Storage Tank Management & Remedial Design/Construction Services

The MARK Group, Inc.
3480 Buskirk Avenue, Suite 120
Pleasant Hill, California 94523
(510) 946-1055

TABLE OF CONTENTS

Storage Tank Management and Remedial Design/Construction Services

INTRODUCTION

The MARK Group, Inc. (MARK) is a full service engineering construction firm specializing in hazardous waste, solid waste, geotechnical, air quality and water resources projects. MARK is capable of providing turnkey construction services from preliminary planning to final construction and operation.

MARK draws upon full staff resources, which include nearly 80 skilled professional, technical, and support construction personnel located in three offices throughout California and Nevada. Proper integration and management of these resources is demonstrated by our successful completion of more than 1000 industrial and hazardous waste projects in the last 8 years.

MARK provides private industry and government with a comprehensive range of environmental service through our two service groups; The MARK Group, Inc., Engineers & Geologists, and The MARK Group, Construction Engineers, Inc.:

- ***MARK Group, Inc., Engineers & Geologists, (EGI)*** - A leader in the field of hazardous materials investigations, underground and aboveground storage tank management, solid waste management, site characterizations, risk assessments, regulatory compliance, and design of air, soil and groundwater cleanup systems, is uniquely qualified to provide the needed environmental services of private and public clients.

- *MARK Group, Construction Engineers, Inc. (CEI)* - A full service remedial construction firm working in conjunction with The MARK Group, Inc., Engineers & Geologists, or with other engineering design firms providing construction remediation services. CEI is licensed for General Engineering Class A and Hazardous Substance Removal and Remedial Actions under State of California's Contractors Licensing Board #504500. CEI specializes in merging scientific and technical capabilities with hands-on construction and cleanup expertise to provide comprehensive design-construct underground storage tank removals

and excavations, modifications and retrofits, and waste remediation services such as the treatment of soil and groundwater impacted from hazardous materials.

Since the inception of MARK on Memorial Day, May 28, 1984 between our principals: Dr. N. Dean Marachi and Mr. David K. Rogers, MARK has emerged as one of the few, high quality, environmental engineering firms in the Western United States. These operating principals with a dedicated, highly qualified staff place MARK in the forefront for the services we provide. We are fully committed not only to the assessment and characterization of problems but more importantly to the application of sound, cost-effective, engineering solutions. Rapid commercial growth, ever-increasing population and the mounting generation of municipal/industrial wastes, all place new demands on environmental sciences and engineering.

MARK has successfully met these challenges through our commitment of service to private and public clients. Our Waste, Air, Water, and Earth Technology services are helping industry and our society solve problems presently facing our environment through the development of state-of-the-art technologies, as well as through the innovative application of proven technologies.

The corporate goal is excellence as measured by these commitments:

- Direct and personal involvement of a principal or senior manager of the firm in every project
- Correct perception of the client's goals and needs
- Timely, cost effective, and technically sound solutions
- Client satisfaction

FULL SERVICE UNDER/ABOVE GROUND STORAGE TANK MANAGEMENT AND REMEDIATION CAPABILITIES

Under/Above Ground Storage Tank Management. MARK provides proven capabilities in the management of storage tanks by providing a complete range of investigation and remediation services, including: geophysical surveys and record searches to confirm underground tank locations, followed by precision tank testing to evaluate a tank's potential for leakage; risk and economic assessments to establish priorities for tank content and sludge treatment or removal; tank removal specifications and shoring design, site investigation, including the development of complete sampling and analytical programs to define the extent of petroleum hydrocarbons in the subsurface and the development of solutions for failed tanks and the design of new tanks and remedial systems to cleanup soils and groundwater. MARK has completed numerous aboveground and underground storage tank projects for government and private clients on projects involving multiple tanks.

Knowledge of Codes, Regulations and Ordinances. The staff members of MARK have kept abreast of the underground storage tank (UST) codes, regulations, and ordinances since the U.S. EPA began promulgating the federal regulations in 1984. In California, the Title 23 CCR Chapter 16 UST regulations were finalized in 1985. Through our diverse project experience, MARK has gained an intimate familiarity with the Chapter 16 regulations.

All UST projects also require compliance with Title 22 CCR Chapter 30. MARK frequently refers to the sections of 22 CCR which address the classification and declassification of hazardous and extremely hazardous wastes. MARK's working knowledge of these regulations as well as federal land ban regulations have routinely enabled the negotiation of agency approval of least cost contaminant treatment and disposal alternatives.

MARK is also experienced in the use of guidance manuals and recommendations put forth by the regulatory agencies. Day to day operations involve frequent reference to the Leaking Underground Fuel Tank (LUFT) Field Manual, in which the Department of Health Services (DHS) and State Water Resources Control Board have established guideline procedures for determining whether a site is clean and safe.

However, the LUFT Manual is not law and is subordinate to the authority of local city and county enforcement documents. By law, all 58 California counties are responsible for implementing the UST regulations. In addition, more than 140 cities and districts have also elected to implement the regulations. MARK has wide experience in working with many of the local enforcement agencies in California and is very familiar with the specific requirements within the San Francisco Bay Area region. Familiarization with these requirements in the early stages of past projects has ensured that work progresses smoothly and at lowest cost. As a rule, MARK establishes lines of communication with LEAs during these early stages. Some of the agencies that may become involved include city governments, fire departments, county health departments, the Air Quality Management district (AQMD), the Regional Water Quality Control Board (RWQCB), and the DHS.

Specific additional written guidelines and field manuals have been issued by some LEAs. In

addition, many LEAs participate in a local oversight program where the LEA acts as a contractor to the state to enforce the regulations. Specific reporting requirements have been specified in some jurisdictions. For example, the RWQCB of the North Coast, San Francisco Bay, and Central Valley regions have produced a set of recommendations which contain specifications for workplans, investigative reports, and remediation plans. MARK has prepared numerous reports in compliance with this document.

Regulatory Relations. MARK provides a solid understanding and record of experience in working with regulatory agencies at the local, state, and federal level on hazardous waste management and spill containment studies. MARK prides itself on its knowledge and application of federal, state and local environmental regulations. We frequently have been able to develop programs in which variances, exemptions, and extensions have been granted to our clients. The quality of our plans and reports is highly regarded by the regulatory community. The plans have often been met with unqualified approvals or have been accepted without major revisions. This fact alone has saved clients valuable time and expense and has resulted in expedited project implementation. We have interfaced with many regulatory agencies, many of whom have considered our work products to be the standards by which others are measured.

Preparation of Environmental Documentation. MARK prepares workplans and reports to comply with applicable regulatory requirements as mandated by these agencies and to be consistent with the short- and long-term objectives of our client. Towards that end, our workplans place a premium on cost-effectiveness and technically sound solutions to protect the public health and the environment while minimizing the liability of our client. We often negotiate with the agencies in the development of our workplans to focus on the appropriate level of effort to address the relevant environmental issues. Below is a list of recent regulations and/or laws for which we have prepared plans and reports:

Hazardous Materials Management

- AB 2185 HMMP/HMBP Compliance
- Uniform Fire Code (UFC) Compliance
- Hazardous Materials Storage Permitting
- Building/Occupancy Permit Permitting
- Right-to Know Reporting
- SARA Title III Reporting/Compliance
- CERCLA/SARA Spill/Release Reporting
- AB 2588 Permitting
- Air Permitting
- UST Permitting

Hazardous Waste Management

- RCRA/HWCL Compliance
- Contingency Planning
- Waste Water Discharge Permitting
- Waste Minimization Planning
- Permit By Rule (PBR) Permitting
- RCRA Part A and B Permitting
- Facility Closure Report Preparation
- Hazardous Waste Transportation and Disposal Permitting
- Stormwater Runoff Compliance

Site-Specific Health and Safety Plans. MARK has established health and safety procedures and, for each project site, a health and safety officer is assigned and a detailed health and safety plan is developed. Our policy is to provide work environments where risks to our employees, clients, subcontractors, and the general public are maintained as low as reasonably achievable. Each employee performing activities at a waste site is responsible for implementing the rules and regulations outlined in the site-specific Health and Safety Plan. The Site Health and Safety

Officer is responsible for the enforcement of the provision of the Plan and MARK's corporate Health and Safety Officer conducts periodic on-site audits to ensure plans are adequate for site conditions and being adhered to by all project staff.

Health and Safety procedures are defined in MARK's Health and Safety Manual for Hazardous Waste Projects which is provided to all employees involved in work at hazardous waste sites. This manual provides general information on health and safety and outlines site operational procedures. MARK also maintains an in-house Health and Safety training program to provide both 40-hour OSHA training and 8-hour Annual Refresher Training.

Workplan Development for the Collection and Analysis of Soil and Groundwater Samples for Hazardous Waste Constituents. MARK has performed numerous recent field exploration and monitoring well installation programs including large exploration programs for projects located throughout California, Nevada and Utah. Our staff members have drilled, sampled and developed thousands of surface water, boreholes and monitoring wells in geology ranging from rock quarries to bay muds from two man floating sampling rigs to 2,500 feet deep drilling rigs. In addition our personnel are experienced in the preparation of site work plans and exploration programs, sampling and analysis plans, health and safety plans, and QA/QC plans.

MARK is staffed with registered geologists, geotechnical and civil engineers and professional staff with extensive field experience in air and mud rotary, hollow and solid auger stem, percussion and diamond core drilling techniques; logging and evaluating soil and rock borings; geotechnical sampling and in-situ testing techniques (e.g., Standard Penetration testing, vane shear testing, field permeability testing), monitoring well installation, development, purging and sampling; lysimeter installation, vadose zone monitoring system design and implementation, and water well drilling and construction.

In addition, MARK staff personnel have extensive experience in deep drilling techniques including use of reverse circulation and an air rotary casing hammer to depths in excess of 2,500 feet. Over the last 10 years, MARK staff have installed more than 2,500 groundwater monitoring wells throughout California, Nevada, Arizona, Utah and other western states in a variety of hydrogeologic/geomorphic environments including coastal bay mud flats, alluvial/fluvial sites, deep (1,500') alluvial desert valleys, and fractured bedrock sites.

Sampling and Analysis. Sampling and analytical activities show whether or not a site has been impacted by hazardous or toxic chemicals currently or formerly used on site. Assessment techniques can include grab samples, surface sampling, "Hazcat" drum sampling, soil vapor surveys, soil sampling from conventional borings, soil and groundwater sampling via small diameter probes, and groundwater sampling from monitoring wells. The selection of sampling techniques is governed by site size and complexity, suspected or observed contamination, and the confidence level required from the assessment.

Sampling of Underground Storage Tanks and Miscellaneous Containers. MARK provides proven capabilities in the sampling and management of storage tanks and containers by providing a complete range of investigation and remediation services, including: geophysical surveys and record searches including hazardous waste manifests to confirm contents of storage

drums and underground tank locations, followed by precision tank testing to evaluate a tank's potential for leakage; risk and economic assessments to establish priorities for tank content and sludge treatment or removal; tank removal specifications and shoring design, site investigation, including the development of complete sampling and analytical programs to define the extent of petroleum hydrocarbons in the subsurface and the development of solutions for failed tanks and the design of new tanks and remedial systems to cleanup soils and groundwater. MARK has completed numerous aboveground and underground storage tank projects for government and private clients on projects involving multiple tanks.

Cleanup and Disposal of Hazardous Waste. Successful site remediation depends on a cost effective approach, a well-planned design, followed by properly managed construction and startup and smooth-running operation. MARK is one of a few companies that can offer clients full-service remediation capabilities and experience comprising of investigation, design, construction, and operation. MARK offers these as single projects and turnkey packages for site remediation. Our remedial designs have included air, soil and groundwater cleanup and recovery systems for pesticides, solvents and toxic metals, bioremediation and/or incineration of petroleum laden soils and sludges, and geotechnical systems for mitigating the further migration of chemicals in the subsurface.

Interim Corrective Actions. Interim Corrective Actions typically include collecting, analyzing and documenting samples; controlling contamination sources; moving hazardous substances for storage, destruction, treatment or disposal; and preventing the migration of contaminants to adjacent sites. MARK provides the staffing, equipment and experience to carry out effective emergency response actions at known or suspected release sites.

MARK has the expertise to quickly evaluate contamination problems and mobilize a full complement of emergency response vehicles and equipment to minimize losses, contribute to the maintenance of a positive public image, and limit long-term liability. Once initial remedial measures have been implemented, our staff of experienced engineers, hydrogeologists, and chemists can carry the project through to implementation of long-term remedial measures involving off-site disposal, on-site containment or treatment, closure, remediation of soils and groundwater, and full site restoration.

MARK is experienced in the location, monitoring, excavation, treatment, transportation and proper disposal of chemically impacted soils. Our staff provide expertise in the design, construction and operation of soil decontamination and treatment systems utilizing a wide variety of treatment methodologies including incineration, volatilization, critical fluid extraction, and capping. We have extensive experience in dealing with soils contaminated with hydrocarbons and solvents. In addition, we are experienced in the development of health and safety procedures and implementation plans for the safe removal and treatment of contaminated soils.

Assessment of Surface and Subsurface Contamination. Building from sampling and analysis results, data collection and monitoring systems are designed to provide a reliable assessment of the areal and vertical extent of chemical impacts (surface and subsurface contamination), the direction and velocity of contaminant transport, and the calculated concentrations at potential human or environmental receptor locations. In addition, data collection and evaluation

assessment provides data on the total quantities of chemical constituents in the soil and groundwater and the potential ease or difficulty in removing these species. This data evaluation assessment is developed to support not only the data needs for evaluation of potential health and environmental risks but also data for remedial design.

Our hydrogeologists, geochemists, analytical chemists, and toxicologists utilize computer simulation of groundwater flow and chemical fate and transport in developing cost-effective field sampling and analytical programs. MARK staff have current knowledge of state and EPA regulations pertaining to hazardous and toxic waste. This experience has been gained from ongoing waste management projects for industrial and government clients under RCRA, TSCA, and CERCLA throughout the U.S.

Paying attention to detail is part of every practice in preparing the groundwater sampling and monitoring program including:

- Number and type of samples to be collected;
- Identity of drilling and laboratory firms;
- Methodologies and analytical procedures to be followed;
- Sample schedule;
- Activity cost;
- Health & safety considerations; and
- Quality assurance/quality control.

Groundwater and Vadose Zone Evaluation. Computer simulation of groundwater flow and chemical fate and transport assist our staff in developing meaningful and cost-effective workplans for the characterization of the hydrogeology and delineation of soil and groundwater impact. Computers are employed for design, modeling and data management for all air, soil and groundwater assessments undertaken by our firm. Our staff are well versed in the development and implementation of data management software, statistical programming, air and groundwater flow and transport modeling, and vadose zone modeling. We have used numerical computer modeling tools to predict air, soil and groundwater withdrawal, treatment and reinjection rates to provide for effective remediation. Data management software commonly employed include the latest microcomputer and minicomputer programs.

Our capabilities include the development, engineering support, application, and verification of numerical models for ecological and water quality predictions. This experience includes developing new models, modifying existing models, and applying particular models to site-specific cases. Modeling and monitoring projects have been conducted for public and private clients in a variety of vadose zone geologic conditions.

Health Risk Assessments. We are also experienced in the sampling and testing of air, soil, leachates, groundwater and surface water to establish threats to the environment, human health, and animal populations. MARK conducts risk assessments not just to satisfy regulatory guidelines but to provide a basis for rational decision making as well. MARK has performed assessments that have evaluated potential exposure through all media types including air, water, and soil. Our risk assessment team uses a multi-disciplinary approach including air, soil, and

water scientists, toxicologists, and engineers. This approach allows us to consider the "what ifs" enabling us to optimize remedial recommendations for any credible problem. Our capabilities include the development, engineering support, application, and verification of numerical models for ecological and water quality predictions.

Remedial Evaluation. MARK identifies the applicable regulatory cleanup levels to estimate the environmental risks and liabilities associated with remediation alternatives ranging from no-action to complete removal of the chemicals to background levels. A typical remedial evaluation includes: 1) identification of remedial technologies; 2) screening of technologies to determine alternatives; 3) screening of alternatives; 4) analysis of screened alternatives with respect to technical, institutional, public health, environmental concerns and cost; and 5) conceptual design.

MARK provides a broad base of knowledge and experience in the evaluation and design of remediation and treatment technologies. We have extensive experience with the development, evaluation, design, and implementation of technologies for groundwater and soil treatment. Such technologies include onsite incineration, vapor extraction (soil venting), isolation, and recovery of subsurface petroleum hydrocarbons, extraction and treatment of groundwater and wastewater.

We provide a staff that is experienced in the preparation of site workplans, health and safety plans, and QA/QC plans. Our hydrogeologists, geochemists, analytical chemists, and toxicologists utilize computer simulation of groundwater flow and chemical fate and transport in developing cost-effective field sampling and analytical programs.

Cleanup Implementation. Cleanup Implementation begins with the development of a Remedial Action Plan (RAP). This is a comprehensive document that sets forth the history of a site, the basis for the selection of a given remedial alternative, the conceptual design of that alternative, and a comprehensive schedule for implementation of the alternative. MARK provides the planning and design expertise needed to prepare comprehensive and technically sound RAPs for a variety of hazardous waste conditions.

Using the negotiated RAP, we would then prepare the detailed plans and specifications and other bid package documents. For simple cleanup activities, these documents can be prepared with minimal effort. The bid package would be sent to pre-qualified and selected contractors. We would then assist the client in selecting a qualified contractor and provide construction management services which may include:

- preparation of Sampling Plan:
- preparation of Health and Safety Plan;
- development and monitoring of construction schedules and cost control through our Management Information System (MIS);
- construction observation and monitoring;
- sampling and testing to verify cleanup;
- preparation of progress/status reports
- preparation of as-built drawings and report;
- closure certification by registered engineers/geologists.

Remedial Construction. MARK's construction personnel are experienced in hazardous waste site operations where attention must be directed not only to the typical fabrication and erection activities, but also to the implementation of on-site health and safety procedures, QA/QC procedures, and hazardous waste transportation and disposal procedures. Our range of services includes: design review to evaluate design basis against performance standards; constructability review of program concept, specifications, and drawings; development of program-specific quality assurance and safety standards from established standards libraries; prequalification of contractors; pre- and post-bid conferences to ensure clarity of scope and approach; systems operability review to optimize long-term maintenance, system performance, and staffing levels; preparation and issuance of construction bid packages; analysis of bids and award of contracts; integration of construction schedules with the master program schedule; shop drawing management; construction, change order, and claims management; quality assurance, verification, and control; logistics management; safety training and assurance; maintenance of construction documentation and data bases; verification of as-built drawings; and management of operations and maintenance manual preparation, procedures, and training.

The range of remediation construction services/technologies include:

- Administration of Contractor Services
- Technical Assistance in Public Affairs
- Emergency Site Mitigation
- In-Situ Rehabilitation
  - — Biological Degradation
  - — Chemical Degradation
  - — Soil-Gas Extraction and Treatment
  - — Water Table Adjustment
  - — Natural Process Restoration

- Design and Implementation of Containment Methods
  - Slurry Wall
  - Sheet Pile
  - Grouting
  - Geomembrane
  - Clay Cutoff
  - Liner
  - Natural Materials
  - Surface Sealing
  - Diversion Channels
  - Hydrodynamic Control
  - Chemical Fixation/Stabilization

- Design and Implementation of Extraction Methods
  - Pumping and Injection
  - Gravity Drainage
  - Withdrawal Enhancement
  - Gas Venting

- Soil Gas Extraction Systems
- Excavation
- Aquifer Restoration

- Design and Implementation of Treatment Methods
  - Carbon Adsorption
  - Steam or Air Stripping
  - Ion Exchange
  - Reverse Osmosis
  - Neutralization
  - Oxidation
  - Biological (anaerobic and aerobic)
  - Incineration and Thermal Conversion
  - Landfarming
  - Recycling and Waste Reduction
  - Chemical Precipitation
  - Sludge Treatment, Reduction, Handling, and Disposal Alternative
  - Solar Evaporation Impoundments
  - Landfill Test Cells
  - Densification

In-Situ and Off-Site Remediation. Selecting both the general and then detailed approach to hazardous waste site remediation requires more than just a familiarity with site conditions and regulatory guidance documents. To be successful, selection and implementation of a remedial approach must evolve a thorough analysis of the problem and its environment, in-depth technical understanding of available remedial technologies, and an appreciation for site specific working conditions.

For project sites where chemical impacts to soil are found, selecting the appropriate remedial approach will involve a balance of three key criteria:

- Availability of the recommended approach to meet remedial goals within the framework of site conditions and local ordinances;
- Freedom of the recommended approach from unwanted, nuisance or even illegal side effects; and
- Ability to achieve the two above goals within project schedule constraints and at acceptable life cycle costs.

For sites where soil bioremediation is to be considered, a multi-step approach is necessary. The first step is a decision whether bioremediation is applicable at all or more appropriate than other perhaps less costly techniques. For soils impacted only by volatile constituents, a soil venting approach, either in-situ or above ground with collection and/or destruction of chemicals of concern, will most often be quicker and less expensive. In addition, if extremely high volatiles are found, bioremediation by itself may not be effective until the toxic effects of those high concentrations can be removed.

In general, if the chemical constituents found in soil are relatively non-volatile and biodegradable, bioremediation typically will be the likely remedial choice. At this point, the program switches to making the following choices:

- Decision to use either indigenous or artificially produced microorganisms;
- Chemical needs to augment the soil to enhance the availability of the organic constituents to microbial action, availability of nutrients, water and air, and to limit the production of unwanted biomass;
- Physical needs to supply water, air and nutrients to the treatment mixture; and
- Physical needs to control the treatment environment to control air emissions, control temperature, and prevent over-watering and possibly runoff due to rain.

All of these issues need careful attention, especially in the San Francisco urban environment and with concern for Bay margin soils that can contain highly impermeable clays and fill of undetermined origin and composition. To address these issues, a bench scale test will be conducted to develop detailed treatment criteria. These criteria typically include:

- Treatment cell configuration (open or closed, size)
- Soil physical treatment requirements (screening, physical amendments)
- Microbial culture preparation and addition
- Chemical addition requirements (nutrients, enzyme, blockers)
- Water and air addition method

These criteria are assembled into a treatment specification which becomes the scope of work for the remediation contractor and upon which the permitting requirements, schedule, and cost are based. Following the above specification, the actual remediation can be undertaken. During soil remediation, periodic sampling can be conducted to measure microbial count, water and nutrient levels, and soil organic content. Given this type of thorough approach, achievement of high efficiency organic removal should and can be expected in a short time.

On-Site Construction Management. MARK provides on-site management services to assist clients in the process of providing construction services that require a full-time on-site construction manager to oversee the construction and operatation of treatment and containment systems. MARK begins the process by evaluating the level of regulatory control, assumption of responsibility, ownership of the facility, use of contractors and legal compatibility.

