Rico Environmental Quality Board.

ISRA COMPLIANCE SOIL AND GROUND WATER REMEDIATION

SITE / LOCATION: Petroleum Products Manufacturing
Middlesex County, New Jersey

PROJECT HIGHLIGHTS:

- *Coordination of all ISRA Compliance Activities*
- *Supervision of Site-Wide Decommissioning Activities during Demolition*
- *Implementation of Soil and Ground Water Remedial Investigations*
- *NJDEP and USEPA Approval of Site-Wide Cap for PCB-Impacted Soils*
- *NJDEP Approval of a Site-Specific Ecologically-Based Alternate Cleanup Level for PCBs in On-Site Wetlands*
- *Design and Operation of a Vacuum-Enhanced Product Recovery System*

PROJECT SUMMARY:

TRC Raviv assisted with the closure of a 15-acre industrial establishment that had been in operation since 1903. The site consisted of 20 buildings used for the manufacture of petroleum jelly and other associated products. TRC Raviv implemented the required ISRA compliance activities including the Preliminary Assessment Report, Remedial Investigation Reports, and Soil and Ground Water Remedial Action Workplans.

TRC Raviv conducted the necessary remedial activities during the razing of the plant, including the removal of numerous underground and above ground storage tanks. Many other areas of concern (AOCs) such as oil/water separators, sumps and pipelines were decommissioned, removed and sampled during the demolition of the facility. Implementation of these remedial tasks at this time resulted in significant cost savings to the client.

Comprehensive site-wide soil and ground water investigations were performed by TRC Raviv, and contaminants such as base neutral compounds (BNs), heavy metals, PCBs, petroleum jelly, and volatile organic compounds (VOCs) were detected at elevated concentrations. TRC Raviv successfully demonstrated to the NJDEP that (1) all metals and BNs were attributable to historic fill material; (2) petroleum jelly was a non-hazardous substance; and (3) PCBs were not impacting ground water.

Following negotiations with the USEPA, NJDEP and prospective purchaser, a site-wide cap and deed notice were approved as remedial measures to address PCBs in soil. The NJDEP also approved the excavation of off-site PCB-impacted soils for placement under the on-site cap, which resulted in a significant cost savings to the client. Another cost-saving measure included successful negotiations with the host municipality resulting in off-site institutional and engineering controls on city-owned property.

TRC Raviv prepared the bid specifications, soil erosion and sediment control plan, and permit applications for the soil excavation work and assisted the client in selecting a contractor. We also provided full-time field supervision of the soil excavation project.

TRC Raviv performed a comprehensive Ecological Evaluation and proposed a Site-Specific Ecologically-Based Cleanup Level for PCBs in on-site wetlands. The NJDEP approved of a less stringent Alternate Cleanup Level, resulting in significant cost savings since wetlands remediation and restoration were not required.

To address ground water, TRC Raviv conducted an investigation to determine the extent and source of floating petroleum product. The product was delineated and a recovery system was designed using a high vacuum to remove the light non-aqueous phase liquid (LNAPL).

Recovered LNAPL and ground water are separated using an oil/water separator. Water is treated with clay filters and granular activated carbon and discharged to the sanitary sewer. The system is maintained and operated by TRC Raviv's New Jersey-licensed wastewater treatment plant operators, who perform routine sampling and reporting to comply with air and water discharge permits.

CAPPING SYSTEM STORM WATER MANAGEMENT

SITE / LOCATION: Scrap Metal Recycling Facility
Middlesex County, New Jersey

PROJECT HIGHLIGHTS:

- *Environmental investigations and remediation of soil and ground water.*
- *Remedial action plan includes installation of a low permeability, soil/bentonite capping system over 2 acres of the 4- acre site, and a storm water treatment system to treat all runoff.*
- *As part of the remedial design, the operations of the site were re-configured to meet the requirements of the capping system and storm water management plan.*
- *The design of the remedial action involved simultaneous approvals from State, County, and Municipal agencies, as well as working with the owner to reconfigure an active working site.*

PROJECT SUMMARY:

TRC Raviv Associates, Inc. (TRC Raviv) performed environmental investigations of the soil and ground water at this 4-acre scrap metal recycling facility. Contamination, which originated from a long history of operations (car crushing began in 1932), includes hydrocarbon related compounds, metals, and PCBs. The NJDEP ordered the owner to design a system such that continued operations would not impact the environment, and to address all existing contamination. The facility is located in a commercial district, with near-by residences.