On many construction projects, MARK acts as the on-site construction manager to oversee the implementation of the CQA program. We can provide a resident engineer to review such task as: data compilation; sources of materials; design criteria; grading plans; geotechnical analyses; laboratory testing; drainage; groundwater monitoring; maintenance; implementation of schedules; costs and budget control; and progress meetings.

Remedial Systems Operations. MARK can provide on-site management services to assist the operations and maintenance of a remedial system. MARK will evaluate the levels of control needed to identify the operational procedures that best suits the client's needs. MARK can also develop operational manuals and provide trainning to on-site facility personnel.

Site Closure Sampling and Certification. Our staff of construction professionals have implemented final verification sampling plans for site closure certifications at numerous hazardous waste sites and waste management units. MARK has developed strong working relationships with the local and regional regulatory agencies. We have direct experience with cleanup and successful, cost-effective completion of local soil and groundwater closure requirements. MARK has recorded many approved RCRA closure plans and certifications for impacted sites and and waste impoundments throughout the state. MARK is also intimately familiar with development procedures for quarterly groundwater monitoring programs.

Cost Control Effectiveness. MARK relies on an integrated, comprehensive project management and accounting system to provide financial controls and firm-wide financial management. The system software is called the Architects and Engineers Management Information System (AEMIS). This software package is in use by large and medium sized engineering firms throughout the United States. It is one of the most up-to-date and effective software packages available to serve professional service firms. AEMIS has been extensively customized to suit MARK's particular project management needs. For each project, the AEMIS system compiles data from collected time sheets and expenses to generate a weekly Project Status Report for the project managers. This report details all activities and expenses and compares these items to the project budget. Depending on the complexities of a particular project, the level of detail necessary to control the budget will vary. The AEMIS system can be configured to provide information on budgetary control and track the progress of the project.

Construction Quality Assurance and Bid Document Coordination Methods. MARK has prepared many construction management plans, including organization, budgeting, scheduling, and cost control aspects. Management plans are job specific, and are tailored to the individual circumstances pertaining to each project. MARK uses the software package Primivera™, a project budgeting and resource loading program, to provide project management data and critical path analysis to ensure that projects are completed in accordance to the estimate and schedule.

An integral part of construction management is the Construction Quality Assurance (CQA) program. The CQA program consists of selected testing and inspection of the final product in order to provide the Owner/Agencies an evaluation of whether the end product is of the specified quality of materials and workmanship. A CQA program consists also of selected tests and inspections during production which assist the Contractor in producing the quality product required.

The CQA typically includes:

- Personnel Duties and Qualifications;
- Inspection Activities;
- Meetings;
- QA/QC Monitoring for Soil Materials;
- QA/QC Monitoring for Synthetic and Geotextile Materials;
- Testing Protocol and Frequencies;
- Reporting Requirements; and

■ Post-Construction Quality Assurance Monitoring.

Quality of our work is an area in which the firm is justly proud. Our quality is not just a matter of following agreed-upon procedures and protocols, but starts from the very beginning of each project with the accurate determination of a clients needs and the involvement of MARK Principals in the planning and execution of the work. Our standard Quality Assurance Plans include the following major subjects:

- *Project Descriptions* include the site location and setting and physical features of the area to be investigated. This includes any features or site uses which may influence the course or findings in the investigation. The objectives and purpose of the project are also set out in this section.

- *Project Organization and Management* describes the MARK corporate organization and its involvement in quality management. It also describes the organization and responsibilities of project personnel in quality assurance and management of project scope modifications.

- *Quality Assurance Objectives* look at the areas of data accuracy, precision, comparability, reproducibility, representativeness, and sufficiency.

- *Sampling Procedures* are next covered in detail. Areas covered are general sampling objectives, sampling locations, types of samples to be obtained, required field equipment and instrumentation, and any non-standard procedures dictated by methodology or the environment. The procedures are specific for soil, groundwater, soil vapors and air. Special procedures are included for the use of temporary probes for groundwater or vapor. This section of the QAPP also describes procedures for site hydraulic evaluations, including water level measurements, slug tests, pumping tests and in-situ exploration and testing.

- *Chain of Custody* is discussed in detail, including responsibilities and protocols, information to be included, and sample security procedures. MARK uses its own chain of custody form and, for large sampling projects, may provide pre-printed special forms and labels to make sampling for efficient.

- *Calibration Procedures and Frequency* are described in detail for standard test equipment such as Ph, conductivity, water level, and dissolved oxygen meters. In addition, general requirements for calibrating more specialized equipment such as field gas chromatographs are covered.

- *Analytical Procedures* must adhere to requirements of the U.S. Environmental Protection Agency (EPA) and State of California. Only Laboratories that are certified by these agencies are used by MARK.

- *Data Validation, Reporting and Document Control Procedures* cover the areas of literature reviews, field measurements, laboratory data, computer-processed data, engineering calculations, reports and drawings. Document control procedures cover responsibilities, accountability, distribution, filing and confidentiality. MARK generated data is sufficient to

allow presentation as evidence in legal proceedings.

- *Quality Control Checks and Frequency* for field work include travel blanks, field blanks, fieldduplicates, field splits, and blind spikes for soil, groundwater and soil gas samples.

- *Audit Procedures* are discussed for field work, office activities, and analytical laboratories.

- Preventative Maintenance Procedures are also discussed for all of the types of instrumentation covered in the calibration section.

- *Data Management* covers accuracy, especially percent recovery for analytical work, precision, completeness, and assessment procedures.

- *Corrective Action* includes procedures to follow if failures are detected in equipment, internal QA/QC checks, system performance, or any other non-compliance. If failures are noted, procedures cover notification and reporting, and review and approval.

- *Quality Assurance Reports to Management* include assessments of data precision, accuracy, completeness, documentation of QA/QC practices, performance audit results, system audit results, and any significant QA problems noted and recommended solutions.

PROJECT MANAGEMENT APPROACH

MARK believes that careful project management is essential in assuring that the work is successfully completed within prescribed cost and schedule limits, while maintaining our rigorous standards of quality and compliance to contract requirements. The following precepts characterize our successful project management approach.

- Clear definition and control of the scope, schedule, and costs
- Recognition of changed conditions and early notification to allow for adjustments in the scope and budget
- Close contact and communication with the client

PROJECT TEAM

To illustrate the level of experienced staff that can be made available to you we have identified selected staff in a number of key project areas of remedial design and construction. The selected staff members are listed below:

Principals

David K. Rogers, P.E., C.E.G.	-	Principal-in-Charge/Health and Safety Officer
N. Dean Marachi, Ph.D., P.E.	-	Quality Assurance/Quality Control

Selected Staff

Alan D. Gibbs, R.G.	-	Manager of Remedial Investigations
James M. Herbert, C.E.G.	-	Hydrogeological Investigations
Dale M. Schneeberger, R.G.	-	Hydrogeological Investigations
Mary Lucas McDonald, R.G.	-	Hydrogeological Investigations
Robert S. Spare	-	Hydrogeological Investigations
Paris A. Hajali, P.E.	-	Remedial Design
Mark H. Stanley, P.E.	-	Remedial Construction Management
Larry E. Hawkins	-	Remedial Construction Services
Brian J. Deshaine, P.E.	-	Remedial Construction Services

Principal in Charge (PIC). David K. Rogers, P.E., C.E.G., a principal of the firm with over 25 years of experience in hazardous waste engineering, acts as Principal in Charge for all hazardous waste projects in Northern California. Mr. Rogers is responsible for insuring that contract obligations are met and that necessary resources are available for the successful completion of the project. The PICs are ultimately responsible for the quality control, and overall performance of the project team. The PICs are registered with the appropriate discipline in the state in which the work is to performed, and signs all proposals, major correspondence, reports, and contracts relating to the work.

Mr. Rogers has over 25 years of professional experience in hazardous and solid waste management. He is a recognized expert in the evaluation of leachate seepage through fractured

and porous media; assessment of low temperature, aqueous geochemistry and environmental fate of dissolved metals, organic compounds and radionuclides in the subsurface; development of feasibility, economic analysis, and engineering design of alternative remedial measures for cleanup of soils, groundwater and surface drainage; and the management of RI/FS programs where multiple responsible parties are involved. Mr. Rogers has extensive project experience in overseeing the implementation of workplans for large industrial waste management units, wastewater ponds, underground storage tanks and large maintenance facilities. In addition, Mr. Rogers has developed quality assurance/quality control and other procedural guidelines for the U.S. Navy, U.S. EPA, and state regulatory agencies.

He has been the Principal-in-Charge of the development and implementation of workplans for for Underground and Aboveground Storage Tank Programs including investigations, removals, characterization of regional and site hydrogeology, toxicological/health assessments, environmental soil and water sampling and chemical analysis, aquifer testing, risk analysis and remedial action planning for numerous DOD and private sites including the Oakland Army Base, Ozol DFSC, Concord Naval Weapons Station, Dugway Proving Grounds, Lawrence Livermore National Laboratory, Stockton Scavangers, USS-POSCO, Tosco Refinery, Southern Pacific Pipelines, Southern Pacific Railroad, Shell Oil Refinery, Exxon Corporation, Peterbilt Motors Company, Wayne Stead Cadillac, Crowley Maritime, Intel Corporation, Teledyne-MEC, Motorola 4-Phase, and Zoecon (Sandoz) Corporation.

Quality Assurance/Quality Control Officer. Dr. N. Dean Marachi, Ph.D., P.E., a principal of the firm with over 25 years experience in hazardous waste engineering, is responsible for developing and implementing chain-of-custody, field, and laboratory Quality Assurance/Quality Control (QA/QC) programs for remediation projects in Northern California. He will insure that the work is completed in accordance with criteria derived from four sources: MARK standard procedures, generally accepted engineering and geologic practices, standards of care required in the geographic area, and the limits prescribed by the client and mutually agreed in writing.

Dr. Marachi has broad professional experience in many areas of remedial engineering including regulatory compliance, site and waste characterization, engineering evaluations and reports, evaluation of feasibility and engineering design, development of alternative remedial actions, risk assessment, and evaluation of capital as well as operational costs of remediation and site cleanup or closure measures in response to recent CERCLA and RCRA regulations.

Selected Staff. The selected staff will be assigned to projects based on his or her respective expertise in a given discipline or level of experience in hazardous waste remediation and construction. These project personnel report directly to a project manager and are responsible for supervising subordinate staff and conducting the day-to-day work. These project workers are all professionals with proven leadership abilities and specialized experience to accomplish the assigned tasks. Many are registered professionals within the states where we conduct our work.

Alan D. Gibbs, R.G., has over 19 years of geologic and hydrogeologic experience. He has a comprehensive background preparing work and health & safety plans for conducting and managing hazardous waste investigations including geologic, hydrogeologic and environmental assessments involving impacted soil and groundwater, feasibility studies and remedial

alternatives, and site clean-up, restoration and closure. He has supervised and performed many subsurface investigation, groundwater monitoring and remediation programs involving multiple groundwater well development and operation, bioremediation, ground water treatment systems. Mr. Gibbs has gained intimate knowledge of the state and local regulatory framework and permitting process and has utilized this knowledge in the course of preparing approved workplans and closure plans for site investigation and site remediation projects. He has acted as liaison to many of the government, county health and local regulatory agencies that also govern potenitally impacted properties and has successfully negotiated closure and reduced requirements for clients throughout the state.

An example of Mr. Gibbs successful relationship with County and local regulatory agencies includes the recently completed soil and groundwater remediation project for a large newspaper facility in which over 4,500 cubic yards of soil impacted with petroleum hydrocarbons was treated in less than six weeks. Mr. Gibbs successfully obtained a release from the DTSC, RWQCB, and the City of Mountain View to begin new construction. In addition, he negotiated with and obtained from the RWQCB approval for a limited groundwater monitoring program rather than a costly groundwater remediation based upon a well received detailed groundwater investigation.

Mr. Gibbs also has an excellent working relationship with Federal and State Agencies including the management of various environmental contracts for the Office of the State Architect (OSA). The projects involved preparing proposals, coordinating subcontractors, conducting cost negotiations, overseeing workplan preparation, and managing daily field operations for soil and groundwater investigations from leaking underground storage tanks. His work was so well received by the OSA Project Manager, Ms. Mary Cooper, that a "sole source" contract was issued to Mr. Gibbs for further site investigation. In addition, Mr. Gibbs is currently under a delivery order contract from the U.S. Army, Sacramento District, Corps of Engineers developing and implementing workplans to "fast track" the complete closure of a wastewater sump and french drain within the Dugway Proving Grounds, Utah.

James M. Herbert, C.E.G. has over twelve years of experience in environmental, hydrogeologic and geotechnical investigations. His experience includes conducting, reviewing and managing hydrogeological assessments, remedial investigations, groundwater flow/contaminant transport evaluations, vadose zone and aquifer characterizations, feasibility studies, geotechnical studies for major civil engineering projects and foundation/structural distress investigations. Mr. Herbert has extensive experience supervising field drilling, logging and sampling of soil borings, slope inclinometers and piezometers as well as the installation, development, and sampling of groundwater monitoring wells.

Mr. Herbert has conducted geologic and hydrogeologic assessments for major oil companies, land developers, lending institutions, insurance companies and attorneys. Sites assessed have included vacant land, housing tracts, commercial centers, operating and manufacturing facilities and gasoline stations. Included in these projects was the geologic and hydrogeologic interpretation of a California NPL-CERCLA Superfund site and downgradient neighborhood.

Dale M. Schneeberger, R.G., has over thirteen years of professional experience in geologic and hydrogeologic investigations, evaluations, and environmental and geotechnical studies. Relevant

grease; and CAM 17 Metals.

Paris A. Hajali, Ph.D., P.E., has over 10 years of experience in environmental engineering, hazardous waste management, design and construction management, and project management activities. Dr. Hajali is responsible for technical direction and quality assurance for remediation projects. His experience in this capacity covers projects of various sizes involving soil and groundwater investigation, design of remedial action systems, remedial construction management, and management of operations and maintenance programs. He has provided professional services for several major clients such as Xerox Corporation, TRW Inc., PacTel Properties, McDonnel Douglas, and Home Federal Bank. Dr. Hajali is the inventor for a "Process and Apparatus for groundwater extraction using a High Vacuum Process", U.S. Patent No. 5,172,764.

Dr. Hajali has implemented the final design of an air stripping system for treating chlorinated hydrocarbon contaminated groundwater; managed the operation and maintenance of the groundwater and vapor extraction systems; evaluated soil and groundwater cleanup effectiveness; developed groundwater cleanup criteria based on the application of risk assessment; designed, fabricated, and installed enhanced groundwater extraction systems (dual phase extraction system); and prepared regulatory agency permits (AQMD and NPDES).

Mark H. Stanley, P.E., has over five years of professional experience in environmental/geotechnical engineering. He has been responsible for preparing environmental documents, workplans, and obtaining permits for site restorations involving on-site soil treatment pile construction and groundwater remediation and monitoring for Regional Water Quality Control Boards, County Health Departments, U.S. Corps and other local enforcing agencies. In addition, he has obtained permits and managed the construction of a municipal Class III landfill closure project in Roseville, California, a remedial soil and groundwater investigation involving leaky underground tanks in Stockton, California, quarterly and annual groundwater Self Monitoring Reports with associated statistical analyses and Solid Waste Water Quality Assessment reports for sites in Contra Costa, and Storm Water Pollution Prevention Plans (SWPP) and Monitoring Plans for industrial facilities in Alameda County.

Mr. Stanley's experience also includes the performance of and /or supervision of geotechnical investigations for projects ranging from small structures to large commercial buildings, as well as conducting construction observation for a variety of projects which included large mass grading projects, clay liner construction, commercial developments, and pile installations. He has extensive experience in installation and operation of field instrumentation, including monitoring equipment such as slope inclinometers, pneumatic piezometers, vertical piezometers, and surface markers.

Larry E. Hawkins has extensive and diverse experience as a construction engineering project superintendent/manager. His primary responsibilities have involved field project management and administration, direct supervision of construction crews, project cost control, contract negotiations, job scheduling and coordination, training of employees for specialized work, directing work in OSHA-defined confined-space environments, and procurement of specialized materials and equipment.

In over 18 years of field management experience, Mr. Hawkins' responsibilities have included work with hazardous waste treatment systems, underground storage tanks, landfills, pipelines, lift and pumping stations, testing of systems using high pressure, x-ray, dye, and television techniques, sewer monitoring devices, and cathodic protection and isolation systems. In the course of his work Mr. Hawkins has directed pipeline projects in ground conditions varying from granitic rock to soft estuarine mud. He has extensive experience in excavation, including open cuts up to 37 feet deep. Many of these projects required dewatering, solid sheeting, or other special construction techniques.

Brian J. Deschaine, P.E., has over six years field supervisory experience in numerous environmental closures, restorations and construction projects, as well as two years experience as a field and laboratory technician. His experience includes all aspects of construction management of numerous underground storage tank (UST) investigations and remediation projects involving site characterizations, soil borings, well construction, development and sampling, remedial evaluations, removal of underground storage tanks, excavation, soil ventilation, bioremediation, groundwater pump and treat, and the design, supervision and installation of double-walled pipe waste systems with leak detectors. Some of Mr. Deschaine's most recent projects have involved field supervising and construction management for the removal of multiple underground storage tanks and restoration of a site in downtown San Francisco, implementation of remedial actions for impacted soil and groundwater at the Georgia-Pacific Tank Farm in Elk Grove, and the construction upgrade to hazardous waste tank and piping systems at the Lawrence Livermore National Laboratory. Mr. Deschaine's experience also includes the closure construction of various wastewater ponds and surface impoundments for private and municipal clients.

Support Staff. The support staff includes degree holding junior professionals, technicians, administrative, and clerical personnel. These typically include engineers and geologists-in-training, field assistants, drafters, field technicians, laboratory technicians, accountants, office administrators, word and data processors, and clerical personnel. Technical services available to the project personnel include our field equipment and vehicles, the laboratory equipment, and computer hardware and software.

SELECTED PROJECT EXPERIENCE

The MARK Group, Inc. (MARK) provides a considerable base of experience in the management and implementation of underground and aboveground storage tank investigation, compliance, remediation, modification and closure programs. MARK has also worked extensively with private industry on environmental sampling and other related hazardous and non-hazardous waste management programs. In the past 8 years alone, MARK has completed more than 1000 hazardous waste management projects for industrial and municipal clients in California, Nevada and throughout the western United States and Canada.

The following project summaries highlight selected MARK experience in underground and aboveground storage tank remedial design and construct services.

TOSCO OIL REFINERIES
VARIOUS ENVIRONMENTAL DESIGN AND CONSTRUCTION
Contra Costa Shoreline, California
Spokanne, Washington

MARK has been providing environmental services to Tosco for more than six years, resulting in regulatory compliance with environmental legislation such as Calderon, Katz and Porter-Cologne, amongst others. MARK has been instrumental in quickly mobilizing a team in assisting Tosco with regulatory negotiations of their current waste discharge requirements for 23 waste management units located throughout Tosco's Avon Facility on the Contra Costa Shoreline in Martinez, California. MARK developed the rationale behind Tosco's current detection monitoring program, installed the majority of the 93 monitoring wells currently used, and conducted extensive hydrostratigraphic investigations. The following services were conducted by MARK for Tosco:

- Underground tank and fuel spill cleanup - sampling and analysis, hydrogeological assessment, prepare cleanup plan, regulatory relations and reports at Tank Farm, CERCLA site, Spokane, Washington.

- Quarterly groundwater monitoring and reporting services - mobilization and implementation of field crew and equipment for well purging and sampling of 75 groundwater monitoring wells for the past six years at the Avon facility;

- Remedial engineering services - site characterization, evaluation of remedial alternatives, plans and specifications for remediation engineering projects, QA/QC plans for remediation engineering, negotiations of cleanup standards, hydrogeologic assessment, closure plans, closure design and certification, and design and/or construction of environmental restoration project at Class I Oily Waste Ponds, Avon Refinery;

- Remedial investigations and remedial action programs - hydrogeologic assessment, monitoring well installation, sampling and analysis plans, site characterization, remedial action evaluation/feasibility studies, regularity compliance/agency relations, QA/QC plans, health and safety plan, forensic services at CERCLA ("Superfund") site, Spokane, Washington; and

UNOCAL SOIL VAPOR EXTRACTION SYSTEM CONSTRUCTION
Avila Beach, California

Unocal Oil, Inc. (UNOCAL) owns and operates an oil refining facility located in Avila Beach, California. Due to past operations the site had several areas affected with petroleum hydrocarbons as gasoline, diesel and BTEX. From prior remedial investigations a soil vapor extraction system was designed to remediate the impacted soil. As a result, MARK was contracted to provide construction management services for the installation of all the piping and associated structures for the system.

MARK developed a workplan which consisted of:

- Preparation of topographical surveys and contoured site plans;
- Preparation of trenching and grading plan for one mile of vapor extraction pipe;
- Restoration of project site and its environs of all debris and wastes from site activities.

In conducting the trenching, MARK had to install numerous hook-ups from a series of extraction wells to the main extraction manifold.

The extraction manifold will be plumbed to a vapor extraction unit located at the UNOCAL tank farm.

All field work and other technical procedures required for this project was strictly adhered to the Quality Control/Quality Assurance Program Plan. At the completion of field activities, MARK documented the construction efforts.

MARK received acknowledgements for excellent work performed on the Avila Beach Vapor Extraction Pipeline System project. The prime contractor wrote, "*Experience and skills were evident in the direction of the crew in all aspects of the work including backfilling, testing, traffic control, and dust suppression. The townspeople and UNOCAL representatives who appeared on the site were also very complimentary of the MARK construction crew*". In addition "The Avial Pilot", the local newspaper, commended MARK efforts on the project for their effort in taking extra steps to insure that residents and business were not inconvenienced.

SF NEWSPAPER AGENCY DESIGN/CONSTRUCT
UST SOIL REMEDIATION AND GROUNDWATER MONITORING
Mountain View, California

MARK was contracted to develop and implement remediation of soil impacted with hydrocarbons, volatile organic compounds (VOCs), and chlorinated hydrocarbons, and assess the groundwater at a large site of former multiple underground fuel tanks.

Prior to beginning soil remediation, three existing monitoring wells were bored out and the boring filled with a cement/bentonite mixture and allowed to cure prior to starting excavation. Over 4,500 cubic yards of soil just above the water table was excavated. The soil was sampled

experience in the hazardous waste management field has included project management and technical responsibilities in the design and implementation of site investigation, monitoring and remediation programs. Mr. Schneeberger is very familiar with CAL-EPA, DTSC, and Regional Water Quality Control Board framework and permitting and has utilized this knowledge in the course of supervising and conducting hydrogeologic investigation and site remediation projects.

Previous professional assignments in underground storage tanks have involved diverse experience in site investigations, characterizations, and site restorations of service stations impacted by total petroleum hydrocarbon releases in areas of shallow groundwater. He has sucessfully prepared and submitted site investigations and remedial action plans involving pump-and-treat, vapor extraction, and bioremediation to the Department of Toxic Substances Control.

Mary Lucas McDonald, R.G., has over ten years of hydrogeological investigation, groundwater quality assessments, and engineering experience for a variety of CERCLA and RCRA environmental projects involving underground storage tanks. Relevant experience has included project management and technical responsibilities in the design and implementation of site investigation and groundwater quality monitoring programs at many local service stations and military facilities. Her field experience includes siting, underground tank removals, installation and development of multiple monitoring wells, soil and groundwater sampling and analysis, and aquifer testing.

She has also prepared work plans, supervised field work, conducted groundwater modeling, and prepared recommendations for soil and groundwater remediation. She has overseen the preparation of plans and specifications and the subsequent construction for soil vapor extraction systems, groundwater extraction systems, and air stripping towers.

Robert S. Spare, R.E.A., has more than five years professional experience as an environmental scientist, with a strong emphasis in geology and groundwater hydrology. Mr. Spare has managed and implemented several facets of air, soil, groundwater and surface water investigation and remediation projects under RCRA. His project experience includes extensive field experience in petroleum site investigations defining lateral and vertical extents of contamination, including logging of exploratory borings and trenches, coordinating remedial response operations and installation of treatment systems. He has direct experience utilizing a number of field investigation techniques including air quality monitoring for ambient, indoor, and stationary stack emissions, soil gas surveys, drilling including air casing hammer, direct- and reverse-circulation mud rotary, and hollow-stem and bucket auger, soil and water sampling and monitoring well installation procedures. To complement his technical expertise, Mr. Spare is knowledgeable of the regulatory framework which governs these various applications, allowing him to handle a variety of environmental situations.

Recently, as part of a comprehensive hydrogeological investigation of a large refinery on the bay shoreline of Contra Costa County, Mr. Spare supervised the drilling, installation, sampling and analysis of samples taken from 52 borings and 18 newly installed groundwater monitoring wells for site constituents including CAM 17 Metals and petroleum hydrocarbons. Approximately 400 soil samples and 20 groundwater samples were analyzed for the following: Total petroleum hydrocarbons (gasoline and diesel); Benzene, toluene, ethlybenzene and xylenes; total oil and

and segregated for remediation by screening on-site using an immuno-assay analysis technique and a photoionization detector (PID).

The excavated soil was treated for removal and destruction of petroleum hydrocarbons by a process called Heat Enhanced Vapor Extraction/Thermal Oxidation (HEVE/TO). Impacted soil was segregated into five treatment piles. During the construction of the soil treatment piles a network of air injection and vapor extraction piping was placed within the soil piles. After assembly, the treatment pile was covered with plastic sheeting to avoid fugitive hydrocarbon emissions and rainwater intrusion.

When clean levels were reached, confirmation sampling was conducted and the treated soil was then used to backfill the excavated area.

To better define the lateral extent of petroleum hydrocarbons and the regional extent of background chlorinated hydrocarbons, a monitoring network consisting of 4 new wells, and 2 upgradient temporary wells were installed.

The entire remediation and investigation program was carefully coordinated with plans for construction of a new building. Due to this construction, MARK managed and maintained the entire program under an ambitious time schedule which was met ahead of schedule resulting in a significant cost savings to the client.

To achieve an accelerated program and meet all regulatory requirements, active cooperation with the client and multiple regulatory bodies was required. MARK was instrumental in coordinating with the City of Mountain View.

MARK recently obtained for the client a release from the DTSC, RWQCB, and the City of Mountain View construction permits following the soil remediation. In addition, MARK negotiated with and obtained from the RWQCB approval for a limited groundwater monitoring program rather than a costly groundwater remediation based upon a well received detailed groundwater investigation.

STOCKTON SCAVENGERS DESIGN/CONSTRUCT
UST SOIL AND GROUNDWATER REMEDIATION
Stockton, California

MARK was contracted to develop and implement a workplan for remediation of approximately 2,000 cubic yards of gasoline and diesel hydrocarbon impacted soil and assess the groundwater condition at a large site of former multiple underground fuel tanks in Stockton, California. Subsequent to the removal of the former fuel storage tanks, soil and groundwater sampling results indicated that elevated hydrocarbon concentrations were still present. Prior to beginning soil remediation, additional soil was removed from the tank pits. The soil was sampled and segregated for remediation by screening on-site using an immuno-assay analysis technique. Although most of the hydrocarbon impacted soil was removed by excavation, safety and structural considerations required closing the excavation with hydrocarbons remaining in the soil.

During backfilling, soil venting piping was installed to allow removal of the last traces of hydrocarbons.

The excavated soil was treated for removal and destruction of petroleum hydrocarbons by a process called Heat Enhanced Vapor Extraction/Thermal Oxidation (HEVE/TO). Impacted soil was segregated into a treatment pile. During the construction of the soil treatment pile a network of air injection and vapor extraction piping was placed within the soil pile. In order to provide for enhanced biodegradation, inorganic nutrients and micro-organisms were spread on the soil with each lift. After assembly, the treatment pile was covered with plastic sheeting to avoid fugitive hydrocarbon emissions and rainwater intrusion. The HEVE/TO piping network also provided the opportunity to complete the process biologically if cleanup goals were unmet (if unnecessary).

When clean soil levels were reached, confirmation sampling was conducted. Along with periodic testing of the extracted soil vapors, the same immuno-assay technique used for judging the limits of excavation was used for field testing to determine the degree of cleanup. Using this technique, treatment for the soil pile was complete in approximately four weeks. The treated soil was then disposed of off-site.

To assess and monitor the groundwater underlying the site, three new wells were installed and developed to evaluate the presence or absence of hydrocarbons. Following installation of the monitoring wells, groundwater samples were collected and analyzed for volatile aromatic hydrocarbons and total petroleum hydrocarbons as gas and diesel.

Currently, MARK is constructing, installing, operating, and monitoring a groundwater extraction and treatment system in compliance with discharged water quality regulations. The operation of this system includes extraction of the groundwater by pumping and treatment of the extracted water prior to its discharge into the sanitary sewer system.

To achieve an accelerated program and meet all regulatory requirements, active cooperation with the client and multiple regulatory bodies was required. MARK was instrumental in coordinating with the City of Stockton, the San Joaquin County Public Health Services Department, Environmental Health Division, and the State of California Department of Toxic Substances Control.

The entire remediation and investigation program was carefully coordinated with concurrent construction of additional facilities at the site, including a new truck wash canopy, oil/water separator and stormwater detention pond. Due to this construction, MARK managed and maintained the entire program under an ambitious time schedule.

GEORGIA-PACIFIC DESIGN/CONSTRUCT
TANK FARM SOIL AND GROUNDWATER REMEDIATION
Elk Grove, California

MARK was contracted to develop and implement a workplan to remediate impacted soils and evaluate potential impacts to groundwater at a site of a former large phenol storage tank in Elk Grove, California. Due to the urgency of the source removal, MARK immediately met with Regional Water Quality Control Board (RWQCB) personnel and began site work within two weeks of authorization by the client. The work included:

- Preparation of a site-specific health and safety plan;
- Preparation of the site area for excavation including saw cutting of concrete, installation of piling for soil stability control, and setting up site control and decontamination facilities;
- Installation of shoring to protect other tanks and equipment in the vicinity of the excavation;
- Removal of impacted soils by workers using level C2 protection (chemical resistant suits with hoods, full face air purifying respirators, double gloves), due to the high anticipated phenol concentration at this stage (Once the high concentration soils had been excavated, based on visual and vapor composition measurements, workers switched to level C protection to speed progress and reduce cost);
- Excavation and sampling of soil to the pre-determined limits based on visual evidence and sample analyses;
- Installation of an extraction trench for later collection and removal of phenol containing water from soil washing techniques;
- Backfilling with imported material followed by compaction and testing;
- Restoration of the site including construction of a new tank pad and containment designed for spill collection;
- Decontamination of excavation equipment; and
- Preparation of a closure report documenting all remediation activities suitable for distribution to regulatory agencies. This report included diagrams illustrating actual phenol removal and volume, analytical data on phenol concentrations at the limits of excavation, description of procedures for source removal and site restoration, and diagram of the proposed or installed groundwater collection trench.

Observations of subsurface conditions during excavation of high phenol concentration soils provided insights on the requirements for further site remedial activities in areas that could not be excavated. As a result, MARK performed the following activities:

- Installation of four shallow soil borings in the area outside the tank containment zone and one angle boring directly below an adjacent tank analyzed for phenols; and
- Development of alternative approaches to remediate soils under an adjacent 70,000 gallon tank.

The conclusions from this subsequent work is that phenol concentrations in the site vicinity have been reduced to preclude an measurable risk to health or groundwater. Limited soil washing will be undertaken to reduce all soil phenol concentrations to below regulatory limits.

FOODMART DESIGN/CONSTRUCT UST SOIL REMEDIATION
Vallejo, California

Following the removal of gasoline storage tanks and dispensing systems from a food convenience mart in Vallejo, California, approximately 750 cubic yards of soil were excavated. Analytical results from soil and groundwater sampling conducted prior to, during and after tank excavation indicated that both soil and groundwater had been impacted by petroleum hydrocarbons.

MARK was then contracted to prepare and implement workplans and health & safety plans for the remediation of the excavated soils followed by site restoration. Representatives of the Vallejo Fire Department, Fire Prevention Division indicated the remediation of the soils was to be completed in approximately 3 months.

In the interest of both safety and efficient operation of the convenience mart, MARK quickly performed the supplemental excavation and stock piling of soil from the pit in the areas showing elevated soil hydrocarbons. Then grab samples were taken from each area with the backhoe bucket and analyzed on site using a immuno-assay techniques specific for petroleum hydrocarbons. The two techniques gave highly reliable results in less than 30 minutes. After remaining traces of hydrocarbons were removed, permission to backfill the excavation was obtained from the Fire Department representative, on-site during this procedure.

Backfilling was done with "pea gravel" to within approximately two to four feet of the surface. Prior to backfilling, a 12 inch well casing was placed vertically in the excavation to later serve as an extraction well if necessary. After placement of the pea gravel, the excavation was filled to the surface with Class II aggregate base rock and appropriately compacted. The surface was then paved with asphalt concrete (AC).

The excavated soil was treated to remove and destroy petroleum hydrocarbons by a process called "Heat Enhanced Vapor Extraction/Thermal Oxidation". Air extracted from the pile first passed through a moisture knockout drum and then into a gas- or propane-fired thermal oxidizer. Hydrocarbon destruction efficiency in the oxidizer was at least 98%, thus minimizing air emissions from treatment. Hot air from the oxidizer was routed back to the soil pile, substantially increasing the rate of volatilization and overall treatment efficiency. In less than two weeks the soil treatment was complete. The treated soil was then used on-site saving the client substantial cost of disposal. A workplan is being prepared for further investigation of impacts to soil and groundwater.

J & W DEVELOPMENT TPH BIOREMEDIATION
Livermore, California

J & W Development (J&W) owns a former recreational vehicle storage site located in Livermore, California. Located on this site were multiple underground and aboveground storage tanks. Due to elevated soil concentrations of fuel hydrocarbons discovered during the removal of the tanks, J&W's contractor excavated (to the extent possible with the available equipment) and segregated contaminated soils.

MARK was contracted to further excavate, segregate, and stockpile soils, and; design and implement a program to restore the site by bioremediating the stockpiled soils so that they might be recycled and used as backfill for the on site excavations. MARK reviewed all prior work and discovered a large area of impacted soils in one of the former tank pits.

MARK performed the following procedures to remove the remaining hydrocarbons from the soil:

- A Caterpillar 225 excavator was used to excavate the remaining soil affected by diesel hydrocarbons from the bottom an sides of the pit. Approximately 4,000 cubic yards of additional soil was removed from the 45 foot excavation.
- Soil excavated was carefully segregated and stockpiled on a paved area to separate soil potentially affected by hydrocarbons from any clean soil that was excavated.
- Five confirmation samples were taken from the pit bottom to confirm complete excavation. Samples were collected and analyzed for BTXE compounds and diesel hydrocarbons. No detectable amounts were detected.
- Stockpiles containing clean soil were spread out to a maximum thickness of two feet and confirmation samples taken according to Chapter 9 of Part III of EPA Publication SW-846.

MARK performed the following procedures to aerate the 660 cubic yards of gasoline impacted soil and bioremediate the 4000 cubic yards of diesel impacted soil:

- Controlled volumes of the stockpiled soil were spread and aerated to remove the volatile components. Confirmation samples were collected and analyzed for BTXE compounds, gas and diesel hydrocarbons. The aerated soils found to be void of hyrocarbons were stockpiled for use as backfill.
- Unconfirmed soils and stockpiled soils affected with diesel were spread over the designated treatment area and augmented with nutrients, moisture and oxygen. Careful monitoring and control of soil nutrient and moisture levels along with continued aeration of the soil enhanced the bioremediation.

Due to organic vapors from the aeration activities the daily volume of soil spread had to be limited as to comply with Regulation 8 of Rule 40 of the San Francisco Bay Area Air Quality Management District (BAAQMD). Regular sampling and testing was conducted on the soils to check the progress of the bioremediation process and to adjust soil chemistry for optimum degradation of hydrocarbons.

After receiving county approval to use all of the treated soils as backfill material, MARK prepared a comprehensive closure report for the site. This report documented the tank closures, soil remediation efforts and contained all sampling and analytical data. Folowing approval the site was restored to pre-remediation conditions.

LOS ALAMITOS ARMED FORCES TPH BIOREMEDIATION
Los Alamitos Reserve Center, California

In an effort to comply with the waste minimization policy of the Department of Defense (DOD) and examine new technologies for waste management, MARK under an indefinite delivery contract with the Sacramento District implemented a bioremediation (Bio) study at the Los Alamitos Armed Forces Reserve Center in California. This study was performed on the most difficult medium for Bio, i.e., low permeability clayey soils, to provide a rigorous test of the effectiveness of the Bio treatment.

The objective of the study was to review performance of an Ex-situ on-site augmented, enhanced and accelerated Bio process on approximately 1,000 cubic yards of soil contaminated with Total Petroleum Hydrocarbons (TPH) to achieve concentrations below the action levels in clayey soils in a timely manner (1 month).

The scope of work included:

- Initial treatability studies;
- Construction of a 55-foot by 175-foot Bio cell consisting of a 6-inch sand layer covering a 25-mil flexible membrane liner;
- Soil screening through a large RD 90A Mechanical Screen;
- Soil spreading over the Bio cell and augmented with bioproduct (microbial population, nutrients, moisture and water) into the soil using a SS-250 soil stabilizer to depths of two feet;
- Careful monitoring and control of bioproduct to optimize Bio process;
- Field screening of soil and air using a hand held air monitor/photoionization detector (PID) in accordance with South Coast Air Quality Management District (SCAQMD) air emissions standards; and
- Soil samples were obtained 12-18 inches deep from the centers of 10 equal sections of bio cell prior to, during and after operations to evaluate TPH concentrations.

Within 11 days of the Bio treatment the microbial population had consumed as much as 97% of the reported TPH and up to 99.6% within 20 days. The resulting concentrations were brought down to half the Standard Threshold Limit Concentration (STLC) for TPH.

MARK conclusions indicated that the Bio process met or exceeded all the DOD evaluation criteria for cleanup of soils impacted by heavy end hydrocarbons produced from past fuel operations of the 1940's. In addition, despite clayey problem soils at the site, the Bio process was demonstrated to be very effective for remediating fuels containing heavy end hydrocarbons and solvents in terms of clean up level achievement, cost-effectiveness, and time efficiency.

At the completion of field activities, MARK prepared a comprehensive study for the Bio process. This study documented the Bio process, contained all sampling and analytical data and provided an efficiency and cost comparison study of the Bio process to other remediation techniques.

DEFENSE FUEL SUPPLY TERMINAL DESIGN/CONSTRUCT
UST SOIL AND GROUNDWATER REMEDIATION
Contra Costa County, California

A defense fuel supply terminal in northern Contra Costa County, California detected leakage among their 11 large (100,000-gallon) underground storage tanks containing JP4 fuel. The prime defense contractor, Tenco had installed monitoring wells to begin the task of defining the possible presence of JP4 in groundwater. MARK reviewed the results of these investigations and conducted the next phase of work, evaluation of the magnitude and extent of the subsurface plume. We reviewed previously collected data, took soil samples and installed new groundwater monitoring wells to facilitate collection of soils and water samples, and to confirm the existence of a perched water table. Soil and water samples were submitted for chemical analysis, and selected soil samples were subject to laboratory permeability tests to aid in determining the competency of a possible confining layer in order to assess the extent of potential migration away from the tank storage area. We located and sampled wells within a 1/2-mile radius of the site, estimated the rate of groundwater movement, and identified potential pathways of migration. For continued monitoring at the facility subsequent to project completion, we developed a water sampling program.

Our study provided some essential hydrogeologic information on groundwater flow direction, aquifer permeability, and water table elevations. The report also described remedial action alternatives for control of fuel migration. A groundwater removal system with water-product separator tank and air stripper was tentatively recommended.

To determine the most effective and cost-efficient remedial alternative, MARK conducted supplemental investigations. New monitoring wells and a fuel skimmer well were installed, soils and groundwater were sampled, and hydraulic testing was performed to assess hydraulic conductivity. One monitoring well was also destroyed and sealed in compliance with regulatory procedures. Field data and analytic results were then interpreted and discussed relative to the feasibility of various remedial action alternatives. Subsequently MARK was retained to provide turnkey services for the installation of an extraction well/fuel recovery system. MARK provided the design, permitting, procurement and installation of the following:

- 8-inch diameter well with a submersible product recovery pump
- oil/water separator; and
- explosion-proof electrical system, piping and instrumentation

As part of a value engineering evaluation, a pilot bore hole was installed to evaluate groundwater levels, hydraulic conductivity and recharge rates of the groundwater. As expected, results of this study indicated slow recharge rates. Consequently, the review of the data assisted in estimating the size of the screened interval and pump capacity. In addition, it was concluded that the requirements for a groundwater depression pump to increase the floating product layer was considered unnecessary. The submersible product recovery pump, which was constructed of stainless steel and teflon wetted parts, was installed to allow for adjustment during seasonal changes. Above ground piping included a manual flowmeter with totalization and a site glass to quantify and optimize the collection of free product. A sophisticated control panel was

designed to indicate and record hours of operation and cycling of the product pump. Circuitry in the panel included interlocks for pump operation as a function high and/or low levels of product in the well and the oil water separator. MARK also developed operation and maintenance manuals for the system. The entire system became fully operational within eight weeks from award of contract and was completed within budget.

CITY OF SAN JOSE UST SOIL AND GROUNDWATER REMEDIATION
San Jose, California

MARK was contracted to remediate approximately 450 cubic yards of hydrocarbon and diesel impacted soil and install a groundwater pump and treat system at a site of a former gasoline/convenience mart in San Jose, California.

Subsequent to the removal of the former fuel storage tanks, soil and groundwater sampling results indicated that elevated hydrocarbon concentrations were still present. Prior to beginning soil remediation, the existing structure and asbestos materials were decontaminated, demolished and removed from the site. Hydrocarbon impacted soil was removed by excavation, a monitoring well was destroyed, and a groundwater extraction well, piping system and a manhole was installed and developed to allow remediation of the hydrocarbons in the groundwater.

Due to the location of the site near a busy intersection within San Jose, numerous permits were required, including a traffic control plan with designated flagmen plus installation and maintanence of temporary (K type) railings, and six foot high temporary chain link fences around the entire work site.

Prior to excavation, a tailgate safety meeting was held prior to beginning the work. Forty-five feet of sheeting, shoring and bracing were installed during the excavation and segregration of spoil piles. Soil samples for chemical analysis were collected from the excavation pits and from the associated spoil piles. All sampling and analytical procedures were performed in compliance with the procedures prescribed by the California Code of Regulations, Title 23, Division 3, Chapter 16; the "Leaking Underground Fuel Tank (LUFT) Manual", the "Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites". The soil piles were placed over a constructed bermed stockpile lined with PVC sheeting to prevent contact of the excavated contaminated material with the underlying soil. Subsequently, the tank pits were backfilled and compacted with Caltrans Class III aggregate subbase material.

Currently, MARK is constructing, installing, operating, and monitoring a groundwater extraction and treatment system in compliance with discharged water quality regulations. The operation of this system includes extraction of the groundwater by pumping and treatment of the extracted water prior to its discharge into the public storm drain system adjacent to the site. Additionally, MARK will provide the City of San Jose with records of operations, and system discharge monitoring as required by the Santa Clara Valley Water District; evaluate the progress of the groundwater remediation; and implement any changes that are necessary to achieve efficient groundwater cleanup, in a reasonable time frame.

GOLDEN GATEWAY CENTER UST REMOVALS AND SITE RESTORATION
San Francisco, California

Golden Gateway Center (GGC) is a complex of multi-story structures that combines commercial and residential uses. Three underground storage tanks (USTs) including two 6,000-gallon diesel tanks, and one 10,000-gallon gasoline tank were formerly located on the site. These tanks and their associated supply and vapor lines were removed by MARK.

Due to the location of the site within the downtown financial district of San Francisco, numerous permits were required, including permission to close the streets during tank removal, and provision protection of adjacent building foundation.

Upon receipt of the required permits, appointments with inspectors from city agencies were scheduled to observe removal activities and a tailgate safety meeting was held prior to beginning the work. In anticipation for heavy automobile and pedestrian congestion, barricades and flagmen were utilized. Prior to excavation, the tanks were emptied of the remaining fuel. The gasoline tank was triple rinsed and the rinsate was removed from the site under hazardous waste manifests. At least 3 pounds of solid carbon dioxide (dry ice) for each 100 gallons of tank volume were placed in each tank to displace combustable vapors within the tanks.

Ornamental bricks were removed and the pavement saw cut at each of the three locations before the tanks were excavated and removed. Each tank was inspected and found to be intact and free of holes or any significant corrosion. During excavation of the tanks, additional work was performed to protect and maintain security of utility lines. Following the inspection, each tank was capped and then transported under hazardous waste manifests for recycling as scrap metal.

Soil samples for chemical analysis were collected from the excavation pits and from the associated spoil piles. One pit contained groundwater which was also sampled and submitted for analysis.

All sampling and analytical procedures were performed in compliance with the procedures prescribed by the California Code of Regulations, Title 23, Division 3, Chapter 16; the "Leaking Underground Fuel Tank (LUFT) Manual", the "Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites", and the San Francisco Department of Public Health UST Removal Regulations.

On the basis of the analytical testing, the soils excavated at each location were found to be free of impacts. Subsequently, the tank pits were backfilled and compacted with the excavated soil, followed by a Caltrans Class II aggregate subbase material. All pavement, concrete and brick work was replaced to restore the sidewalk and surroundings.

Upon completion of all field activities a required report was submitted to the owner and filed with the local regulatory agencies. This report documented the removal efforts and contained all sampling and analytical data. Currently, the site is awaiting closure pending the review of the San Francisco City and County Department of Public Health and the Regional Water Quality Control Board.