TRC Raviv developed the design for a bentonite capping system (Wyoming bentonite enclosed in a geotextile shell) overlain with compacted fill. The placement of this capping system will enable some contaminated soils to be left on-site, and will ensure that ground water and the underlying soils will not be further impacted in the future by site operations. In addition, a storm water treatment system was designed which includes re-grading of the entire site to collect runoff, a large detention basin for the settling of particulates, and a 6,000-gallon oil-water separator. Finally, the site re-development plans include provisions to improve the visual appearance of the site.

This project was challenging in that it involved coordination with State, County, and Municipal regulatory agencies to obtain all of the approvals. In addition, the remedial solution was designed to be not only cost effective, but to re-design the site and the operations, such that it could continue to operate in the future. The construction will be staged so that the existing operations can continue during construction.

**ISRA COMPLIANCE
SOIL AND GROUND WATER INVESTIGATIONS
PRODUCT RECOVERY**

SITE / LOCATION: Freon Manufacturing Facility
Bergen County, New Jersey

PROJECT HIGHLIGHTS:

- *Successfully completed complex delineation of 13 areas of concern (AOCs)*
- *Identified and delineated several dense non-aqueous phase liquid (DNAPL) areas*
- *Removed over 1,000 gallons of DNAPL from the ground water within 3 weeks of discovery*
- *The quick response to DNAPL recovery improved ground water quality, resulting in significant long-term cost savings to the client*

PROJECT SUMMARY:

TRC Raviv conducted supplemental soil and ground water investigations at the site for compliance with ISRA. TRC Raviv reviewed the prior consultant's work and prepared a soil and ground water Remedial Investigation Workplan for submittal to the NJDEP that identified potential AOCs and suspected dense non-aqueous phase liquid (DNAPL) areas.

The NJDEP-approved workplan consisted of soil sampling, ground water sampling, a Geoprobe ground water investigation and monitoring well installation. The results of soil sampling confirmed the extent of elevated levels of volatile organic compounds, base neutral compounds, metals and PCBs. The presence of DNAPL, consisting of freon and other chlorinated hydrocarbons, was confirmed in several areas. TRC Raviv immediately began product recovery activities and removed over 1,000 gallons of DNAPL within 3 weeks of discovery. Subsequent DNAPL delineation investigations revealed the presence of DNAPL within the thin sand layers of the site's underlying varved clay. TRC Raviv designed a network of recovery wells to intersect the DNAPL zones and continue DNAPL recovery.

TRC Raviv is currently evaluating remedial technologies for ground water including Hydrogen Release Compound, Vacuum-Enhanced Recovery and Funnel and Gate Treatment/Containment. For soil remediation, an On-Site Thermal Desorption Unit is being considered.

ISRA COMPLIANCE SOIL AND GROUND WATER INVESTIGATION AND REMEDIATION

SITE / LOCATION: Chemical Manufacturing Facility
Bergen County, New Jersey

PROJECT HIGHLIGHTS:

- *Site-wide remedial investigation of soil and ground water*
- *Horizontal and vertical delineation of LNAPL source area*
- *Excavation of impacted soils in an active loading dock area*
- *Design, implementation and operation of a bioremediation pilot testing program for treating volatile organic compounds in ground water*
- *Design of a bioremediation system for ground water remediation*
- *ISRA compliance following a transfer of company assets*

PROJECT SUMMARY:

The facility, located in an industrial area of Bergen County, New Jersey, began producing vinyl-type coatings in 1969, and later added fabric softeners to the product line. Raw materials included alcohols, pigments and phthalates.

Following the removal of underground storage tanks (USTs), the major contaminants of concern detected in soil and ground water at the site were isopropyl alcohol (IPA), acetone (a degradation product of IPA), and phthalates. Monitoring wells revealed impacts to the overburden and bedrock wells. The extent of the plume was limited to the property due to gentle ground water gradients and natural degradation of the contaminants.

TRC Raviv Associates, Inc. (TRC Raviv) delineated the dissolved plume horizontally and vertically, and identified the transfer lines from the former USTs as one of the contaminant sources. Observations of impacted soils during the removal of the transfer lines confirmed that contaminant releases were associated with the lines. A bench-scale biodegradation study was conducted to determine the feasibility of bioremediation of the compounds of concern. The study indicated that bioremediation was a viable option.