LIVERMORE MUFFLER SHOP UST REMOVALS AND SITE RESTORATION
Livermore, California

Livermore Muffler Shop (LMS) facility located in Livermore, California is currently operating on the site of a former service station. Several underground storage tanks including two 5,000-gallon and one 6,000-gallon gasoline tank, one 6000-gallon diesel tank and one 500-gallon waste-oil tank were formerly located on the site. These tanks and their associated supply and vapor lines were removed by MARK. Each tank was inspected and found to be intact and free of holes or any significant corrosion.

During excavation of the underground waste-oil tank, backfill materials were found to be affected by spillage of waste oil. In compliance with the requirements of Subchapter 16 of Chapter 3 of the California Code of Regulations (CCR) and the guidelines issued by the Alameda County Department of Environmental Health, MARK recovered samples from the soils exposed in each of the pits after the underground storage tanks had been exhumed and from the trenches opened to remove the supply and vapor lines. Field work included soil sampling, analysis, data evaluation and reporting. Analytes reported in the soil included low levels of long-chain hydrocarbons (oil, grease and diesel fuel). Following soil sampling the tank pits were lined with plastic (to segregate clean backfill and mark the extent of the excavation) and immediately backfilled with pea gravel and a one foot layer of compacted road-base material. Upon completion of all field activities all required reports were filed with the local regulatory agency.

MARK was retained to develop a work plan and perform a complete site remediation and execute closure requirements. The remediation program consisted of the following elements:

- Excavation of the remaining soil affected by long-chain hydrocarbons from the subsurface beneath the former site of the waste-oil storage tank;
- Confirmation of complete excavation of soil affected by hydrocarbons;
- Off-site disposal of approximately 40 cubic yards of affected soil to a permitted disposal facility;
- Backfilling of the excavation with clean fill and compacted Class II aggregate base material; and
- Repaving of the site with three inches of bituminous macadam over a minimum of eight inches of Caltrans spec aggregate base material.

All soil sampling, analytical work, field work and other technical procedures required for this project was conducted according to MARK's project-specific Quality Assurance Program Plan. MARK's standard operating procedures are compliant with EPA and State of California requirements.

At the completion of field activities, MARK prepared a comprehensive closure report for the site. This report documented the remediation efforts and contained all sampling and analytical data. This report was subsequently approved by the Alameda County Department of Environmental Health and the Regional Water Quality Control Board.

FREMONT UST REMOVALS AND SITE RESTORATION
Los Angeles, California

MARK was contracted to provide general contracting services for the removal of one 1,500-gallon leaking underground boiler fuel oil storage tank (UST) from the Fremont Indemnity facility in Los Angeles, California.

The UST was approximately 23 feet below grade (4 feet below the foundation) and located within six feet of the building. Due to the tank location, removal procedures required extensive shoring construction to minimize lateral soil movement and building distress and risk to the integrity of the building and appurtenant structures. The scope of work included:

- Presentation and submittal of a site specific health and safety plan and all applicable regulatory permit applications;
- Drilling of two angled soil borings under the UST as part of a comprehensive soil and groundwater investigation;
- Shoring construction involving 40 foot steel H-piles (W12 x 53) set in two foot auger holes on four foot centers around the perimeter of the excavation. The steel piles were laterally braced at a depth of 14 feet below grade with steel beams (W14 x 90). The steel piles were backed with 5/8-inch steel plates to a depth of ten feet below grade preventing soil from caving in from the excavation sides;
- Excavation and segragation of the petroleum hydrocarbon impacted soils from the clean soil during tank removal and shoring activities.
- Excavation and exhumation of the tank for proper disposal including the cutting and recycling of the tank as scrap metal; and
- Sampling of soil samples taken from the tank pit and impacted soil pile and analyzed for benzene, toluene xylene and ethyl benzene (EPA Method 8020) and Total Extractabel Hydrocarbons (TEH/8015) by modified EPA method 8015 according to CADHS Method/LUFT Manual Procedures as required by the Los Angeles Fire Department.

Following soil sampling, remedial actions were taken to mitigate the impacted soils:

- Excavation of the remaining soils affected by hydrocarbons beneath the former site of the tank;
- Confirmation of complete excavation of soil affected by hydrocarbons;
- Off-site disposal of affected soils to a permitted disposal facility; and
- Backfilling of the excavation with clean fill and compacted Class II aggregate base material.

All soil sampling, analytical work, field work and other technical procedures required for this project was conducted according to MARK's project-specific Quality Assurance Program Plan. MARK's standard operating procedures are compliant with EPA and State of California requirements.

At the completion of field activities, MARK prepared a comprehensive closure report for the site. This report documented the remediation efforts and contained all sampling and analytical data. This report was subsequently approved by the Regional Water Quality Control Board.

R1U1 WASTE TANK AND PIPING SYSTEM UPGRADE CONSTRUCTION
Livermore, California

The R1U1 waste tank collection systems services the Lawrence Livermore National Laboratory (LLNL) research facilities located in Livermore, California. The system is designed to collected liquid wastes comprised of residues from various classified experiments. The lab waste stream is known to contain various heavy metals, solvents and low levels of radioactive wastes. In an effort to modernize the system, MARK was contracted by LLNL to provide all labor, materials, and equipment to provide and install:

- Underground/aboveground laboratory waste piping;
- Aboveground single-walled storage tanks;
- Complete leak detection system;
- Heat tape for freeze protection of single wall waste piping;
- Electrical supply/conduit/starters as required; and
- Structural epoxy coated concrete pad with retention walls for two 4200-gallon tanks as well as the existing pump pad.

Since all of the work performed on this project was within high security areas, all contractor personnel required escort by LLNL security personnel. Some of the specific work tasks performed by MARK are listed below.

- Quality Control;
- Site Demolition;
- Excavation, backfilling and trenching;
- Asphaltic concrete paving;
- Portland cement concrete paving;
- Concrete formwork and reinforcement;
- Cast-in-place concrete work;
- Structural steel work;
- Laboratory waste piping construction;
- Laboratory waste lift station construction;
- Single-walled storage tank construction;
- Installation of leak detection system; and
- Basic mechanical and electrical requirements including conduits, raceways and fittings;

MARK provided complete turnkey service throughout the project duration. Due to changes in scope directed by the design engineer and unforeseen adverse climate conditions during the course of the project, extensive changes and delays were encountered. However, MARK was still able to meet the clients needs and schedule without encountering extensive cost over-runs.

GROUNDWATER PUMPING STATION CONSTRUCTION
Livermore, California

In effort to increase the groundwater supply of the onsite water treatment plant which services the Lawrence Livermore National Laboratory (LLNL) research facilities located in Livermore, California, two existing wells and three future wells were planned to be connected. MARK was contracted by LLNL to provide all labor, materials, and equipment to:

- Connect two (2) existing wells located west of LLNL to the onsite water treatment plant; and
- Install electrical facilities to operate three (3) future wells;

Specific items of work included:

- Excavation, backfilling and grading;
- Installation of two well head manholes;
- Construction of concrete control vault and air valve assemblies including electrical and mechanical exhaust fans and dehumidifier;
- Installation of approximately 1,560 lineal feet of buried double-walled (3-inch x 6-inch) containment piping
- Construction of leak detection systems at Building 11 and vault;
- Installation of other electrical systems including telemetry and control system, flow meters and transmitters, motor starters and vault misc., ground system, PG&E service to vault and conduit for future wells.

All work was accomplished in accordance with the specifications, federal, state, Alameda County, local requirements, and accepted safety standards. MARK consulted applicable regulatory and permit requirements of appropriate government agencies before initiating the work.

TRAVIS AIR FORCE BASE OIL/WATER SEPARATOR SYSTEM CONSTRUCTION
Solano County, California

Under the direction of the U.S. Air Force 60th Contracting Squadron (USAF), MARK was contracted to remove existing oil/water separators and replace with new oil/water separators with slop tanks, height extensions, hold down hardware, concrete tip down pads, concrete bollards and PVC sewer lines at eight buildings, and provide a catch basin at one building all located at Travis Air Force Base, California.

The work to be performed included the furnishing of all labor, materials, and equipment for:

- Compliance with all federal/state/local regulations;
- Preparation of a site-specific Health & Safety Plan including provisions for lead based paint removal;
- Acquisition of all permits including Form WCR 103;
- Decontamination, demolition and removal of existing oil/water separators ranging from 500 gallon to over 10,000 gallon capacity with 24" cast in place concrete walls;

- Excavation, backfilling and compacting for utilities;
- Over excavation and removal of impacted soils;
- Paving and other resurfacing;
- Modification and retrofit of existing sanitary sewer system;
- Cast-in-place concrete and other related masonary work; and
- Reconstruction of existing drainage trench.

Performance of the project is strictly adhered to by the Quality Assurance/Quality Control Plan and Environmental Protection requirements as to the complexity and duration of construction work. Construction is expected to be completed by the end of 1993.

LEVIN-RICHMOND TERMINALS STORMWATER RUNOFF PLAN AND MONITORING
Richmond, California

Levin-Richmond Terminals (LRT) owns and operates three marina terminals used for the loading and unloading of bulk raw materials within the City of Richmond, California. As a result of stormwater permitting regulations, LRT contracted MARK to complete Storm Water Pollution Prevention Management Plans and Monitoring Plans for the sites.

The Storm Water Pollution Prevention Plan described the sources of contact between storm water with potential chemical constituents which may have resulted in the release of polluted storm water or non-storm water from the facility. The pollution prevention plan included:

- site maps;
- a narrative of structural and non-structural measures which impacted storm water management;
- a list of chemical constituents that had a reasonable potential to be present in a storm water discharge and an estimate of their quantities on an annual basis;
- a discussion of significant spills or leaks of toxic or hazardous substances to storm water that have occurred since November 19, 1988; and
- a summary of existing storm water sampling and analysis data.

The report also discussed management practices designed to control storm water pollution onsite.

The general contents of the monitoring plan for each site included:

- a brief rationale for selection of the monitoring methods;
- selected analytical methods to detect pollutants in the storm water discharge;
- sampling methods, location, and frequency of monitoring; and
- a quality assurance/quality control program.

The major objective and outcome of the monitoring plan was the development of the rationale, details of implementation, and schedule of events for performance of the monitoring plan. MARK expects that individual monitoring of each facility may be required for a short period

of time in order to establish and discharge characteristics of the site. Subsequently, the reduced program of group monitoring could be conducted.

SIX NPDES WASTEWATER PONDS CLOSURE
Contra Costa County, California

USS-POSCO, Industries, Inc. (POSCO) operates a steel processing facility located in Pittsburg, California. As part of its NPDES Waste Water Treatment System, POSCO utilizes six surface impoundments.

In response to the California Regional Water Quality Control Board (RWQCB) request, MARK was contracted to conduct a Sampling and Analsis Program to characterize the liquid and sediment in the six surface impoundments. The work was conducted to comply with provisions of the Toxic Pits Cleanup Act of 1984 (TPCA). Work included pond sediment and liquid surveys, sampling, chemical analysis and data evaluation.

The chemical results indicated that while the liquid in all six ponds was not hazardous, the sludge/sediment in five of the six ponds was technically hazardous under existing California regulations due to elevated levels of aresenic, lead, zinc and/or chromium. MARK on behalf of the client submitted a petition to the Department of Health Services (DOHS) requesting that the pond be classified as non-hazardous. In support of this petition MARK developed a data base to evaluate the pond sediment/sludge potential threat to surface or groundwater and various options for pond closure.

Since MARK was contracted to prepare a Report of Waste Discharge (ROWD) for the six surface impoundments a Hydrogeological Assessment Report (HAR) that is required under TPCA was also conducted. Field work included drilling and logging of several soil borings and, sampling and laboratory analysis of soils. Monitoring wells were then constructed, developed and sampled to assess potential impacts to ground water. In addition, MARK managed a feasibility study to stabilize/solidify the pond sediments/sludge. The study included the cost for decanting the liquids from all six ponds and discharging it into the industrial waste treatment plant with the remaining sediment/sludge stabilized and disposed to an on-site landfill.

Subsequently, five out of the six ponds were reclassified as non-hazardous. MARK was retained to develop a field observation and confirmation sampling program which consisted of:

- Observation of excavation and trenching of waste ponds;
- Field confirmation sampling and analysis testing; and
- Clearing of the project site and its environs of all debris and wastes from pond restoration activities.

CHEMICAL MANUFACTURING WASTEWATER PONDS CLOSURE
Contra Costa County, California

MARK prepared a closure plan for two surface impoundments (ponds) occupying a combined area of 16 acres. The ponds were operated by a large national chemical company specializing in the production of inorganic chemicals. The ponds, which were constructed in 1972, stored leachate from former mining waste piles left on the property over seven decades ago by the previous land owner. The ponds were currently regulated under a Waste Discharge Requirement (WDR) issued by the California Regional Water Quality Control Board. The closure plan was prepared in response to the Toxics Pit Cleanup Act (TPCA) of 1984 as a result of comprehensive characterization of pond liquids and sludges. Results of the characterization study indicated trace levels of arsenic, copper, lead, nickel, and elevated levels of zinc and iron in 13 million gallons of liquid and 10,000 cubic yards of sludge. Numerous alternatives were evaluated including:

- on-site disposal
- off-site disposal
- volume reduction
- stabilization
- resource recovery

Each alternative was qualitatively evaluated on the basis of four criteria:

- technical
- institutional
- environmental risk, and
- cost

During the alternative evaluation, treatability and pilot plant studies were conducted to assess the effectiveness of commercial recovery of iron and zinc, the major components of the waste streams. In addition, acute toxicity studies on waste sludges and effluents generated from the treatability studies were performed.

The recommended closure alternative involved construction of a treatment plant to selectively separate the metals of commercial value and discharging the effluents into receiving water pursuant to current National Pollutant Discharge Elimination System (NPDES) standards established by federal (EPA) and local (DHS & RWQCB) regulatory requirements. The closure plan and resource recovery approach was one of the first procedures developed and implemented in the spirit of the Resource Conservation and Recovery Act (RCRA). As a result, the plan was approved by EPA, DHS, and the RWQCB, and a variance was granted from TCPA milestones to allow construction and operation of the treatment plant. The treatment plant began operation in summer 1990.

CLOSURE OF WASTEWATER LAGOONS
Livermore, California

The Lawrence Livermore National Laboratory (LLNL) owned and operated nine surface impoundments as part of a field testing laboratory at Site 300. These surface impoundments collected a variety of liquid wastes consisting of cleanup residue from high explosives and munition tests. Site 300 is situated in extremely hilly terrain between the Livermore Valley and the San Joaquin Valley in Alameda County, California. The site is under high security, and all contractor personnel were required to be escorted by LLNL security personnel.

MARK was contracted by LLNL to close the nine surface ponds and acquire closur certification. The objective of the closures was to place an impervious clay cap over the lagoons which would prevent further downward migration of the residue from explosive tests. MARK performed the following scope of services:

- Preparation of the site for construction, including levelling the site, which were on very hilly terrain;
- Backfilling the ponds to within approximately two feet of the surrounding ground surface with compacted general soil;
- Installation of a compacted clay soil base imported from a borrow area on the Laboratory property;
- Compaction of clay soil cap material;
- Grading of the clay soil to provide proper surface runoff drainage;
- Field permeability testing; and
- Clearing of the project site and its environs of all debris and wastes from pond closure activities.

A clay material was located off-site and tested by MARK to insure it had the low permeability necessary to minimize downward migration of the hazardous confluents. The clay, when properly compacted, had a conductivity of 10^{-8} centimeters per second. After site preparation, the clay was laid down in thin lifts and compacted to achieve the required properties. The total thickness of the clay cap required was two feet. It was sloped to provide drainage. To protect the clay, an 18-inch topsoil cover was placed over the clay and hydroseeded.

A wide range of equipment was required to achieve the proper grading and compaction due to the terrain and variety of lagoon size. Several sites were worked simultaneously due to the very severe schedule constraints imposed by the Laboratory and enforced by contractual liquidation damages. MARK met all specifications for the clay cap and associated drainage control and actually improved upon schedule requirements.

HUNTWAY REFINERY RCRA PART A/B PERMITTING
Wilmington, California

Huntway Refinery Company (Huntway) operates an asphalt producing refinery in Wilmington, California. The wastewater treatment facility is used to to collect and treat process wastewater as well as stormwater. Associated with the treatment system is a concrete wastewater holding pond which aerates the influent and biologically treats the wastewater.

It is the intention of Huntway to modify its wastewater treatment system. Then in accordance with 40CFR 265, Huntway will close its wastewater holding pond once the system modifications have been completed.

The surface impoundment is currently used to recover residual oil from wastewater generated form oil dehydration and the refining process, and to treat water to meet Los Angeles County Sanitation District (LACSD) discharge limits. The recovered oil is then recycled on site. The surface impoundment receives the wastewater from upstream Water/Oil Recycling/Treatment (WORT) units. The wastewater from the pond is then discharged to the LACSD's sewer system, and the recovered oil is returned to the crude stream. Additionally, the surface impoundment is utilized to retain stormwater per LACSD permit requirements and to retain wastewater on an as-needed basis.

MARK, working closely with Huntway, prepared a comprehensive RCRA Part B compliance submittal which included:

- engineering information about the impoundment;
- a sampling and analysis plan (SAAP);
- the impoundment closure plan;
- Huntway's Hazardous Materials Business Plan (HMBP);
- impoundment closure cost estimate;
- groundwater monitoring systems workplan; and
- health and safety plan and miscellaneous commercial documentation needed to comply withthe subittal requrired.

The submittal was reviewed by the regulatory agencies with monor comments which allowed the facility to obtain its permit in a timely manner.

UNOCAL CHEMICALS DIVISION
FUGITIVE EMISSIONS MONITORING
La Mirada, California

The Unocal Chemical Division, Unocal Corporation (Unocal) owns and operates a major chemical manufacturing facility, located in La Mirada, California. In response to the California "Toxic Hot Spots" Act, California AB 2588, MARK was contracted to substantiate Unocal's claim that EPA's estimating techniques were too high for current process design and maintenance procedures and to perform an independent study to quantify of fugitive emission

of 1,3-butadiene from the butadiene feed lines (BD) in the polymer process area.

The first step in the process was to determine which lines in the process area were to be sampled. In this case, most lines in the BD area contained pure 1,3-butadiene. For this step in the program, the scope of work was to physically locate, inventory, and tag with a unique identification code, all those lines and components from which fugitive emissions had to be measured. All information obtained, along with physical descriptions of each component, was to be collected and transferred to a master database on an PC-compatible portable computer in the MARK offices.

As a second step in the program, each individual component and associated fittings with that component of the BD process lines were to be monitored (screened) for fugitive emissions. This step involved the use of a organic vapor analyzer (OVA) and both a Foxboro MIRAN 1B2 and a Foxboro MIRAN 1BX Infrared Analyzer to monitor each emission point in the butadiene plant process lines.

Analysis of the emission data allowed MARK representatives to select 30 components for additional detailed sampling. The objective of the additional sampling was to quantify the fugitive emission of butadiene in pounds per hour from those specific components. In this detailed procedure, a given component was first sampled and "screened" with an OVA and the two analyzers. Then the subject component was enclosed or "bagged" and sampled so as to quantify its total fugitive emissions rate in pounds per hour of butadiene. Finally, another screening effort was performed to monitor the consistency of the component emission during the entire testing process. The objective of this "bagging" study was to quantify the fugitive emissions from the specific component and compare that emission value to the measured "screening" values. A unit-specific relationship between bagged component emission rate and screening value was obtained. This relationship or unit-specific emission factor was used to calculate the component-specific emissions for the butadiene line.

Subsequently, the fugitive emissions were monitored and quantified to be over one order of magnitude less than the current EPA method. Statistical evaluation of the results indicated that the MARK method had a correlation factor of 0.98, whereas the correlation factor for the EPA method was less than 0.50.

The MARK method provided the necessary accuracy and precision to measure and quantify fugitive emissions from a thousand piping and process components. The method improved the ability of a team of people to measure the low level fugitive emissions found in a facility which had a state-of-the-art repair and maintenance program.

DAVID K. ROGERS, P.E., C.E.G.

EDUCATION

M.S., Geological Engineering, Mackay School of Mines, University of Nevada, Reno; 1975
B.S., Geological Engineering, Mackay School of Mines, University of Nevada, Reno; 1967

REGISTRATION

Professional Engineer - California, Nevada
Geologist - California, Idaho, Oregon
Engineering Geologist - California, Oregon
Environmental Assessor - California
Environmental Manager - Nevada
Professional Hydrogeologist - American Institute of Hydrology

PROFESSIONAL HISTORY

1984 - Present	Principal, The MARK Group, Engineers & Geologists, Inc.
1974 - 1984	Principal Engineering Geologist, Converse Consultants Inc.
1977	Senior Staff Geologist, Woodward Clyde Consultants
1973 - 1974	Consulting Geologist
1967 - 1973	Staff Geologist, Utah International, Inc.
1968 - 1970	Chemical Officer, Chemical Corps, U.S. Army

SUMMARY

Mr. Rogers has over 25 years of professional experience in hazardous and solid waste management. He is a recognized expert in the evaluation of leachate seepage through fractured and porous media; assessment of low temperature, aqueous geochemistry and environmental fate of dissolved metals, organic compounds and radionuclides in the subsurface; development of feasibility, economic analysis, and engineering design of alternative remedial measures for cleanup of soils, groundwater and surface drainage; and the management of RI/FS programs where multiple responsible parties are involved. Mr. Rogers has extensive project experience in siting and site evaluation for industrial and municipal waste landfills, evaporation ponds, incinerators, and waste transfer/storage facilities. In addition, Mr. Rogers has developed quality assurance/quality control and other procedural guidelines for the U.S. Navy, U.S. EPA, and state regulatory agencies. As expert witness and technical advisor to various legal counsels for industry, Mr. Rogers has participated in a wide spectrum of litigation and potential litigation involving CERCLA (superfund) projects, site restoration, property transfers, and settlement of owner-contractor disputes.

With this broad experience, Mr. Rogers serves The MARK Group, Engineers & Geologists, Inc. and Construction Engineers Inc. (MARK) as Principal-in-Charge of major hazardous and solid waste management remediation projects throughout the Western U.S. and he is the designated Managing Principal responsible for the Northern California operations. In this capacity, he is responsible for technical quality assurance of industrial projects and is the liaison with clients, regulatory agencies and subcontractors. Because of Mr. Rogers' broad background and variety of project experience, he is knowledgeable in the regulatory process of several governmental agencies including the State Water Resources Control Board, Regional Water Quality Control Boards, California Department of Health Services, Nuclear Regulatory Agency, Department of

Transportation, U.S. EPA, Corps of Engineers, Washington Department of Ecology, and the Canadian Department of Environment.

SELECTED EXPERIENCE

- Supervised and performed site characterization and hydrogeologic evaluation for compliance with RCRA and State mandated regulatory requirements. This work for surface impoundments or landfills containing hazardous materials included monitoring well installation, environmental sampling, down-hole and surface geophysical surveys, chemical analysis of soil and water, risk assessment, studies of regional hydrogeology, aquifer testing, comprehensive well inventories, cone penetrometer tests, closure plans, corrective action plans, and cleanup activities at the following sites:

  - Dow Chemical U.S.A., Contra Costa County, California
  - Stauffer Chemical (Rhone-Poulenc), Contra Costa County, California
  - O'Brien Paint Company, San Francisco County, California
  - Borden Chemical, Pendleton County, Oregon
  - Tosco Refinery, Contra Costa County, California
  - USS-POSCO, Contra Costa County, California
  - Sandia National Laboratory, Alameda County, California
  - Rohm & Haas, San Mateo County, California
  - Zoecon (Sandoz), San Mateo County, California
  - City of San Jose, Santa Clara County, California
  - Exxon Refinery, Solano County, California
  - Shell Oil Refinery, Contra Costa County, California
  - Newhall Refinery, Ventura County, California
  - PG&E, Humboldt County, California
  - Techalloy Corporation, Riverside County, California
  - Western Farm Services, Monterey County, California
  - Western Farm Services, San Benito County, California

- Supervised and conducted hydrogeological investigations for Underground and Aboveground Storage Tank Programs including characterization of regional and site hydrogeology, toxicological/health assessments, environmental soil and water sampling and chemical analysis, aquifer testing, and risk analysis for the following:

  - USS-POSCO, Contra Costa County, California
  - Tosco Refinery, Contra Costa County, California
  - Tosco Corporation, Sacramento County, California
  - Tosco Corporation, Spokane County, Washington
  - Southern Pacific Pipelines, Contra Costa County, California
  - Southern Pacific Railroad, San Mateo County, California
  - Southern Pacific Railroad, Los Angeles County, California
  - Shell Oil Refinery, Contra Costa County, California
  - Exxon Corporation, Santa Clara County, California
  - Unocal, Los Angeles County, California
  - Peterbilt Motors Company, Alameda County, California
  - Wayne Stead Cadillac, Contra Costa County, California
  - Crowley Maritime, Alameda County, California
  - Crowley Maritime, Humboldt County, California

- Ozol DFSC, Contra Costa County, California
- INTEL Corporation, Santa Clara County, California
- Teledyne-MEC, Santa Clara County, California
- Motorola 4-Phase, Santa Clara County, California
- City of Santa Monica, Los Angeles County, California
- Morton International, Inc., Los Angeles County, California
- Fremont Indemnity, Los Angeles County, California
- Harken Marketing, Various Locations, Southern California
- Zoecon (Sandoz) Corporation, San Mateo County, California

- Supervised and conducted engineering feasibility studies, cost-benefit analysis, cost estimates for alternative remedial measures, including storage tank removal, vapor extraction, bioremediation, excavation and disposal, pump and treatment to clean up soils and groundwater containing petroleum hydrocarbons, metals, and/or chlorinated hydrocarbons for:

  - INTEL Corporation, Santa Clara County, California
  - Wayne Stead Cadillac, Contra Costa County, California
  - Librascope Corporation, Santa Clara County, California
  - Motorola 4-Phase, Santa Clara County, California
  - Zoecon (Sandoz) Corporation, San Mateo County, California
  - J. B. Dewar, San Luis Obispo County, California
  - Unocal, Los Angeles County, California
  - Mobil Oil Company, Los Angeles County, California
  - Pentachem Corporation, San Benito County, California
  - Fremont Indemnity, Los Angeles County, California
  - Harken Marketing, Various Locations, Southern California
  - City of Santa Monica, Los Angeles County, California

- Directed multi-disciplinary team efforts on air and water quality solid waste assessment tests (SWAT), Report of Disposal Site Information (RDSI), and CEQA requirements for Class II and Class III landfills. These projects included work plan development, subsurface sampling and analysis, air and groundwater sampling and analysis, comprehensive well inventories, development of closure plans and engineering design of closure activities for the following:

  - USS-POSCO, Contra Costa County, California
  - Dow Chemical U.S.A., Contra Costa County, California
  - City of San Jose, Santa Clara County, California
  - Buttonwillow Landfill, Kern County, California
  - Holiday Rock Company, San Bernardino County, California
  - Olinda Landfill, Orange County, California
  - Yucaipa Landfill, San Bernardino County, California
  - Yeager Construction, San Bernardino County, California

- Directed or conducted Site Investigations (SI), Remedial Investigations/Feasibility Studies (RI/FS), Remedial Action/Corrective Action Plans (RA/C), and closure activities for the following CERCLA/SARA sites and/or State Superfund activities:

  - GBF Landfill(s), Contra Costa County, California

- Arsenic RA/C, San Mateo County, California
- Bayshore Railyard RI/RA, San Mateo County, California
- Hillview-Porter Drive RI/FS, San Mateo County, California
- Middlefield Road RI/FS/, Santa Clara County, California
- Taylor Railyard RA/C, Los Angeles County, California
- Stringfellow Acid Pits, Riverside County, California
- North Market Street SI and RI/FS, Spokane County, Washington

- Developed and/or implemented closure and remedial action plans, including evaluation of alternatives, preparation of feasibility studies, preparation of cost estimates, remedial design and writing specifications for sites such as the following:

  - CD Medical, Contra Costa County, California
  - Tosco Refinery, Contra Costa County, California
  - Dow Chemical U.S.A., Contra Costa County, California
  - Zoecon (Sandoz), San Mateo County, California
  - Librascope Corporation, Santa Clara County, California
  - Motorola 4-Phase, Santa Clara County, California
  - City of Santa Monica, Los Angeles County, California
  - Coachella Valley MAD, San Bernardino County, California
  - Techalloy Corporation, Riverside County, California

- Developed Quality Assurance Project Plans (QAPP), standard procedures, design manuals, health and safety criteria, and work plans for sampling protocol for site characterization and remediation activities at various hazardous waste sites, for military special weapons escort teams, and site control and cleanup for nuclear and chemical incidents, and for implementation of corporate health and safety programs.

- Supervised and conducted environmental assessments and audits for commercial property transactions in connection with SB 245 (Torres) and industrial liability loss prevention programs. The project work consists of site history compilation (title searches, aerial photo interpretations, interviews with long term or former employees, site reconnaissance, drilling/sampling and analysis of soil, groundwater monitoring, and environmental impact assessment. Some typical projects include:

  - Tosco Refining Company, Contra Costa County, California
  - Prometheus Development Company, Contra Costa County, California
  - Rohm & Haas, San Mateo County, California
  - Travelers Insurance Company, Santa Clara County, California
  - Unocal Real Estate, Los Angeles County, California
  - Unocal Real Estate, Ventura County, California
  - Southern Pacific Railroad, Los Angeles County, California
  - Cathay Bank, San Bernardino County, California
  - City of Santa Monica, Los Angeles County, California
  - Concordia Development, Various Locations, Southern California
  - Singer Furniture Company, Los Angeles County, California

- Provided technical consultation to counsel on geotechnical, hydrogeology, and engineering geology issues; prepared technical reports, briefed attorneys on interrogatories, has given depositions and/or courtroom testimony on the following cases

or pending litigation and has testified, also, before the California Coastal Commission and for numerous city and county hearings:

- East Bay Regional Parks v. Villa Mira Vista Development
- W. Chesboro and M. Herbelin v. Humboldt Bay Wastewater Authority
- Macondray Terrace Associates v. Ralph Larson and Sons, Inc.
- H. Swartz v. A. Zipursky
- McKeever et al. v. Shell Oil Co. et al.
- Zoecon Corp. v. Rhone-Poulenc, Inc.
- United States, et al. v. Stringfellow, et al.
- Chemical Waste Management v. McKay, et al.

ORGANIZATIONS

American Institute of Hydrology
American Institute of Mining Engineers
Association of Engineering Geologists
California Mining Association
Geological Society of America
National Water Well Association
Society of Military Engineers

PUBLICATIONS

Rogers, D.K. and Marachi, N.D., 1989, Vacuum extraction of industrial solvents from soil to enhance aquifer remediation: Joint Technological Exchange Conference, Moscow, USSR.

Marachi, N.D. and Rogers, D.K., 1989, Vacuum extraction of volatile organic solvents from soils: Proc of XII International Conference in Soil Mechanics and Foundation Engineering, Rio de Janeiro, Brazil.

Ellgas, R.A., Marachi, N.D., and Rogers, D.K., 1989, Vadose zone cleanup of volatile organics by steam injection and vapor extraction: Presented at the 6th Annual Hazardous Materials Management Conference, Santa Clara, California.

Bonham, H.F. and Rogers, D.K., 1983, Geologic Map, Mt. Rose NE Quadrangle: Nev. Bur. Mines and Geol. Map No. 4 Bg, 1:24,000 scale.

Rogers, D.K., Simon, D.B., and Stellar, J. 1979, Active Fault Zones and Regional Seismicity in Western Nevada: in 17th Annual Engineering Geology and Soils Engineering Symposium, April, 1979, Moscow, Idaho, pp. 275-293

Trexler, D.T. and Bell, J.W. (D.K. Rogers contributing mapping), 1979, Geologic Map and Earthquake Hazards Map, Carson City Quadrangle, Nada: Nev. Bur. Mines and Geol. Map, 1:24,000 scale.

Bingler, E C (D K. Rogers contributing mapping), 1977, Geologic Map and Earthquake Hazards Map, New Empire Quadrangle, Nevada· Nev. Bur. Mines and Geol. Map,

1:24,000 scale.

Rogers, D.K., 1975, Project Mapping: in Guidebook to the Quaternary Geolog along the western flank of the Truckee Meadows, Washoe County, Nevada, by E.C. Bingler, Nev. Bur. Mines and Geol. Report 22, 14 pp.

Rogers, D.K., 1975, The California Earthquake of June 7, 1975 - Geology and Isoseismal Map: Earthquake Engineering. Research Institute Newsletter, v. 9, pp. 78-81.

Rogers, D.K., 1975, Environmental Geology of Northern Carson City, Nevada: Univ. Nev. M.S. Thesis, 133 p.

Rogers, D.K., 1975, How Geology Affects Land-use Planning in Northern Carson City, Nevada: Proc. of the 18th Annual Meeting of the Association of Engineering Geologists, Nov. 2-8, p. 42 (abs).

Rogers, D.K., 1975, The Carson Lineament: its influence of recent left-lateral faulting near Carson City, Nevada: Geo. Society America Abs with Programs, v.7, no.7, p. 1250 (abs).

N. DEAN MARACHI, Ph.D., P.E.

EDUCATION Ph.D., Geotechnical Engineering, University of California, Berkeley; 1969
M.S., Civil Engineering, University of California, Berkeley; 1966
B.S., Civil Engineering, Oregon State University, Corvallis; 1965

REGISTRATION Civil Engineering - Arizona, California, Nevada, Oregon, Washington
Geotechnical Engineering - California
Environmental Assessor - California

PROFESSIONAL HISTORY

1984 - Present	Principal, The MARK Group, Engineers & Geologists, Inc.
1979 - 1984	Managing Vice President,Converse Consultants Inc.
1974 - 1978	Managing Director, Chairman of the Board, Tehran - Berkeley Consulting Engineers
1973	Assistant Professor of Civil Engineering, Arymehr University
1969 - 1972	Assistant Chief Engineer, Converse Davis and Associates

SUMMARY

Dr. Marachi has broad professional experience in many areas of civil engineering including geotechnical engineering; seepage and dynamics of fluids through porous media; fate and risk analyses; waste (sanitary or hazardous) technology and management, and environmental engineering. Dr. Marachi is responsible for technical direction and quality assurance in many of The MARK Group's industrial and hazardous waste projects. His experience in this capacity includes projects involving site and waste characterization, engineering evaluations, fate and risk analyses, development and feasibility and engineering design of alternative remedial actions, and evaluation of capital as well as operational costs of remediation and site cleanup or closure measures. Dr. Marachi is also an expert in identification and quantification of hazards, natural and man-made, and their singular or joint probabilities of occurrence, analysis of potential damages and alternative mitigation costs, and evaluation of owner's total exposure costs (annualized in dollars) for any of the hazard scenarios.

Dr. Marachi has also served as expert witness and technical advisor to various legal counsels for industry, professional firms, and non-regulatory governmental agencies. Such forensic services cover a wide spectrum of litigation or potential litigation involving hazardous waste, environmental impacts, faulting and seismicity, construction accidents and claims, groundwater and landslide correction. Dr. Marachi is also intimately familiar with the regulatory processes of many agencies such as the State Water Resources Control Board, Air Resources Board, Department of Health Services, Division of Safety of Dams; Regional Water Quality Control Boards, Air Pollution Control Districts, County Health Departments; and Federal Energy Regulatory Commission, Environmental Protection Agency, Nuclear Regulatory Commission, Department of Defense - Naval Facilities Engineering Command, U.S. Bureau of Reclamation, and U.S. Army Corps of Engineers.

SELECTED EXPERIENCE

- Directed and supervised site characterization and hydrogeologic evaluation for compliance in RCRA Part B permits, reports of waste discharge under CCR Title 23, Subchapter 15 and AB3566 (Katz). This work included monitoring well installation, environmental sampling, chemical analysis of soil and water, contaminant assessment, studies of regional and local hydrogeology, aquifer testing, percolation and water chemistry tests for waste management facilities containing hazardous materials at the following sites:

  - Industrial Plants Landfills, Contra Costa County, California
  - Chemical Processing Plants, Contra Costa County, California
  - Oil Refinery, Oily Waste Ponds, Contra Costa County, California
  - Railyard, San Mateo County, California
  - DOD Fuel Depot, Contra Costa County, California
  - Maritime Facility, Humboldt County, California

- Directed and supervised waste and site characterization, hydrological, hydrogeological, meteorological, demographical and water and land use studies, and water and air sampling and data evaluation for preparation of Report of Waste Discharge (ROWD), Hydrogeological Assessment Report (HAR), and/or water quality and air quality Solid Waste Assessment Test (SWAT) report in compliance with CCR Title 23, Chapter 3, Subchapter 15; AB3566 (Katz); and AB3525 (Calderon) for the following landfills and impoundments:

  - Class III Landfills (5), Tulare County, California
  - Class II and III Landfills (2), Colusa County, California
  - Class II Impoundments (3), Colusa County, California
  - Class III Landfills (2), Glenn County, California
  - Class III Landfill (1), Solano County, CAlifornia
  - Class III Landfill (1), Contra Costa County, California
  - Chemical Processing Concern, Class III Landfills (2), Contra Costa County, California
  - Steel Manufacturing Concern, Class III Landfills (2), Contra Costa County, California
  - Utility Concern, Class II Impoundments (4), Kings County
  - DOE and Oil Producing Concern, Class II and III Impoundments and Landfills, Kern County, California
  - Paint Manufacturing Concern, Class I and II Impoundments and Landfills, San Mateo County, California

- Directed and performed computer data management programming, statistical analysis in compliance with CFR Title 40, Part 264 and CCR Title 23, Subchapter 15 for the groundwater monitoring systems:

  - Chemical Manufacturing Concern, Contra Costa County, California
  - Steel Manufacturing Concern, Contra Costa County, California
  - Computer Manufacturing Concern, Pima County, Arizona

- Directed and supervised fate and toxicological/health risk analysis in accordance with U.S. EPA method and California Department of Health Services' Decision Tree method of analysis:

  - Transportation Company, San Mateo County, California
  - Industrial Concern, Contra Costa County, California
  - Chemical Manufacturing Concern, Santa Barbara County, California
  - Semiconductor Manufacturing Concern, Santa Clara County, California

- Supervised the development of closure plan in accordance with CFR Title 40 Part 264 and/or CCR Title 23 Subchapter 15, developed plans and specifications for closure construction, and/or supervised construction activities and prepared as-constructed documents:

  - Balance Rock and Exeter Landfills, Tulare County, California
  - Oily Waste Ponds, Contra Costa County, California
  - Process Water Ponds of Industrial Plant, Contra Costa County, California

- Directed Remedial Investigation/Feasibility Report (RIFS) studies; design of preferred remediation; preparation of design plans, specifications, and permit application; construction, operation and monitoring of the cleanup and remediations (vacuum extraction) and/or supervision and monitoring of construction activities:

  - Semiconductor Manufacturing Concern, Santa Clara County, California
  - Chemical Manufacturing Concern, Santa Barbara County, California
  - Fuel Distribution Station, San Luis Obispo County, California
  - Oil Refinery, Contra Costa County, California

- Provided technical consultation to counsel on geotechnical, hydrogeological, and construction engineering issues; prepared technical reports, briefed attorneys on interrogatories, has given depositions and/or courtroom testimony on the following cases or pending litigation:

  - W. Chesboro and M. Herbelin v. Humboldt Bay Wastewater Authority
  - Griffin v. Vesper Memorial Hospital
  - Lionsgate Corporation v. U.S. Army Corps of Engineers
  - Kaiser Aluminum v. Contractors and Consultants
  - City of South San Francisco v. Kennedy Jenks
  - Vesta Bartheld v. Blackhawk Corporation

- As professor of civil engineering, developed the course outline and materials and taught courses in:

  - Seepage and Groundwater
  - Soil Mechanics
  - Geotechnical Engineering
  - Dam Engineering
  - Earthquake Engineering
  - Field and Laboratory Soil Testing

ORGANIZATIONS

American Public Works Association
American Society of Civil Engineers
Bay Area League of Industrial Associations
Bay Area Water Works Association
Construction Specifications Institute
Earthquake Engineering Research Institute
Government Refuse Collection and Disposal Association
International Society of Soil Mechanics and Foundation Engineers
National Water Well Association
Peninsula Industrial Business Association
Seismological Society of America
Structural Engineers Association of Northern California
U.S. Committee of the International Congress of Large Dams

PUBLICATIONS

Dr. Marachi has published 18 scientific articles in reputable professional or scientific publications. The following is a selected short list.

Marachi, N.D., and Dixon, S.J., 1972, A method for evaluation of seismicity: Proc. of the Intl. Conf. on Micronzonation, v.1, pp. 379- 394.

Marachi, N.D., 1973, Dynamic soil problems at the Joseph Jensen filtration plant: in San Fernando, California Earthquake of February 9, 1971, U.S. Dept. of Commerce, NOAA, v.1, pp. 815-820.

Marachi, N.D., and Anton, W.F., 1981, Hazard evaluation of Mokelumne aqueducts: Proceedings of the Specialty Conf., Water Forum '81, v.2, pp. 711-718.

Marachi, N.D., Dayton, D.J., and Dare, C.T., 1982, Geotechnical properties of peat in San Joaquin Delta: in Testing of Peats and Organic Soils, P.M. Jarrett ed., ASTM STP 820, pp. 207-217.

Dezfulian, H., and Marachi, N.D., 1982, Evaluation of dynamic soil properties for geotechnical earthquake engineering purposes: Proc. 7th European Conf. on Earthquake Engineering, Athens, pp. 355-352.

Dezfulian, H., and Marachi, N.D., 1984, Dynamic properties of silty sands and sandy silts - A case study: Proc. Int. Conf. on Case Histories in Geotechnical Engineering, St. Louis.

Marachi, N.D., 1984, Comparison of seismic and non-seismic hazard exposure costs of a major water transmission system: Proceedings of the Eighth World Conference on Earthquake Engineering, v.7, pp 499-506.

Ellgas, R.A., and Marachi, N.D., 1988, Vacuum extraction of Trichloroethylene and fate assessment in soils and groundwater - case study in California: Proc. Joint CSCE-ASCE National Conf. on Environmental Engr., Vancouver, Canada, pp. 794-801.

Marachi, N.D., and Rogers, D.K., 1989, Vacuum extraction of volatile organic solvents from soils: Proc. 12th Int. Conf. Soil Mechanics and Foundation Engineering, Rio de Janeiro, Brazil.

Ellgas, R.A., Marachi, N.D., and Rogers, D.K., 1989, Vadose zone cleanup of volatile organics by steam injection and vapor extraction: ASCE Nat. Conf. on Environmental Engr., Austin, Texas.

ALAN D. GIBBS, R.G.

EDUCATION: M.S., Geology, California State University, San Diego, 1976
B.A., Geology, California State University, San Francisco, 1973
Certificate, Hazardous Materials Mgmt, University of California, Davis

REGISTRATION: Registered Geologists - California, Arizona, Oregon, and Florida
Registered Environmental Assessor - California
40-hour CERCLA/SARA Health and Safety Training, 29 CFR 1910.120
Certificate, 8-hour CERCLA/SARA Supervisory Training, 29 CFR 1910.120

PROFESSIONAL HISTORY

1993 - Present	Manager of Remedial Investigations, The MARK Group, Inc.
1989 - 1993	Supervisor, Geology, Western Operations, Clayton Environmental Consultants, Inc.
1988 - 1989	Geologist, Unitek Environmental Consultants, Inc.
1974 - 1988	Senior Geologist, Utah International/Pathfinder Mines Corp.

SUMMARY

Mr. Gibbs has over 18 years of geologic and hydrogeologic experience. He has a comprehensive background preparing work and health & safety plans for conducting and managing hazardous waste investigations including geologic, hydrogeologic and environmental assessments involving impacted soil and groundwater, feasibility studies and remedial alternatives, and site clean-up, restoration and closure. He has supervised and performed many subsurface investigation, groundwater monitoring and remediation programs involving multiple groundwater well development and operation, bioremediation, ground water treatment systems. Mr. Gibbs has gained intimate knowledge of the state and local regulatory framework and permitting process and has utilized this knowledge in the course of preparing approved workplans and closure plans for site investigation and site remediation projects. He has acted as liaison to many of the government, county health and local regulatory agencies that also govern potenitally impacted properties and has successfully negotiated closure and reduced requirements for clients throughout the state.

An example of Mr. Gibbs successful relationship with County and local regulatory agencies includes the recently completed soil and groundwater remediation project for a large newspaper facility in which over 4,500 cubic yards of soil impacted with petroleum hydrocarbons was treated in less than six weeks. Mr. Gibbs successfully obtained a release from the DTSC, RWQCB, and the City of Mountain View to begin new construction. In addition, he negotiated with and obtained from the RWQCB approval for a limited groundwater monitoring program rather than a costly groundwater remediation based upon a well received detailed groundwater investigation.

Mr. Gibbs also has an excellent working relationship with Federal and State Agencies including the management of various environmental contracts for the Office of the State Architect (OSA). The projects involved preparing proposals, coordinating subcontractors, conducting cost negotiations, overseeing workplan preparation, and managing daily field operations for soil and groundwater investigations from leaking underground storage tanks. His work was so well received by the OSA Project Manager, Ms. Mary Cooper, that a "sole source" contract was issued

to Mr. Gibbs for further site investigation. In addition, Mr. Gibbs is currently under a delivery order contract from the U.S. Army, Sacramento District, Corps of Engineers developing and implementing workplans to "fast track" the complete closure of a wastewater sump and french drain within the Dugway Proving Grounds, Utah.