The severely impacted soils were excavated over a holiday period during temporary cessation of facility operations. The excavation was extended to the top of bedrock. The area was backfilled with a permeable medium and three bioreactor trenches were installed for implementation of a bioremediation system. A bioremediation pilot study was conducted, introducing a passive oxygen releasing compound (ORC) within the bioreactor trenches and later liquid nitrogen and phosphorous as nutrients. These compounds had been identified as the limiting compounds for bioreaction processes. The results of this pilot study indicated that bioremediation was successfully enhanced, rapidly reducing the contaminant concentrations in ground water. This information was utilized in the design of a more aggressive, permanent, low cost bioremediation system. The bioreactor trenches installed following soil excavation will deliver the oxygen and nutrients to the contaminated ground water.

Subsequently, the facility's assets (building and equipment) were purchased, which triggered ISRA compliance. TRC Raviv was retained to inspect the premises and complete a preliminary assessment report and site investigation in other areas of concern.

Several additional miscellaneous tasks were completed by TRC Raviv including engineering design and construction oversight of a secondary containment structure for off-loading raw materials in the loading dock area.

SPILL/DISCHARGE PREVENTION PLAN ENGINEERING AND CONSTRUCTION

SITE / LOCATION: Oil Refinery
Middlesex County, New Jersey

PROJECT HIGHLIGHTS:

- *Evaluated the existing secondary containment for 20 aboveground storage tanks for compliance with State and Federal regulations pertaining to the facility Spill and Discharge Prevention Control and Countermeasures (SPCC/DPCC) Plan*
- *Tanks ranged in size from 200,000 to 4,500,000 gallons (5,000 to 110,000 barrels)*
- *Developed engineering plans for the upgrade of the secondary containment systems*
- *Provided engineering oversight and testing during construction of the upgrades*
- *Prepared as-built drawings and amended the SPCC/DPCC Plan*

PROJECT SUMMARY:

To maintain compliance with State and Federal regulations pertaining to the facility Spill/Discharge Prevention Control and Countermeasures (SPCC/DPCC) Plan, TRC Raviv Associates, Inc. (TRC Raviv) evaluated the existing secondary containment for 20 aboveground storage tanks (ranging in size from 200,000 to 4,500,000 gallons). Using surveyed site maps, tank information, and site inspections, tank failure and spill scenarios were evaluated to determine if the existing secondary containment capacity was adequate. Additionally, TRC Raviv performed comprehensive engineering evaluations of containment wall and berm integrity to determine if the existing containment structures were structurally suitable for spill containment.

Based on the evaluations, TRC Raviv developed detailed engineering plans for the upgrade of all deficient secondary containment systems. Approximately 10 tanks, with multi-million gallon capacities, required complete upgrades to their secondary containment systems. Upgrades included a total reconfiguration of the existing system, construction of new soil berms, the removal of existing berms to enable a more effective use of existing containment capacity, reinforcement of existing concrete containment walls, and sealing of pipe penetration breaches.

TRC Raviv provided engineering oversight and engineering testing during the construction of secondary containment system upgrades. After successful construction, TRC Raviv prepared as-built drawings, performed final volume calculations to document that the required secondary containment capacity was achieved, and amended the facility's SPCC/DPCC Plan.

SEDIMENT REMEDIATION ENGINEERING AND CONSTRUCTION

SITE / LOCATION: Dundee Canal
Passaic County, New Jersey

PROJECT HIGHLIGHTS:

- *Environmental investigation of soil, sediment, surface water quality, and hydraulic connection between canal and ground water*
- *NJDEP approval of remedial action workplan for subaqueous in-place capping of impacted sediment*
- *Full-service engineering including geotechnical evaluation of canal sediment, capping system design, bid procurement/contractor selection, permitting, construction management, as-built drawings, Remedial Action Report and Deed Notice*
- *Installation of a 3.5-acre capping system for 9,000 cubic yards of impacted sediment*
- *\$1.2 million remedial action design, installation, and reporting completed within budget*

PROJECT SUMMARY:

The Dundee Canal ran parallel to the Passaic River extending over a mile from the Dundee Dam in Clifton, New Jersey to its outlet at the Passaic River in Passaic, New Jersey. The Canal was partially filled as a result of the New Jersey Department of Transportation construction of the Route 21 extension, but two unfilled portions or ponds covering an area of 3.5 acres remained.