SELECTED EXPERIENCE

- Project Manager for a soil and groundwater remediation project for a large newspaper facility located in Mountain View, California. Project involved preparation of workplans, site-specific health and safety plans, sampling and analysis plans, conceptual plans for remediation, and construction management. Soil remediation involved a process called Heat Enhanced Vapor Extraction/Thermal Oxidation which treated over 4,500 cubic yards of soil impacted with petroleum hydrocarbons in less than six weeks. Obtained a release from the DTSC, RWQCB, and the City of Mountain View to begin new construction. In addition, negotiated with and obtained from the RWQCB approval for a limited groundwater monitoring program rather than a costly groundwater remediation based upon a well received detailed groundwater investigation. Groundwater is currently being monitored.

- Supervisor, Geology Group responsible for a subsurface investigation performed for the Price Company as a result of discovering thousands of cubic yards of soil impacted by low level heavy petroleum hydrocarbons during construction at site adjacent to the San Francisco Airport. A site history review and data collected revealed prior activities were the cause of the impacts. As a result, the City of South San Francisco, the property owner, was responsible for the clean up of the site.

- Completed a feasibility study of remedial option for soil and groundwater. Evaluation was based on technical feasibility and economic considerations. Three options were considered including groundwater pumping (via extraction wells), treatment and discharge; interceptor trenches, groundwater collection, treatment and discharge; and enhanced or in-situ biodegradation. The feasibility report was very well received by the San Mateo County Health Department, who stated that they planned to use it as a model for their department for future problem sites. The project was turned over for implementation of a risk assessment and final remediation.

- Performed an environmental assessment and subsurface investigation of a parking garage in San Francisco for the San Francisco Health Department. Two out-of-service UST's were located under the sidewalk and street, of which one was suspected of leaking. Fifteen boreholes and three monitoring wells were installed to define the horizontal and vertical extent of soil and groundwater impacted by petroleum hydrocarbons. There were numerous unmarked subsurface pipes beneath the asphalt and underlying cobble street. A final report and preliminary cost estimate for remediation was submitted to help facilitate budgetary planning and comparison of bids for subcontracted work.

- Supervisor, Geology Group, responsible for an investigation in San Francisco to determine the lateral extent of groundwater contamination caused by a leaking UST. Drilled thirty boreholes and developed three monitoring wells. Bunker oil was encountered onsite from an unknown offsite source. Worked closely with the San Francisco Department of Public Works, Port Authority, and the Regional Water Quality Control Board (RWQCB) to modify the current compliance to drinking water standards. The client was released from

responsibility of monitoring and remediation pending further evaluation of the region by the RWQCB.

- Supervisor, Geology Group, responsible for the investigation of soil and groundwater contamination caused by leaks from a number of UST's that had been removed in South San Francisco, California. The chemical compounds detected in the greatest concentration included 1,2,-dichloroethane, 1,2-dichloroethene, benzene, vinyl chloride, mineral spirits and diesel. Drilled and sampled five boreholes and installed and sampled 10 monitoring wells on site. Conducted a variable rate well performance to determine maximum pumping rate achievable without drying out the well, then proceeded to conduct a sixteen hour pump test to identify characteristics of the aquifer, such as hydraulic conductivity, transmissivity, storativity, groundwater velocity, and porosity.

- Supervisor, Geology Group, responsible for the San Francisco Municipal Railway (MUNI) Kirkland Bus Yard (Kirkland), which is a parking lot and service area for buses owned and operated by the City and County of San Francisco. More than 50,000 gallons of diesel and automotive fuels are stored onsite. Follow-up subsurface investigation determined that diesel fuel was floating in the groundwater beneath the site. An interim skimming system was installed while site mitigation procedures and recommendations to minimize offsite migration were developed.

- Project Manager for an OSA contract at Los Alamitos involving the investigation of the potential impact and extent of contamination to soil and groundwater from existing and former underground storage tanks. Mr. Gibbs prepared the initial proposals, coordinated subcontractors, conducted cost negotiations, oversaw workplan preparation, and managed daily field operations. Work performed was so well received by the OSA Project Manager, Ms. Mary Cooper, that a "sole source" contract was issued to Mr. Gibbs for further site investigation.

- Project Manager for a delivery order contract from the U.S. Army, Sacramento District, Corps of Engineers to develop and implement a workplan to "fast track" the complete closure of a wastewater sump and french drain within the Dugway Proving Grounds, Utah. Field work included excavation under level C and collection and analysis of multiple soil samples for volatile organics, metals and sulfide reactivity.

- Project Manager for a preliminary subsurface investigation to assess and evaluate whether petroleum hydrocarbons were present in the subsurface soils and underlying groundwater at the site of the preferred construction location for a new Environmental/Research Center within the U.S. Naval Construction Battalion Center at Port Hueneme, California.

- Supervisor, Geology Group, responsible for the site assessment and subsurface investigation of several Orchard Supply Hardware sites (OSH) throughout the San Jose area. Performed historical reviews, acted as liaison with the SCVWD for the obtainment of closure for one former underground storage tank site and reduced quarterly groundwater monitoring requirements for another site with seasonal elevated groundwater levels.

- Supervisor, Geology Group, responsible for the site assessment and subsurface investigation of several maintenance yard sites throughout the Bay Area owned by the San Francisco French Bread Company. One such project completed in San Jose involved a

Phase II subsurface investigation which was performed in the vicinity of former underground storage tanks and impacted soils. Remedial actions included overexcavation of impacted soils and backfilling with rock and pea gravel. In order to facilitate future remedial efforts, an extraction well was installed in the backfill resulting in a significant cost savings to the client.

- Project Manager for the performance of 34 preacquisition environmental assessments for a large financial institution within the San Jose/South Bay Area. Work performed included the review of Federal, State and local regulatory agency listings, title reports, and aerial photos; site inspections; asbestos surveys; hydrogeological review; personal interviews regarding previous and present hazardous material operating activities conducted at sites; and summary reports describing the results of the site visits and site history evaluations. All 34 assessments were completed on a "fast-track" basis within a two week period during a holiday period.

- Supervisor, Geology Group, responsible for numerous preliminary assessments throughout the Santa Clara Valley and Bay Area for major banks including: American Savings, Wells Fargo Bank, Comerica, Bank of America, Bank of the West, Mechanics Bank, and the Bank of the Orient. Many of the preliminary assessments were followed up by subsurface investigations. Several sites assessed revealed former underground storage tanks located at the site. Preliminary subsurface and historical site use investigations documented the former land use and established that contamination was not caused by the client's operations. Acted as liaison with regulatory agencies and coordinated the turnover of continued investigation and remediation to the responsible parties.

- Planned, implemented and supervised logistics of air lifting complete drilling rig, support equipment and personnel into environmentally sensitive areas adjacent to the Grand Canyon National Park. Both project and company attracted favorable publicity for efficiency, ingenuity and meeting rigid environmental requirements.

- Project Manager for over 6,000 acres of mineral lode and placer claims in Stanislaus National Forest for over ten years. Directed highly efficient clean up and reclamation activities effectives enough to warrant release of annual bond requirements.

- Project Manager and Senior Geologist responsible for extensive site investigations for mineral potential of former and existing mine sites throughout most of the National Forests within the western United States. Work included conducting numerous court house records searches for land status and environmental status, as well as preparation of plans for operation for US Forest Service approval.

- Managed, supervised and trained teams of technicians and construction workers for various tasks involved with environmental impact studies and regulatory compliance issues on various complex mining and geological projects in Utah, Arizona, California and Nevada.

- Re-evaluated land holdings and re-prioritized budgeted funds to address public sensitivities of Uranium mining near Yosemite National Park.

- Project Manager for geologic investigations for Webber multiple arch Dam. Investigations included six rotary, NX core borings to maximum depths of 60 feet, geologic mapping, water pressure testing and selection of samples for triaxial testing.

PROFESSIONAL AFFILIATIONS

American Institute of Mining Engineers
Nevada Mining Association
California Mining Association
National Groundwater Association

JAMES M. HERBERT, C.E.G.

EDUCATION: B.S., Geological Sciences, California State University, Long Beach, 1980
Certificate, 40-hour CERCLA/SARA Health and Safety Training, 29 CFR 1910.120
Certificate, 8-hour CERCLA/SARA Supervisory Training, 29 CFR 1910.120

REGISTRATION: Certified Engineering Geologist - California, 1991
Registered Geologist - California, 1991

PROFESSIONAL HISTORY

1993 - Present	Senior Project Geologist, The MARK Group, Inc.
1988 - 1993	Project Manager, Leighton and Associates, Inc.
1985 - 1988	Project Geologist, American Geotechnical
1985	Staff Geologist, D.A. Evans, Inc.
1981 - 1985	Staff Geologist, GeoSoils, Inc.
1980	Hydrologic Assistant, U.S. Geological Survey

SUMMARY

Mr. Herbert has over twelve years of experience in RCRA/CERCLA environmental, hydrogeologic and geotechnical investigations. His environmental assessment experience includes conducting, reviewing and managing site assessments, remedial investigations, groundwater flow/contaminant transport evaluations, feasibility studies, geotechnical studies for major civil engineering projects and foundation/structural distress investigations. Mr. Herbert has conducted ground water quality monitoring and hydrogeological interpretation in accordance with Article 5 of Chapter 15 of Division 3 of Title 23 of the California Code of Regulations (Article 5) and has extensive field experience in drilling, logging and sampling soil borings as well as installing developing and sampling groundwater monitoring wells. His remedial investigation/feasibility experience under CERCLA includes performing comprehensive hydrogeologic impact interpretations of a Riverside County, California NPL Superfund site and the downgradient neighborhood.

Mr. Herbert's is also experienced in geotechnical engineering encompassing most aspects of hillside, landslide and flatland grading for residential, commercial, and transportation concerns. He has extensive experience in landslide and soil creep investigations, embankment settlements, bridge and dam foundations, aggregate resources and structural distress. He has drilled, installed and monitored slope inclinometers and piezometers within active and inactive landslides.

SELECTED EXPERIENCE

- As part of an environmental team, conducted 34 preliminary environmental assessments within the San Jose/South Bay Area. Work performed included the review of Federal, State and local regulatory agency listings, title reports, and aerial photos; site inspections; asbestos surveys; hydrogeologic review; personal interviews regarding previous and present hazardous material operating activities conducted at sites; and summary reports describing the results of the site visits and site history evaluations.

- Conducted geologic evaluation of NPL-CERCLA Superfund site in Riverside County, California for litigation of personal damages. Constructed over 26 miles of detailed geologic cross sections using over 300 water well/monitoring well logs. The cross sections were utilized in constructing computer generated structure - contour maps of the lithologies underlying the site and the affected adjacent community. These maps were the structural basis for a finite element groundwater flow/contaminant transport model used to estimate the extent and timing of the spread of contamination.

- Project Hydrogeologist responsible for water quality monitoring and hydrogeological interpretation in accordance with Article 5 of Chapter 15 of Division 3 of Title 23 of the California Code of Regulations (Article 5) for an inactive landfill for Kings County.

- Project Hydrogeologist responsible for water quality monitoring and hydrogeological interpretation in accordance with Article 5 of Chapter 15 of Division 3 of Title 23 of the California Code of Regulations (Article 5) for waste management units for USS-Posco, Industries in the Contra Costa County, California.

- Project Hydrogeologist responsible for water quality monitoring and hydrogeological interpretation in accordance with Article 5 of Chapter 15 of Division 3 of Title 23 of the California Code of Regulations (Article 5) for five municipal landfills for the County of Sonoma.

- Conducted environmental evaluation of a non-permitted hazardous material storage and transportation facility located within an abandon urban railroad depot in California. Characterized the lateral and vertical extent of contamination by drilling, logging and sampling the vadose zone and installing, developing and sampling groundwater monitoring wells. The data was utilized in designing the vapor extraction remediation system.

- Conducted, reviewed and managed underground storage tank removals and remedial investigations for site throughout California for a major oil company. Performed and directed vadose zone and groundwater investigations, laboratory test result evaluations and regulatory compliance.

- Conducted and managed a remedial investigation of an abandoned aerospace manufacturing facility. Assessed impact of chlorinated solvents from onsite and offsite sources on shallow groundwater. Project involved the drilling, installation, and development of borings and groundwater monitoring wells for the assessment of the vertical and lateral extent of soil and groundwater contamination.

- As part of an environmental team, conducted 34 preliminary environmental assessments within the San Francisco Bay Area. Work performed included the review of Federal, State and local regulatory agency listings, title reports, and aerial photos; site inspections; asbestos surveys; personal interviews regarding previous and present hazardous material operating activities conducted at sites; and summary reports describing the results of the site visits and site history evaluations.

- Conducted, reviewed and managed numerous preliminary environmental assessments and facility audits for sites throughout California. Work performed included: review of Federal, State, and local regulatory agency files, records, title reports and aerial photographs; site inspections; personal interviews regarding present and historic hazardous

material use or activities conducted on or adjacent to sites; and preparation of summary reports describing the results of the record review and site observations.

- Directed and performed field mapping, aerial photograph analysis, drilling and trenching to identify and delineate the vertical and horizontal extent of known and suspect landslides in the Capistrano siltstone of southern Orange County, California for the Irvine Company, S&S Homes and various other land developers. Work involved identification of landslide features before and during earthwork operations for shear key and buttress design and construction. Designed and directed final design and installation of subdrain systems.

- Performed landslide, slope creep and slope softening studies in existing residential developments throughout southern California for various attorneys, insurance companies and building institutions. Work involved research of grading reports and previous geologic studies as well as aerial photographic analysis and field mapping of ground surface and structural features.

- Installed and monitored slope inclinometers at residential tracts built on previously unidentified landslides within the Big Rock Mesa community of Malibu, California for the County of Los Angeles.

- Performed field mapping and graphical analysis of landslides and other forms of slope instability for engineering design of stabilization measures in Dana Point and San Juan Capistrano for the Bear Brand Ranch Development Company. Work involved retaining walls, shear keys, and gravity buttresses.

- Conducted preliminary geotechnical investigation of a 13-mile segment of a proposed tollway in the foothills of southeastern Orange County, California. Mapped potential landslides and zones of slope instability in highly variable terrain. Work included drilling, downhole logging and sampling of soil borings, interpretation of geologic conditions and preparation of reports and maps issued to state and local agencies.

DALE M. SCHNEEBERGER, R.G.

EDUCATION
M.S., Geology, California State University, Long Beach, 1984
B.S., Geology, California State University, Long Beach, 1980
B.A., Biology, California State University, Fullerton, 1977
A.A., Science, Golden West College, Huntington Beach, 1975

REGISTRATION
Geologist, California
American Institute of Professional Geologists
Environmental Assessor, California
Certificate, 40-hour CERCLA/SARA Health and Safety Training, 29 CFR 1910.120

PROFESSIONAL HISTORY

1992 - Present	Senior Geologist, The MARK Group, Engineers & Geologists, Inc.
1989 - 1992	Manager of Geological Services, SNR Company
1989	*Staff Geologist, Leighton & Associates*
1985 - 1989	Research Geologist, Jet Propulsion Laboratory/California Institute of Technology
1985	Senior Geologist, P.E. Geotechnical
1979 - 1982	Staff Geologist, Earth Technology Corporation

SUMMARY

Mr. Schneeberger has over thirteen years of professional experience in geologic and hydrogeologic investigations, evaluations, and environmental and geotechnical studies. Relevant experience in the hazardous waste management field has included project management and technical responsibilities in the design and implementation of site investigation, monitoring and remediation programs. Mr. Schneeberger is very familiar with CAL-EPA, DTSC, and Regional Water Quality Control Board framework and permitting and has utilized this knowledge in the course of supervising and conducting hydrogeologic investigation and site remediation projects.

Previous professional assignments in RCRA facility investigations (RFIs) have involved diverse experience in geologic mapping and subsurface evaluation techniques which include wireline log and computer groundwater modeling, statistical analysis, geophysical surveys, exploratory drilling and logging, and aquifer evaluation studies. As a senior level geologist in both consulting and private industry, Mr. Schneeberger has provided technical direction, review and supervision of a variety of environmental restoration projects.

SELECTED EXPERIENCE

Hazardous Waste

- Project manager for the remediation of petroleum hydrocarbon impacted soil and ground water in south Orange County using vapor extraction and pump-and-treat technologies
- Project manager for a site investigation to characterize and remediate petroleum hydrocarbon releases in area of shallow ground water in Los Angeles County Prepared

a site remediation work plan for submittal to the LADPW. Implemented the remediation of gasoline, diesel, and waste oil impacted soil using excavation and onsite bioremediation.

- Project manager for a site investigation to characterize the release of chlorinated hydrocarbons (1,1,1-TCA, PCE) to soil and ground water at a food processing plant and metal finishing facility. Prepared work plans and progress reports to RWQCB. Characterized plume using soil borings and soil gas survey techniques.

- Project manager for a site investigation to characterize and remediate petroleum hydrocarbon releases (gasoline) from a services station in an area of shallow groundwater. Prepared a site investigation and remediation workplan and submitted it to the County Department of Health Services. Used excavation and disposal, pump-and-treat, and vapor extraction technologies to remediate the soil and groundwater.

- Project team leader for a RCRA facility investigation (RFI) to characterize releases of fuel and chlorinated hydrocarbons in soil and shallow groundwater for two major heavy manufacturing facilities. RFI included the installation of numerous soil borings, groundwater monitoring wells, data analysis and report writing for submittal to the Department of Health Services. Project also included the preparation of a closure plan for one of the facilities to remove it from part-B permit status.

- Project manager for a RFI of heavy metal contamination associated with a solid waste management unit at a RCRA facility. Project included extensive soil boring sampling, data analysis and report writing.

- Project manager for aquifer characterization study at a RCRA facility including deep monitoring well design and installation, geologic and geophysical logging, aquifer tests, and ground water modeling. Project included preparation of a work plan in coordination with Cal-EPA and DTSC to investigate sources of sulfate contamination in the groundwater.

- Prepared a revised ground water monitoring plan and post closure permit application for a $1.5 M in-place facility closure within U.S. EPA region IX.

- Prepared numerous ground water monitoring reports, and supervised and reviewed Phase I environmental site assessments reports for property transactions.

- Performed follow-up geologic/hydrogeologic study of potential sites for the proposed MX Missile program including investigation of regional aquifers in the southwestern U.S., prepared maps delineating depths to groundwater and alluvial isopach maps; and prepared final reports to the United States Air Force.

- Prepared delineation of past and present centers of volcanic activity and hazardous waste appraisal of the Pasco Basin.

Geotechnical

- Performed surface and subsurface geologic and geophysical investigations in support of the a proposed Foothill Transportation Corridor in Orange County, California. Project included aerial photographic interpretation, geologic mapping of bedrock and surficial units, planning and coordination of drilling and trenching activities, logging of trenches and boreholes, evaluation of slope stability, rippability, erosion potential, compressibility, and recent tectonic activity, geologic and geophysical data analysis and report preparation and review.

- Project manager for a seismic and geotechnical safety element for the City of Whittier's General Plan.

- Supervised field investigations, monitoring of engineered fill materials, and preparation of preliminary soils investigations and final soils reports for a site survey in Corona Del Mar to identify potential geologic hazards prior to grading; fill placement control for a cement treated soil buttress in Laguna Niguel; fill control and dewatering for a proposed development of a flood plain in south San Diego; numerous geologic site investigations for preliminary soils reports at various sites in Orange County.

- Compiled and analyzed geologic mapping, aerial photographs, and reports for an economic mineral and geothermal resource evaluation for most of Nevada and western Utah.

- Prepared maps identifying potential future centers of volcanic activity, studied landslide triggering mechanisms at the Subic Bay Naval Base, Philippines.

ORGANIZATIONS

South Coast Geological Society
National Water Well Association
Association of Hazardous Materials Professionals
California Groundwater Association

MARY LUCAS McDONALD, R.G.

EDUCATION B.A., Geology, Carleton College, Northfield, Minnesota, 1981
Research paper "Groundwater in the Koolau Range, Oahu, Hawaii, a study based on the structures and types of rocks present".
Hazardous Materials Management Course, University of California Extension, Davis, California, Fall of 1987.
Geology field camp in the Black Hills of South Dakota with Eastern Illinois University, Summer of 1980.

PROFESSIONAL REGISTRATIONS

Registered Geologist, California

PROFESSIONAL HISTORY

1991 - Present	Consultant, Mary Lucas McDonald
1989 - 1991	Project Manager, Harding Lawson Associates
1983 - 1989	Project Geologist, Brown and Caldwell
1981 - 1983	*Staff Geologist, Ecology and Environment*

SUMMARY

Ms. McDonald has over ten years of RCRA/CERCLA site risk investigation, feasibility study and remediation experience for a variety of environmental projects . Relevant experience in the hazardous waste management and remedial investigations has included project management and technical responsibilities in the design and implementation of site investigation and monitoring programs under Title 22, Title 23, and underground storage tank regulations at many local industrial facilities.

Her field experience includes conducting preliminary assessments, installation of monitoring wells, soil and groundwater sampling and analysis, and aquifer testing. She has also supervised groundwater and air modeling, and health risk assessments for a variety of sites and facilities. She is also experienced in the use of computers in project budgeting, scheduling, and planning.

SELECTED EXPERIENCE

- Project Hydrogeologist for the site investigation and remediation of a chemical blending and packaging plant in Santa Clara Valley. The lead agency was the San Francisco Bay Regional Water Quality Control Board. Responsible for development of the technical approach to the investigation and remediation of site soil and groundwater containing primarily halogenated hydrocarbons. Implemented soil vapor surveys and groundwater monitoring well installation to investigate the distribution of organics in the on and off site soil and groundwater. Performed slug tests to estimate aquifer parameters. Organics were identified 300 feet down gradient of the plant in the shallow groundwater. Negotiated with

the San Francisco Bay Regional Water Quality Control Board on approach to evaluate potential contribution from off site sources and on the on site groundwater remediation. Provided oversight of the implementation of a pilot scale soil venting system to remediate site soils near the above ground tank farm. Submitted application for permit to operate the full scale soil remediation. Responsible for primary contact with client and regulatory agencies.

- Project manager responsible for the development and implementation of the site investigation and remediation of a leaky underground storage tank in Modesto, California. Ms. McDonald prepared the work plan and supervised the field work, conducted an aquifer test, and prepared reports summarizing the results of the investigation and making recommendations for soil and groundwater remediation. Groundwater modeling was conducted to estimate plume capture under various pumping scenarios. Emissions from the stripping tower were estimated based on the results of the groundwater modeling and a permit to operate without treatment of the air emissions was obtained from the air district. Under her oversight, construction documents were prepared for a groundwater extraction system and air stripping tower followed by granulated activated carbon polishing units and the remediation system was constructed.