TRC Raviv Associates, Inc. (TRC Raviv) performed remedial investigations of canal soil, sediment and surface water to delineate the extent of contaminants in the Canal and to assess the hydraulic connection between the Canal and ground water. TRC Raviv designed a 3.5-acre in-place capping system for the ponds to ensure containment of 9,000 cubic yards of sediment and facilitate the natural re-establishment of the aquatic ecosystem. The plan was approved by the NJDEP.

The sediment was 15 feet thick in locations and had very low strength. TRC Raviv performed a detailed geotechnical-testing program that enabled the selection of a permeable geotextile with a permeable soil cover that successfully contained the sediment while supporting the weight of the cap. The final capping system design included an anchored geotextile overlain by 2 feet of fill. The fill was specifically selected to resist erosion once the pond areas were refilled with flowing water and to facilitate the re-establishment of the aquatic ecosystem after encapsulation.

The 3.5-acre capping system was installed under the direct supervision of TRC Raviv engineers. The capping system installation was successfully completed, within budget, in June 2000. TRC Raviv prepared the Remedial Action Report, which included as-built drawings and the draft Deed Notice, for submittal to the NJDEP.

CLOSED MUNICIPAL LANDFILL GROUND WATER INVESTIGATION

LOCATION: Ocean County, New Jersey

PROJECT HIGHLIGHTS:

- *Streamlined the investigation of a closed municipal landfill by combining the SI and the RI into one phase and by employing real-time delineation techniques. Used landfill leachate indicator parameters to identify contaminant migration pathways*
- *Negotiated work plans with the NJDEP under the scrutiny of several interested parties, including a citizen-led group formed to explore potential causes of childhood cancer cases and the NJDHSS*
- *Analyzed 15 years of historical ground water quality data to establish temporal trends and evaluate contaminant plume stability over time, and refute inaccurate statements about off-site impacts*
- *Presented findings at several public meetings of concerned citizen group*
- *Supported arguments for natural remediation of the minimal landfill impacts to ground water quality that were identified*
- *Developed scientifically based, cost effective long-term monitoring program to confirm plume stability and natural remediation processes*

PROJECT SUMMARY:

TRC Raviv Associates, Inc. (TRC Raviv) was retained by a Township in Ocean County to satisfy the requirements of a Memorandum of Agreement (MOA) that was entered into by the Township with the New Jersey Department of Environmental Protection (NJDEP). The MOA required the investigation of a municipal solid waste landfill that had been closed. The landfill was being investigated as one of several potential sources of carcinogens in an effort by a citizen's group and state agencies to identify potential causes of childhood cancers.

The MOA required that the Township complete a Preliminary Assessment, prepare a Site Investigation Workplan, implement the Site Investigation and prepare a report, and prepare a Remedial Investigation Workplan, implement the Remedial Investigation and prepare a report. TRC Raviv saved at least a year and several tens of thousands of dollars by combining the Site Investigation and Remedial Investigation, thereby eliminating the need for at least one workplan and report, with all the concomitant time frames for preparation, client review, and review by the NJDEP. By fully assessing and utilizing the historical information compiled in the Preliminary Assessment, we were able to focus the Site Investigation/Remedial Investigation on just those Areas of Concern (AOCs) that truly warranted investigation, thereby keeping the scope of the investigation appropriately focused.

During the initial phase of the Remedial Investigation, TRC Raviv employed real-time delineation techniques - Hydropunch ground water sampling and field analysis for landfill leachate indicator parameters - to delineate ground water quality impacts. This provided data to scientifically select locations for permanent monitoring wells and minimize the number of iterative phases of well installation. TRC Raviv worked in conjunction with ground water modelers who were developing a 3-dimensional regional flow model for a Superfund site 2 miles to the west; this model assisted us in the determination of contaminant migration pathways and the selection of monitoring well locations.

TRC Raviv represented the Township at negotiations with the NJDEP at which key elements of the Remedial Investigation were negotiated, and made several presentations at the monthly meetings held by the group of concerned citizens investigating possible causes of childhood cancer in the Township. These meetings are regularly attended by 100 to 200 citizens and representatives of local, state and federal agencies.

GROUND WATER SUPPLY

SITE / LOCATION: Senior Retirement Community
Morris County, New Jersey

PROJECT HIGHLIGHTS:

- *Implemented several single-well and two multi-well aquifer pumping tests to determine well and aquifer yields*
- *Calculated basin water budget and aquifer recharge rates to support ground water withdrawal needed by development*
- *Prepared and obtained NJDEP approval to modify Township's existing Water Allocation Permit to include the new development's ground water supply wells*

PROJECT SUMMARY:

TRC Raviv Associates, Inc. (TRC Raviv) was retained by a major residential developer in northern New Jersey to implement an aquifer-testing program at a senior retirement community under construction in Morris County, New Jersey. Due to shortages in the host Township's existing ground water supply system, the developer was required to identify and develop sufficient water to meet the planned community's needs. To that end, the developer installed eight test wells into the crystalline bedrock underlying the site. Once the developer could develop sufficient yield, the wells were to be tied into the Township's existing water supply and distribution system.

The community needs about 120,000 gallon per day (gpd), equivalent to an average of about 85 gallons per minute (gpm). In accordance with the New Jersey Department of Environmental Protection-Bureau of Safe Drinking Water (NJDEP-BSDW), the developer had to demonstrate that the new wells had the capability of providing more than three times the needed yield, to ensure adequate supply if any individual well fails to supply an adequate yield, or if one of the Township's wells temporarily goes off-line.

TRC Raviv designed a ground water well and aquifer testing program to satisfy the requirements of the NJDEP-Bureau of Water Allocation (BWA). Initially, step tests were run on each individual well to determine the maximum sustained yield. After the optimal pumping rate was selected, a 72-hour pumping test was run on each well to verify that the well could provide the yield on a sustained basis. Transducers were installed in nearby wells to provide water-level data to assess aquifer properties and interference effects. A multi-well aquifer pumping test work plan was provided to the NJDEP-BWA for their approval. Through our close working relationship with this bureau, we were able to address their concerns and obtained timely approval for the client.

A 72-hour, five-well aquifer pumping test was conducted to verify that the aquifer could sustain a withdrawal rate of 270 gpm. TRC Raviv coordinated with a pumping-test contractor to provide pumps and flow measurement equipment; we installed transducers in pumping and observation wells that recorded water-level data electronically. Water-level measurements were also collected in piezometers in on-site wetlands to show that pumping the bedrock aquifer would not have an adverse effect on wetlands habitats. The water-level data were processed using computer-driven programs to determine aquifer hydraulic properties and demonstrate long-term aquifer yield.

TRC Raviv calculated a water budget for the entire drainage basin and determined the safe yield of the well filed in accordance with NJDEP requirements. We used the results of the testing program to prepare a comprehensive hydrogeologic report and an application to modify the Township's existing Water Allocation Permit to incorporate the community's new wells and increase the overall allocated pumpage. We received high praise from the NJDEP-BWA for the completeness and scientific quality of the two documents, and the request for modification has been granted by the NJDEP.

UST CLOSURES GROUND WATER REMEDIATION

SITE / LOCATION: Coatings Manufacturing Facility
Bucks County, Pennsylvania

PROJECT HIGHLIGHTS:

- *Supervision of UST removal and closure of on-site disposal well*
- *Designed, constructed and currently operating a ground water recovery and treatment system*
- *Currently coordinating closure of project in accordance with Pennsylvania ACT II Requirements*

PROJECT SUMMARY

TRC Raviv supervised the removal of several underground storage tanks and the closure of a disposal well. A ground water investigation indicated that elevated levels of volatile organic compounds were present. As a result, TRC Raviv implemented a ground water remediation program in 1991. The remedial design included two ground water recovery wells, an air stripping tower and an on-site injection well.

During 7 years of ground water remediation, approximately 75 million gallons of ground water have been treated, and contaminant concentrations in ground water were significantly reduced. TRC Raviv is currently coordinating closure of the project in accordance with the Pennsylvania Department of Environmental Protection's ACT II Requirements.