- Project Geologist for the site investigation at a Los Angeles Refinery for a major oil company. The lead agency was the South Coast Regional Water Quality Control Board. Developed the technical approach for the soil and groundwater quality investigation conducted the field work. Prepared the final report presenting the methods and results of the investigation. Based on our findings the agency required quarterly monitoring of the groundwater. Developed the technical approach to the investigation of a previous waste disposal site at the refinery and provided oversight for its implementation. Supplied air respiratory protection was required for the field work due to the presence of hydrogen cyanide at levels near IDLH.

- Office Coordinator for site investigations and remediations at 17 service stations in the San Francisco Bay Area for a major oil company. Responsible for project scheduling, development and review of cost estimates, and review of work products for consistency and technical quality. As office coordinator Ms. McDonald acted as the primary client contact for scheduling and development of new work.

- Project Manager for numerous service stations responsible for developing technical approachs and oversight for underground storage tank removals, site investigations, and remedial actions at numerous sites. Field work included assessing soil and groundwater contamination by petroleum products, organic solvents, pesticides, and metals.

- Project Manager for the soil and groundwater remediation at a former gasoline service station being developed as a motel in Santa Cruz, California. The soil remediation involved removal and disposal of approximately 1000 cubic yards of soil containing gasoline. Because of the fast paced schedule required by the developer, insitu methods for soil remediation could not be implemented. Developed groundwater treatment system for groundwater produced during normal dewatering activities at the motel.

- Project Manager for the CERCLA investigation of Hunters Point Annex in San Francisco. Technical tasks included the assessment of soil and groundwater at 16 identified sites within the facility; preliminary assessments of 44 sites and implementation of site inspections at 2; planning of removal actions at three sites including air modeling to assess potential health risks from two of the removal actions; planning for sediment, water, and tissue sampling to assess the potential impact of the facility on San Francisco Bay; and planning of an environmental risk assessment to assess the potential risk to local biota. Responsible for primary client contact, regulatory agency contact, subcontractor overview, development and maintenance of project budget and schedule, review of technical documents, and budget and contract negotiations. Under Ms. McDonald's management, HLA booked approximately $7 million for this project under contract to the Navy CLEAN prime contractor.

- Technical assistance team member under contract to the Environmental Protection Agency providing emergency response to oil and hazardous materials spills.

Professional Affilliations

National Groundwater Association
Association for Women Geoscientists, Chair of the local education committee and secretary

ROBERT S. SPARE, R.E.A.

EDUCATION B.A., Environmental Sciences, California State University, Hayward, 1986
Certificate, 40-hour CERCLA/SARA Health and Safety Training, 29 CFR 1910.120
Certificate, 8-hour CERCLA/SARA Supervisory Training, 29 CFR 1910.120

REGISTRATION Environmental Assessor - California

PROFESSIONAL HISTORY

1987 - Present	Project Environmental Scientist, The MARK Group, Inc.
1986 - 1987	Project Manager, Thermal Analytical Environmental Division
1986	Air Quality Specialist, Ecoserve, Inc.
1985	Temporary Intern, Contra Costa County Community Development Department
1983	Operations Specialist, U.S. Navy

SUMMARY

Mr. Spare has more than five years professional experience as an environmental scientist, with a strong emphasis in geology and groundwater hydrology. Mr. Spare has managed and implemented several facets of air, soil, groundwater and surface water investigation and remediation projects under RCRA. His project experience includes extensive field experience in petroleum site investigations defining lateral and vertical extents of contamination, including logging of exploratory borings and trenches, coordinating remedial response operations and installation of treatment systems. He has direct experience utilizing a number of field investigation techniques including air quality monitoring for ambient, indoor, and stationary stack emissions, soil gas surveys, drilling including air casing hammer, direct- and reverse-circulation mud rotary, and hollow-stem and bucket auger, soil and water sampling and monitoring well installation procedures. To complement his technical expertise, Mr. Spare is knowledgeable of the regulatory framework which governs these various applications, allowing him to handle a variety of environmental situations.

Recently, Mr. Spare performed groundwater evaluation monitoring investigation at a State Superfund landfill site in Kings County. The investigation included use of temporiary probes to delinate the lateral and vertical extent of chemicals found downgradient of the landfill, installation of monitoring wells, source characterization and evaluation of corrective action strategies. These efforts include planning and implementation of field investigations, budgetary control, data management and evaluation, supervision of field personnel, and technical report preparation.

SELECTED EXPERIENCE

Solid/Hazardous Waste

- Performed groundwater evaluation monitoring investigation at a State Superfund landfill site owned by Kings County. The investigation included use of temporiary probes to delinate the lateral and vertical extent of chemicals found downgradient of the landfill,

installation of monitoring wells, source characterization and evaluation of corrective action strategies.

- Developed and implemtated of a water quality assessments at landfills owned by the City of Merced and the County of Tulare. Field work included surface water sampling, vadose zone characterization, well construction, development and sampling, hydraulic testing and laboratory analysis.

- Prepared compliance documents pursuant to regulations pertaining to water quality monitoring at four landfills owned by Sonoma County. Prepared a revised Water Quality Monitoring Program and Financial Assurance (WQMP) in accordance with Article 5 of Chapter 15 of Division 3 of Title 23 of the California Code of Regulations (Article 5). For each site, the work included: (1) Completion of Supplemental Field Investigations and Preparation of Data Compilation Report; (2) Interim Water Quality Monitoring; and (3) Preparation of an Article 5 Compliance Document incorporating a proposed water quality monitoring program and response plan for financial responsibility.

- Performed sampling, evalution and reporting of quarterly water quality monitoring data at a landfilled owned by Glenn County.

- As part of a comprehensive hydrogeological investigation of a large refinery on the bay shoreline of Contra Costa County, supervised the drilling, installation, sampling and analysis of samples taken from 52 borings and 18 newly installed groundwater monitoring wells for site constituents including CAM 17 Metals and petroleum hydrocarbons. Approximately 400 soil samples and 20 groundwater samples were analyzed for the following: Total petroleum hydrocarbons (gasoline and diesel); Benzene, toluene, ethlybenzene and xylenes; total oil and grease; and CAM 17 Metals.

- Managed, and evaluated the groundwater data collected as part of the self monitoring program at at a large refinery on the bay shoreline of Contra Costa County. Responsible for graphing and projecting groundwater impacts.

- Conducted a subsurface investigation at two oily waste impoundments closed under TPCA, at the Avon Refinery in Martinez, California. This investigation included installation and development of groundwater monitoring wells, soil and groundwater sampling, statistical analysis, and hydraulic testing and data management.

- Project Manager for a soil remediation project performed for a large maintenance yard in Stockton, California. Project involved the excavation, sampling, segregation and remediation of total petroleum hydrocarbon impacted soil, as well as backfilling and the grading and paving of site. Secured all necessary permits, prepared the remediation of soil using Heat Enhanced Vapor Extraction techniques. Prepared closure report and obtained County and Water Board approval of closure.

- Performed an emergency response investigation at suspected fuel spill at a local refinery. Activities included operation of a backhoe, lithologic logging, soils mapping, and subsurface characterization.

- Conducted soil and groundwater investigations for hazardous materials at an industrial chemical manufacturing facility in Contra Costa County.

- Conducted site characterization studies to evaluate waste constituent migration in the groundwater and vadose zone at more than fifteen waste management units and industrial facilities. Duties included groundwater and soil sampling, monitoring well installation, data evaluation and reporting.

- Assisted with closure of nine surface impoundments at the Lawrence Livermore National Laboratory, Suite 300. This project included excavation and removal of suspect waste and regulatory closure under TPCA regulations.

- Implemented water quality solid waste assessment tests (SWAT) at ten industrial landfills in accordance with Water Code Section 13273 (AB 3525-Calderon) which involved construction of groundwater monitoring wells, soil and groundwater sampling, water level measurement, hydraulic testing and data management.

- Implemented water quality solid waste assessment tests (SWATs) at the inactive landfills at the Avon Refinery in Martinez, California. This project involved installation and development of groundwater monitoring wells, soil and groundwater sampling, and hydraulic testing and data management.

Air

- Managed and implemented air quality solid waste assessment tests (SWATs) at 15 municipal and industrial landfills, and prepared reports in accordance with Health and Safety Code Section 41805.5. These programs included meteorological monitoring, landfill gas characterization, subsurface gas monitoring, and ambient air testing.

- Supervised the testing of air pollutants at a chemical manufacturing facility. Methods of testing included EPA Methods 1 through 20 for identification of benzene, methane, total reduced sulfur, EPA 601, 602 for halocarbons and aromatics and tetrachlorinated dibenzodioxins (TCDD).

- Participated in the technical report preparation for compliance and engineering studies for air quality control regulations.

- Developed and/or designed air monitoring equipment and instrumentation for numerous federal, state and local air assessment monitoring methods.

PROFESSIONAL ASSOCIATIONS

Air and Waste Management Association
Golden West Chapter of APCA
National Water Well Association

PUBLICATIONS

Tom, Donavan G., Reilly, Thomas C., and Spare, Robert S., "Subsurface Landfill Fires: Management By Evaluation", Waste Age Magazine, June 1993, Vol 24, Number 6, pp 271-274.

PARIS A. HAJALI, Ph.D, P.E.

EDUCATION	Ph.D., Civil Engineering, University of Oklahoma, 1987 M.Sc., Civil Engineering, University of Oklahoma, 1981 B.Sc., Civil Engineering, University of Oklahoma, 1979
REGISTRATION	Professional Engineer, State of California, Registration No. C46643

PROFESSIONAL HISTORY

1993 - Present	Associate, The MARK Group, Engineers & Geologist, Inc.
1992 - 1993	Senior Project Engineer, Woodward-Clyde Consultants
1991 - 1992	Senior Executive Manager, C&C Construction Company LTD, Lagos, Nigeria
1987 - 1991	Assistant Project Engineer, Woodward-Clyde Consultants
1982 - 1984	Instructor, American University of Beirut
1981 - 1982	Environmental Engineer, Dar Al Handasah Consultants

SUMMARY

Dr. Hajali has over 10 years of experience in environmental engineering, hazardous waste management, design and construction management, and project management activities. Dr. Hajali serves as Manager of Remediation with The MARK Group. In this capacity he is responsible for technical direction and quality assurance for remediation projects. His experience in this capacity covers projects of various sizes involving soil and groundwater investigation, design of remedial action systems, remedial construction management, and management of operations and maintenance programs. He has provided professional services for several major clients such as Xerox Corporation, TRW Inc., PacTel Properties, McDonnel Douglas, and Home Federal Bank. Dr. Hajali is the inventor for a "Process and Apparatus for groundwater extraction using a High Vacuum Process", U.S. Patent No. 5,172,764.

SELECTED EXPERIENCE

- Project Manager, Xerox Corporation, Industrial property in the City of Irvine. Responsibilities included completion and implementation of the final design of an air stripping system for treating chlorinated hydrocarbon contaminated groundwater; management of the operation and maintenance of the groundwater and vapor extraction systems; evaluation of soil and groundwater cleanup effectiveness; development of groundwater cleanup criteria based on the application of risk assessment; design, fabrication, and installation of enhanced groundwater extraction systems (dual phase extraction system); and preparation of regulatory agency permits (AQMD and NPDES).

- Project Manager, Clay street Properties, City of Lancaster, Commercial site. Responsibilities included soil and groundwater investigation, design of soil and groundwater remedial program including specifications and engineering drawings.

- Project Manager, TRW, Inc., City of Industry, Industrial site. Responsibilities included design of soil and groundwater remedial program including engineering specifications and drawings; construction management for site structure demolition and soil treatment system; development of soil cleanup levels for metals, petroleum hydrocarbons, and chlorinated hydrocarbons; and preparation of regulatory agency permits (NPDES, AQMD, DTSC).

- Project Manager, Rosenow Spevacek Group, City of El Cajon, City Revitalization Program. Responsibilities included preparation of a preliminary site assessment, asbestos evaluation, and soil and groundwater investigation.

- Project Manager, PacTel Properties. Preparation of preliminary site assessments for twelve properties in Southern California.

- Project Manager, Xerox Corporation, Industrial Properties in Rochester, New York. Responsibilities included design, fabrication, installation, and start-up of five soil and groundwater treatment systems (dual phase extraction systems).

- Task Manager, Home Federal Bank, Commercial property in the City of Laguna Hills. Managed a pilot testing program for onsite hydrocarbon-contaminated soil treatment, assisted with NPDES permitting, and participated in developing soil and groundwater remedial programs for the site.

- Task Manager, Xerox Corporation, Nationwide facilities. Participated in the decommissioning of underground field storage tank facilities at 45 sites in 25 states. Project activities included reporting to the client and various federal, state, and local regulatory agencies, and coordination with local contractors for the removal of the tanks.

- Task Manager, Hopkins Development, Gas station in the City of Lancaster. Supervised the construction and start-up of a vapor extraction system to treat petroleum hydrocarbon contaminated soil.

- Task Manager, J.H. Baxter, Wood treatment facility in the City of Long Beach. Conducted a feasibility study for treating soil and groundwater contaminated with PCBs and heavy metals.

- Senior Executive Manager, Lagos, Nigeria. Assisted the Managing Director (President) with the Lagos Area Office management. Assignments included: project coordination for construction projects estimated at $50 million, such as the Calabar Jetty Project for oil loading, OPIC - Ikeja commercial estate development for the Ogun State Government, and the Maroko II office building; business development and client maintenance, negotiations of contracts and tenders, company planning and organization as a member of the Management Committee, and review of departmental reports. Special assignments involved the consolidation of field and office operations including the Cost Estimation, Accounting, Purchasing, Architectural Design, and Planning & Control departments. Also assisted Area Office Managers in the preparation of cash flow projections, profitability analysis, and budget and fund disbursement reports.

- Teaching Assistant, School of Civil Engineering and Environmental Science. Taught courses in Groundwater Pollution Control (CE 5020), Environmental Impact Assessment (CE 5863), and Hydroscience (CE 3112).

- Research Assistant, Environmental and Groundwater Institute. Involved in research projects such as the use of microcosms for evaluation of the land applicability of hazardous wastes, potential of artificial recharge of groundwater in the United States, and determination of the completion point of aquifer restoration programs (how clean is clean).

- Instructor, School of Civil Engineering. Taught Fluid Mechanics I and II, Solid Waste Management, Hydrology, Sanitary Engineering I and II (water and wastewater treatment), and Environmental Field Survey Training.

- Environmental Engineer. Worked on the design of sewerage systems, water supply networks, and solid waste disposal of towns and cities of Lebanon, Saudi Arabia, Kuwait, Jordan, Iraq, and Nigeria.

PATENTS

United States Patent invention for "Process and Apparatus for Groundwater Extraction Using a High Vacuum Process" United States Patent No. 5,172,764, Patent dated December 2, 1992.

PUBLICATIONS

Dr. Hajali has published several scientific articles in reputable professional or scientific publications, including:

Enhanced Groundwater Extraction Utilizing Innovative Technology: "HIVAC" HAZMAT West 1990, Long Beach, California, November 1990.

A Statistical Approach to Evaluate Hydrocarbon Contamination in the Unsaturated Zone (with T. Marshall and W. Overman), Hydrocarbon Contaminated Soils Symposium, University of Massachusetts, November 1990.

Remediation of Groundwater Contamination in a Low Permeability Medium, HAZMAT West 1988, Long Beach, California, November 1988.

Remedial Action Evaluation System: A Methodology for Determining the Completion Point for Aquifer Restoration Programs, Proceedings of the 8th National Conference Superfund '87, Washington, D.C., November 1987.

Artificial Recharge of Groundwater (with M. O'Hare, D. Fairchild, and L. Canter), Published by Lewis Publishers, Inc., Chelsea, Michigan, 1986.

National Feasibility of Artificial Recharge for Irrigated Lands, National Water Well Association, Southern Regional Groundwater Conference, Houston, Texas, September 1985.

Artificial Recharge of Groundwater in the Contiguous United States -- Status and Potential with M.P. O'Hare et al.), U.S. Soil Conservation Services, Washington, D.C., June 1985.

Priority Ranking of Sanitary Landfills in the Garber Wellington Area (with L. Canter), National Center for Groundwater Research, NCGWR 80-35, November 1980).

Rehabilitation of Polluted Aquifers (with L. Canter), National Center for Groundwater Research, NCGWR 80-12, October 1980.

Effects of Sanitary Landfills on Groundwater Quality (with L. Canter), National Center for Groundwater Research, NCGWR 80-14, October 1980.

Transport Parameters (with J. Laguros), National Center for Groundwater Research, NCGWR 80-33, November 1990.

MARK H. STANLEY, P.E.

EDUCATION B.S., Civil Engineering, University of California, Berkeley; 1988
M.S., Geotechnical Engineering, University of California, Berkeley; 1990
Certificate, 40-hour CERCLA/SARA Health and Safety Training, 29 CFR 1910.120

REGISTRATION Professional Engineer - California

PROFESSIONAL HISTORY

1990 - Present Senior Project Engineer, The MARK Group, Inc.
1988 - 1990 Staff Engineer, Harding Lawson Associates

SUMMARY

Mr. Stanley, has over five years of professional experience in environmental/geotechnical engineering. He has been responsible for preparing environmental documents, workplans, and obtaining permits for site restorations involving on-site soil treatment pile construction and groundwater remediation and monitoring for San Joaquin, Sacramento, San Mateo, Contra Costa, and Solano County Health Departments, U.S. Corps and other local enforcing agencies. In addition, he has obtained permits and managed the construction of a municipal Class III landfill closure project in Roseville, California, a remedial soil and groundwater investigation involving leaky underground tanks in Stockton, California, quarterly and annual groundwater Self Monitoring Reports with associated statistical analyses and Solid Waste Water Quality Assessment reports for sites in Contra Costa, and Storm Water Pollution Prevention Plans (SWPP) and Monitoring Plans for industrial facilities in Alameda County.

Mr. Stanley's experience also includes the performance of and /or supervision of geotechnical investigations for projects ranging from small structures to large commercial buildings, as well as conducting construction observation for a variety of projects which included large mass grading projects, clay liner construction, commercial developments, and pile installations. He has extensive experience in installation and operation of field instrumentation, including monitoring equipment such as slope inclinometers, pneumatic piezometers, vertical piezometers, and surface markers.

SELECTED EXPERIENCE

- Senior Engineer for characterization and closure of a paint sludge french drain at the U.S. Army Dugway Proving Grounds, Utah. Prepared work plans and sampling and analysis plans for waste characterization and construction operations for the drain closure, including excavation of chemically-impacted drain materials and surrounding soils, chemical stabilization of paint sludge, and screening and confirmation sampling of excavated materials.

- Senior Engineer for the construction management of the remediation of impacted soil and groundwater from former USTs at a maintenance yard in Mountain View, California. Work involved overseeing the drilling of soil borings, monitoring well development and sampling, and remediation of soil using HEVE/TO soil venting techniques to remove hydrocarbons from the soil and the development of a Water Quality Monitoring Plan.

- Senior Engineer for the construction management of the drilling of multiple soil borings, installation and development of monitoring wells to characterize the extent of contamination from USTs at a maintenance yard in Stockton, California. Installed HEVE/TO soil venting techniques to remove hydrocarbons from the soil and the development of a Water Quality Monitoring Plan.

- Supervised geotechnical investigations for closure of waste management unit located in Pittsburg, California. Investigations included drilling, sampling, analysis of test data, stability analysis, and report. Waste and subsurface materials were tested in the field and laboratory to perform stability analyses.

- Performed Quality Assurance/Quality control for geotechnical portions of closure of four industrial waste management units. The work included excavation, compaction and testing of 150,000 cubic yards of compacted fill at the four sites. Assisted in preparation of closure reports for the waste management units.

- Prepared quarterly and annual groundwater quarterly reports for three waste management units. Monitoring data were statistically analyzed for eleven quarters of sampling from 21 wells and three surface water sampling locations of the three waste management units. Recommendations were provided for future monitoring.

- Developed Storm Water Pollution Prevention (SWPP) and Storm Water Monitoring Plans for a 42 acre industrial site located in Richmond, California. Project required estimating quantity of storm water flows and identification of sources which could potentially impact storm water quality. Schedule for implementation for construction of storm water structural controls and implementation of "best management practices" were developed.

- Prepared Solid Waste Water Quality Assessment report for a landfill in Richmond, California. Work included performance of pump test to evaluate hydraulic conductivity of underlying native soils and waste management unit, evaluation of pump test data and groundwater data.

- Conducted construction observation and supervision of excavation and placement of materials for a 60 acre development on a previously abandoned industrial site. Work included the installation of wick drains, the placement of a surcharge fill, and removal of the remnants of abandoned structures.

- Supervised geotechnical investigation The Old River Intake Facility the Los Vaqueros Project in Contra Costa County. Investigations included drilling, sampling, performance of cone penetration and vane shear tests, in-situ shear wave velocity measuring, test data analysis, and final report preparation. Supervised or performed seismic response modeling (SHAKE analysis), liquefaction, stability, and settlement analyses. The project required substantial coordination between the different disciplines of the project design team to perform the analyses. Conducted lateral and axial pile analysis for the proposed 60'x90' structure to be constructed within the existing levee. The structure will be supported by 88 pipe piles requiring the development of P/Y and T/Z curves accounting for both group and dynamic effects. Current state-of-the-art in dynamic pile analysis was researched and applied to these analyses for both design based and operating based earthquake loadings.

- Supervised geotechnical investigation The Old River Pipeline portion of the Los Vaqueros Project in Contra Costa County. Investigations included drilling, sampling, performance of cone penetration and vane shear tests, in-situ shear wave velocity measuring, test data analysis, and final report preparation. Estimated range potential settlements induced by seismic shaking of the underling sand strata. Developed site specific correlations using laboratory test data and cone penetrometer test results to calculate the Modulus of Soil Reaction, E's, and composite modulus, E'c.

- Supervised geotechnical investigation of existing commercial development located in San Mateo County, California. Performed settlement analysis and prepared report after reviewing site fill/preload history, settlement history, and developed recommendations for possible future modifications. Site is underlain by approximately 30 feet of Bay Mud previously surcharge for the existing development. Recommendations were provided for various proposed alternatives which would place new structures across differentially preloaded and filled areas resulting in varying degrees of differential and total settlements. Report provide guidance in the selection of preload fills (time and height) and foundation support (as a function of preload and proposed building loads).

- Performed consolidation analyses for the widening of a highway interchange in Novato, California. Work included modeling various fill configurations using light weight fills to meet the project settlement limitations.

- Conducted construction observation and instrumentation installation and monitoring for a three phase 80-acre commercial project constructed on soft soils in Novato, California. Installed and monitored over 25 pneumatic piezometers and 9 slope inclinometers. Developed fill schedule based upon measured site response due to fill placement (pore pressure and lateral deformations). Performed various analyses including: pre and post construction slope stability analysis and settlements analyses which included evaluation of the performance of the wick drained preloaded areas and evaluation of settlements on box culvert crossing the site.