**ISRA COMPLIANCE
SOIL AND GROUND WATER INVESTIGATIONS
SOIL REMEDIATION**

SITE / LOCATION: Wood Treating Facility
Burlington County, New Jersey

PROJECT HIGHLIGHTS:

- *Coordination of ISRA Compliance Activities*
- *Successfully completed delineation of 9 areas of concern (AOCs).*
- *Implementation of Soil and Ground Water Remedial Investigations*
- *Engineering Design of NJDEP-Approved Site Cap for Arsenic-Impacted Soils*
- *Provided Engineering Inspections of the Implementation of the Capping System*

PROJECT SUMMARY:

Soil and ground water investigations were performed at the 13-acre wood treating facility in southern New Jersey for compliance with ISRA. Reporting activities included the Preliminary Assessment Report, Remedial Investigation Workplans and Reports, and a Soil Remedial Action Workplan.

As a result of the initial soil sampling program, TRC Raviv determined that arsenic was the primary contaminant of concern at the site and the NJDEP agreed to limit future sampling to arsenic analysis only. TRC Raviv successfully demonstrated to the NJDEP that the contaminated soils could be capped in place on-site, in conjunction with other site improvements (i.e. paving) planned by the property owner.

TRC Raviv prepared the bid specifications for the soil excavation activities and assisted the client in selecting a contractor to perform the work. Our engineers provided full-time field supervision of the arsenic-impacted soil excavation and capping project. In accordance with an NJDEP-approved Soil Remedial Action Workplan, approximately 8,000 cubic yards of arsenic-impacted soil were excavated, relocated, and capped with asphalt, resulting in significantly reduced costs and future liability to the client. The project took approximately 6 weeks and \$1,000,000 to complete.

TRC Raviv proposed to conduct quarterly ground water sampling to demonstrate that elevated levels of ammonia and nitrate in ground water are undergoing natural attenuation. This passive form of remediation has resulted in significant savings to the client.

ISRA COMPLIANCE SOIL AND GROUND WATER REMEDIATION

SITE / LOCATION: Textile Processing Facility
Bergen County, New Jersey

PROJECT HIGHLIGHTS:

- *Delineated a 4-acre plume of dissolved and free-phase tetrachloroethylene (PCE) in ground water.*
- *Construction and operation of a vacuum enhanced remediation system to recover free-phase PCE and contaminated ground water and treat impacted soils in-situ.*
- *A 400-foot long reaction wall is in the design phase for long-term plume maintenance.*
- *Remediated over 400 tons of PCE-contaminated soils on-site using soil vapor extraction system.*

PROJECT SUMMARY:

TRC Raviv Associates, Inc. (TRC Raviv) has performed complete turnkey engineering on this project, including the investigation, design, construction, permitting, and routine operation and maintenance of the remediation program. Free-phase PCE was discovered in several areas of the site during the initial investigations conducted for ISRA compliance. Following the delineation of eleven areas of concern at the site, a remedial action workplan was prepared to recover contaminated ground water and treat the remaining contaminated soils in-situ using a vacuum enhanced recovery system.

To date, approximately 200 gallons of PCE have been recovered as pure product, and 100 gallons have been recovered from the dissolved phase using a ground water treatment system that consists of a network of vacuum enhanced recovery wells. Over 400 tons of soil was excavated for on-site treatment via soil vapor extraction. The treated soils were then reused on-site, resulting in significantly reduced remedial costs and future liability to the client.

A ground water recovery trench was also installed to intercept the off-site migration of contaminated ground water. The treated ground water from both systems is discharged to surface water under a NJPDES Discharge to Surface Water Permit. TRC Raviv recently obtaining approval to discharge the treated water to the county utilities authority sewer system, resulting in significant savings due to a reduction in the sampling requirements.

Carbon units used to treat the vapors from the remediation system are regenerated on-site using TRC Raviv's mobile carbon regeneration trailer. On-site carbon regeneration is cost-effective, and provides a reliable measure of the amount of product recovered.

The ground water plume still contains high levels of dissolved PCE, occupies an area of about 4 acres, and discharges to an adjacent surface water body. It is recognized that complete recovery of PCE product will likely never be achieved and that restoration of the ground water system would be difficult, if not impossible. Therefore, active remediation will not be cost effective for the future. TRC Raviv has developed a plan for the installation of a passive reaction wall to be installed between the leading edge of the PCE plume and the surface water body.