- Performed construction observation and testing of 16-350-kip post tensioned anchors installed through the concrete gravity abutments of Combie Dam located in Nevada County. Project entailed working closely with field representatives of State of California (DSOD) and the Federal Energy Regulatory Commission (FERC). Testing of installations included water pressure tests of foundation rock, proof, performance and lift off tests of anchors.

KENNETH B. KING, P.E.

EDUCATION B.S. Civil Engineering, University of California, Berkeley; 1959

REGISTRATION Professional Engineer - California, Oregon, Washington

PROFESSIONAL HISTORY

1989 - Present	Manager of Water Technology, The MARK Group, Engineers & Geologists, Inc.
1980 - 1989	Principal Engineer-Vice President, Converse Consultants Northern California
1976 - 1980	Chief of Fill Dams Department, Morrison-Knudsen Engineers
1973 - 1976	Principal Engineer, R.W. Beck and Associates
1967 - 1973	Supervising Engineer, Morrison-Knudsen Engineers, Brazil
1959 - 1967	Associate Engineer, State of California Department of Water Resources

SUMMARY

Mr. King has over 30 years of experience in remedial design and construction, heavy civil engineering, and water resources engineering projects. He has participated in all phases of work including feasibility, design, construction, and operation of projects. He provides a strong technical capability as well as effective management skills. With his depth of experience he provides a unique perception of the requirements of projects from the feasibility period through final design and later during the operation of the project. He has been responsible for all phases of projects including appraisal studies, preliminary design, final design, construction surveillance, and project operation. Throughout his career he has been involved with design of treatment systems for hazardous waste solids and liquids and associated piping and infrastructure systems for containment and removal of waste material. He has managed the final design, construct materials investigation and construction management of backfilling of five waste management units in which the design and construction was performed in seven months and included regulatory closure certification.

SELECTED EXPERIENCE

Waste Management

- Project Manager for the final design, construct materials investigation and construction management of backfilling of five waste management units. Design and construction was performed in seven months and included regulatory approval. Volume of backfilled materials for the five ponds was approximately 150,000 cubic yards.

- Project Manager of the design and construction surveillance of a 120-acre pond for retention of hazardous liquid and waste materials. Hazardous materials included uranium, molybdenum, copper, and acidic leachate. Work included preliminary design, field investigations, testing, selection of alternatives for design, final design, and construction surveillance.

- Project Manager for turnkey construction of backfilling of two waste ponds. Work included

preliminary design, final design and construction of backfill and drainage facilities for the ponds. Work also included closure plan for the ponds.

- Prepared Environmental Site Assessment for 65-acre commercial development site. The area included marshlands and backfilled areas. Investigations included review of groundwater records, backfilled materials and records, regulatory records, previous ownership, and a report providing a summary of findings.

- Prepared Environmental Site Assessment for a 20-acre housing development. Assessment included review of records of groundwater, backfill materials and records, regulatory records, previous ownership, use of pesticides on agricultural land, and report to provide a summary of the findings.

- Project manager for Report of Waste Discharge for 25-acre solid waste disposal site. Work included water quality assessment, evaluation of waste characterist2ics, remediation alternatives, selection of alternatives, and report.

- Project manager for evaluation of large and small dams used for storage of copper tailings. Field investigations included drilling, sampling, testing and installation of monitoring wells. Evaluation was made of the stability and retention capability of the structures. Methods of remediation were developed to improve stability and to collect seepage through the dams.

- Project manager for safety inspection report for 14 lead and barite tailings structures in Missouri. Work included hydrologic and groundwater evaluation, review and evaluation of stability of earth and hydraulic structures, erosion effects, and recommendations for monitoring of the structures.

Dams

- Project manager in charge of the Economic Feasibility and Preliminary Design of the New San Clement Project. Investigations included economic analysis, selection of reservoir size, field investigations, feasibility design of the project and cost estimates. The selected project included a 300-foot high roller compacted concrete dam, multiple level intake, fish passage facilities, spillway, powerhouse and access roads. A feasibility design and cost estimate also was prepared for a concrete faced rockfill dam alternative.

- Project manager for the hazard evaluation studies of the Mokelumne Aqueducts owned by East Bay Municipal Utility District. The studies consisted of the evaluation of alternatives for the replacement or improvement of the existing aqueducts.

- Independent Consultant for the FERC Reports for French Lake, Saw Mill, Bowman Rockfill and Bowman South Arch Dams. These reports were prepared and submitted to the FERC.

- Responsible for safety inspection reports for the Division of Safety of Dams (DSOD). In the last seven years, over 20 dams have been reviewed and reports and designs for remedial measures have ben performed. The dams consisted of earthfill, rockfill, concrete gravity and concrete arch dams.

- Project manager for the review of stability and hydrology of a 150-foot high arch dam and gravity abutments. The studies for the review included static and seismic reanalysis of the

arch dam and the development of the probable maximum flood and remedial measures. Final design and construction surveillance was performed on this remedial measure for the outlet and spillway.

- Project manager for the geotechnical field investigations, final design and construction of a 140-foot high earth-rock dam and appurtenant structures in Douglas County, Oregon.

- Project manager of the safety evaluation of 23 tailings dams in Missouri. Evaluation included stability studies, hydrology, hydraulics, field investigations and a separate report for each of the tailings dams. Mr. King was also Project manager for the dam safety analysis of five dams for the City of Kodiak, Alaska. Work included geotechnical field investigations, stability analysis, and operations and maintenance manual.

- Project manager for feasibility study of a water supply project having a 100-foot high earthfill dam for the City of Aurora, Colorado. Work included responsibility for evaluation of potential water resource developments, conducting field investigations, preparation of feasibility reports and final design.

- Project manager for the evaluation of several hydroelectric projects in Alaska, Vermont and Ohio. The evaluations included geotechnical field investigations, layout of structures, power potential and reports.

- As Supervising Civil Engineer, Mr. King was responsible for the field investigations and final design of earth-rockfill dams for the period he was in Brazil. he was principally involved in three large hydroelectric projects: Passo Real, Itumbiara and Sao Simao.

- Chief Civil Engineer responsible for the final design of a 200-foot high rockfill dam (Passo Real) with a volume of 4,000,000 cubic yards. Work included geotechnical field investigations (borrow areas, testfills, foundation studies, materials balance, testing programs), instrumentation, and design of dam, design of powerhouse and evaluation of post-construction instrumentation results.

- Project engineer responsible for the feasibility report of a 2,500-MW hydroelectric project (Itumbiara). The project consisted of a 400-foot high earth-rock dam with 35,000,000 cubic yards, spillway and 10 unit powerhouse. Studies consisted of geotechnical investigation (borrow areas, foundations and materials sources), selection of dam height, design of structure and cost estimate.

- Project engineer responsible for the feasibility and final design of a 400-foot high earth rockfill dam of a 2,500-MW hydroelectric project (Sao Simao). The project consisted of a 400-foot high earth-rock dam for a 2,500-MW hydroelectric project. The volume of the dam embankment was approximately 32,000,000 cubic yards. Particular features of this project were that the river bed contained up to 130 feet of sands and gravels and the river diversion cofferdam was approximately 165 feet in height. Geotechnical investigations for the project included adits, borrow area studies, test fills, foundation studies and concrete materials investigations.

- Geotechnical investigations for river diversion of the Passo Real, Itumbiara, and Sao Simao projects. Average annual flows of the rivers were in excess of 50,000 cfs. Investigations were conducted to facilitate excavation of borrow areas to minimize the effect of high

amounts of rainfall and maximize the reduction of moisture during relatively dry periods.

- Design engineer for the Oroville Dam project and participated in the selection of alternatives of design and the test fills.

LARRY H. HAWKINS

EDUCATION: Graduate, Oroville High School, California; 1965
College level course work in Marketing; 1966-68
College level course work in Computer Applications; 1968-69

REGISTRATION: General Engineering Contractor's Licenses, California
Certificate, 8-hour CERCLA/SARA Supervisory Training, 29 CFR 1910.120
Certificate, OSHA Trench Safety (Competent Person) Training Title 8, Ch.4
California Blaster's License
California Society of Safety Engineers Association Certification
Hazardous Materials Operations Training Compliance Certification
Radiation Safety and Nuclear Gauge Certification

PROFESSIONAL HISTORY

1991 - Present	Construction Manager, The MARK Group, Construction Engineers, Inc.
1990 - 1991	Project Manager, Preston Pipelines
1989 - 1990	Project Manager, Granite Construction, Inc.
1987 - 1989	Project Manager, W. H. Ebert Corp.
1986 - 1987	Project Manager, Dalton Construction Corp.
1985 - 1986	Project Manager, DYN Construction, Inc.
1985 - 1985	Project Manager, Miller Construction, Inc.
1984 - 1985	Project Manager, Oakdale Irrigation District
1980 - 1984	Supervisor, Granite Construction, Inc.
1974 - 1980	Independent General Engineering Contractor

SUMMARY

Mr. Hawkins has extensive and diverse experience as an engineering project superintendent/manager. His primary responsibilities have involved field project management and administration, direct supervision of construction crews, project cost control, contract negotiations, job scheduling and coordination, training of employees for specialized work, directing work in OSHA-defined confined-space environments, and procurement of specialized materials and equipment.

In over 25 years of field management experience, Mr. Hawkins' responsibilities have included work with landfills, storage facilities, USTs, pipelines, lift and pumping stations, testing of systems using high pressure, x-ray, dye, and television techniques, sewer monitoring devices, and cathodic protection and isolation systems. In the course of his work Mr. Hawkins has managed landfill construction projects ranging from subliner excavation and preparation to landfill cover, grading and paving construction projects. He has extensive experience in excavation, including open cuts up to 37 feet deep. Many of these projects required dewatering, solid sheeting, or other special construction techniques.

SELECTED EXPERIENCE

- Construction Manager for the installation of a primary liner, a leachate collection system and a secondary liner for a storm water runoff and fertilizer by-product retention pond. The scope of work consisted of the following work tasks: removal, cleanout and placement of approximately 4,000 cubic yards of sludge from the existing pond to a nearby process lagoon; installation of the PVC liner, hypalon liner; excavation; backfill and trenching; installation of concrete and reinforcing steel; procurement of construction materials; construction of leachate collection piping and geotextiles.

- Construction Manager for landfill closure improvements to the Sunnyvale Sanitary landfill in Sunnvale, California. Work consisted of furnishing all labor, materials, equipment, tools, and services necessary to install complete and in place the necessary improvements on site in accordance with the plans and City of Sunnyvale Standard Specifications.

- Construction Manager for the installation of a flexible High Density Polyethylene (HDPE) liner, eight (8) gas extraction wells and four (4) monitoring probes for the City of Mountain View's landfill/golf course/amphitheater along the shoreline of the SF Bay.

- Construction Manager for the removal and dewatering of all existing sludge from the inactive sludge pit bottom and all sides including along a dike traversing the southern end of an inactive sludge pit for the Simpson Paper Company in Ripon, California.

- Construction Manager for the landfill closure improvements to the Berry Street Mall landfill (landfill) in Roseville, California. Work performed included installation of a four foot minimum clay (low-permeability soil) cover on the landfill; placement of an eight ounce geotextile fabric; construction of a Leachate Collection System consisting of six inch perforated high density polyethylene (HDPE) corrugated pipe in a layer of Class 2 permeable material enclosed in a geotextile wrap; construction of a Methane Gas Collection System consisting of three inch perforated and solid HDPE corrugated pipe wrapped in with a geotextile fabric; construction of drainage systems complete with asphalt concrete drainage ditches, inlet aprons, corrugated steel culverts, down drains, and desilting basin; construction of riprap rock slope protection, asphaltic concrete paving, road and parking lot with a subgrade scarified to a depth of six inches, and covered with a 3/4 inch Class 2 aggregate base; completion of concrete work, desilting basin outlets; installation of erosion control devices including silt fences, sandbags, and hydroseeding; and construction of groundwater and vadose zone monitoring wells.

- Construction Manager for the dewatering and closure of a surface water impoundment containing approximately 9,000 cubic yards of alum-mud at an agricultural products facility located in Richmond, California.

- Construction Manager for the placement and compaction of low permeability soils and placement of geomembrane materials for a site at the Alameda Naval Air Station, California.

- Construction Manager for the remediation of approximately 450 cubic yards of hydrocarbon and diesel impacted soil and installation of a groundwater pump and treat system at a site of a former gasoline/convenience mart in San Jose, California.

- Construction Manager for the import of 40,000 cubic yards for a 25 acre hydrocarbon contaminated site. Project involved excavation, compaction of soils and placement of geomembrane materials for closure of the site. The site was later developed for 300 housing units.

- Construction Manager for the placement and compaction of low permeability soils and placement of geomembrane materials for modifications to a retention pond at the Lawrence Livermore National Laboratory.

- Construction Manager for the upgrade construction of the R1U1 waste tank collection system designed to collected liquid wastes comprised of residues from various classified experiments. The lab waste stream is known to contain various heavy metals, solvents and low levels of radioactive wastes from the Lawrence Livermore National Laboratory.

- Construction Manager for the construction of the groundwater pumping station and pipeline to increase the groundwater supply of the onsite water treatment plant which services the Lawrence Livermore National Laboratory research facilities located in Livermore, California.

- Construction Manager for satellite sewer monitoring stations at the Lawrence Livermore National Laboratory. Provided complete turnkey service throughout the project duration. MARK was able to meet the clients needs and schedule without encountering cost over-runs.

- Construction Manager for the removal of 14,000 cubic yards of heavy metal contaminated soils for a chemical processing plant.

- Project Manager - Alameda Naval Air Station. Involved in the removal of hazardous materials found to be affecting a 300-unit housing project for naval personnel. Total project cost $35 million. Groundwater at this site was contaminated and required special handling. Also, the top ten inches of affected soil had to be removed on the 22-acre site and exported for off-site disposal. Daily air and groundwater quality monitoring and dewatering were required while installing a lift station and 27,000 feet of associated sewer, water and storm piping and structures.

- Construction Manager of a for the removal of contaminated soils at a 22 acre site for the U.S. Navy.

- Directed and managed numerous projects of varying size and scope:

  - Bridge Deck Renovations (six locations), Highway 80, Federal Government
  - Rocklin, California, Sewer Installation and Pond Closure, EPA
  - Underground Tank Removals and Installations, various locations and owners
  - Excavation Blasting Project, Spring Valley Apartments, Grass Valley, California.

- Field Engineer responsible for the installation underground/aboveground double-walled polypropylene laboratory waste piping, aboveground single-walled storage tanks, and complete leak detection system at LLNL.

- Field Engineer for a project involving the removal impacted soils and monitoring of groundwater at a site of a former large phenol storage tank in Elk Grove, California. The project involved shoring and careful removal and excavation of extremely hazardous impacted soil near large tank farm foundations. Specific work included shoring, removal of impacted soils, excavation and sampling of soil, installation of an extraction trench for later collection and removal of shallow groundwater, installation of four shallow soil borings and one angle boring and analyzed for phenols, collection of groundwater samples, backfilling, restoration and closure report.

- Managed the remediation of a 4-acre site involving excavations to 45 feet and the bioremediation of approximately 4,000 cubic yards of soil containing hydrocarbons in Livermore, California.

- Managed the complete environmental restoration of several impacted sites involving the removal of multiple underground storage tanks throughout the Bay Area. Field activities have included excavation, sampling, segregation and disposal of affected soil, as well as backfilling and the grading and paving of site. Secured all necessary permits, prepared the closure report and obtained County and Water Board approval of closure.

- Field supervisor for project involving the removal of multiple underground storage tanks located in downtown San Francisco. The project involved shoring and careful removal and excavation of underground tanks near building foundations and elaborate brick work. Specific work included redirection of street traffic, sampling, segregation and disposal of affected soil, as well as backfilling and the grading and paving of site. Secured all necessary permits, prepared the closure report.

- Field Coordinator for an extensive quarterly ground water monitoring program involving 32 separate waste management units and over 100 ground water monitoring wells located in four separate water bearing zones.

- Field Engineer responsible for the removal of existing oil/water separators and replacement with new oil/water separators with slop tanks, height extensions, hold down hardware, concrete tip down pads, concrete bollards and PVC sewer lines at eight buildings for the U.S. Air Force Base at Travis, California.

- Field Supervisor for a soil remediation project performed for the U.S. Army Corps. of Engineers at the Oakland Army Base. Project involved hydrocarbon treatment using Heat Enhanced Vapor Extraction techniques.

- Field Engineer responsible for the decontamination, removal and replacement of an existing schedule 80 PVC laboratory waste line with a state of the art double walled polypropylene pipe system incorporating various leak detection devices. Project involved installation of over 2,500 lineal feet of six inch by four inch polypropylene pipe including numerous clean-outs branches and individual building penetrations and lab tie-ins at LLNL.

- Performed hazardous waste characterization for a municipal corporation yard. Work included consolidation of compatible wastes, segregation of separate waste classes, drum decontamination and the preparation of various waste products including paints, solvents, herbicides, pesticides, fumigants, Asbestos products and unknown wastes for transportation and disposal.

- Designed and Prepared cost estimates for various hypothetical treatment systems as part of financial assurance responsibility requirements relating to recent revisions to Article 5 of Title 22 of the California Code of Regulations (CCR). Treatment systems varied in complexity from simple single constituent systems to multi-component multi-phase treatment systems for the Port of San Francisco, USS-Posco, and C&H Sugar Company.

- Field Engineer for the closure of a Class III landfill for the California Integrated Waste Management Board. Project included providing all labor, materials, and equipment for the landfill closure improvements including installation of a low-permeability cover, placement of geotextile membrane, construction of a leachate and gas collection system and other associated construction.

- Field Engineer for the dewatering of a paper mill waste pond. Participated in construction activities which included emptying of the pond of its contents and dewatering the paper mill sludge, removal of the existing synthetic liner, excavation of anchor trenches, general earthmoving activities, backfilling of the cavity with imported clay soil and the placement and compaction of a 2 foot thick bentonite enriched clay cap. Other related activities included the development, preparation and completion of an in-place permeability test as part of the closure certification.

- On site consultant and field engineering supervisor for a major chemical manufacturing company, specific projects included a feasibility study, preparation of bid documents and construction management services relating to the characterization, cleanout and disposal of Alum-mud from a 10,000 cubic yard lined process waste pond. Other projects completed on site included a site wide aerial survey and the preparation of a paving and grading plan to control run-off from several acres of exposed fill as well as the removal and closure of several underground storage tanks, several of which contained hazardous wastes and required the use of vapor suppressive foam during removal operations.

- Field Engineer for the closure of a Class I agricultural waste pond. Participated in construction activities which included drainning and emptying of the pond of its contents and removal of the existing synthetic liner, excavation of anchor trenches, general earthmoving activities, backfilling of the cavity with imported clay soil and the placement and compaction of a 2 foot thick bentonite enriched clay cap. Other related activities included the development, preparation and completion of an in-place permeability test as part of the closure certification.

- Field coordinator for project involving the decontamination and reconstructed a low level radioactive waste sump. Specific work involved removal of all radioactive sludge and water before and after the cleaning process, installation of a teflon coated epoxy resin liner and the review of design parameters as well as the installation of a primary containment fiberglass reinforced plastic tank.

- Designed, installed and developed well head assemblies and filtration systems for a leachate recovery system at a municipal South Bay landfill.
- Lead technician for an industrial waste study for major U.S. Navy installation in the Bay Area.
- Designed waste oil management system for semiconductor manufacturing plant.

Air

- Revamped a 24,000-CFM dust collection system for a major chemical manufacturing company to account for baghouse loading and to improve efficiency of overall system.
- Conducted bagging study to evaluate accuracy of field air quality monitoring procedure.
- Performed test to identify mass flow rate of low pressure drop air quality monitoring instruments.
- Conducted fugitive emissions monitoring using OVA and MIRAN infrared analyzer for a large (over 9,000 components) chemical plant.
- Field coordinator for a fugitive emissions study involving 25,000 components.

SAN FRANCISCO
NEWSPAPER AGENCY
Agent of
San Francisco Chronicle San Francisco Examiner

August 15, 1993

Mr. Alan Gibbs
The Mark Group
Hookston Square #120
3480 Buskirk Ave.
Pleasant Hill, CA 94523

Dear Mr. Gibbs:

This is a short note to express appreciation for the high quality of work you have done for the San Francisco Newspaper Agency over the past five years. The Mark Group jumped into an extremely complex and somewhat sensitive subsurface petroleum and solvent contamination at a site the San Francisco Newspaper Agency had leased in Mt. View, California. We have been involved in five separate sites with contamination and long ago learned that the key to a successful remediation is multi-faceted. A significant key, however, is to have a working relationship with the remediation consultant where they make options available to us which include adequate remediation while remembering that the cost is also a focus of our concern.

You and The Mark Group have demonstrated at every turn that you understand not only the mandated requirements for clean-up but also the liability/fiscal needs of your clients. As you know, our current project has significant financial disincentives if not completed on schedule. At the outset it appeared that we would not be able to meet the deadline simply because of the logistics of the work required; however, the schedule I received today from The Mark Group shows the project now ahead of schedule and completing before the financial disincentives kick in. Thank you for your aggressive and intelligent ability to make adjustments that meet your clients' needs. Also, I look forward to receiving your two proposals for our upcoming projects at San Francisco and Burlingame.

Yours truly,

Phil Quinton
Manager of Administrative Services

agibbs.813

People • Service • Environment

STOCKTON SCAVENGER ASSOCIATION, INC.

(ˆskav-en-jer)
THOSE ENGAGED IN SALVAGING REUSABLE MATERIAL

September 24, 1993

TO: Potential Clients for The Mark Group

We have had the opportunity to utilize The Mark Group's services from the period beginning October 1992 to present. We contracted for their services for several projects including groundwater remediation, soil remediation, storm water runoff designs & development and construction of a truck washing facility. These projects were all running concurrently.

We found the Mark Group to be very responsive to requests for information or time tables. In our opinion they were cautious with subcontractor insuring both quality of work at the lowest reasonable cost. We found the quality and thoroughness of their work to be of a high level, and we would not have any problem either using them in the future or recommending their services.

Sincerely,

Robert Newburne
Regional Controller

1240 NAVY DRIVE • STOCKTON, CA 95206 • PO BOX 1747 • STOCKTON CA 95201 • TELEPHONE 209/946-5721 • FAX 209/948-4013

Serving Stockton Since 1917

Unocal Petroleum Products
& Chemicals Division
Unocal Corporation
911 Wilshire Blvd., P.O. Box 7600
Los Angeles, California 90051
Telephone (213) 977-7536

UNOCAL 76

L. J. Savaglio
Manager, Loss Prevention
& Regulatory Compliance
Pipeline

August 2, 1993

Mr. Larry Hawkins
The Mark Group
3480 Buskirk Avenue
Suite 120
Pleasant Hill, CA 94523

Avila Beach Project

Dear Larry:

It has been about a year since the completion of the Avila Beach Remediation Project. The Mark Group was responsible for the installation of 5000 feet of 12" pipe and smaller lines connecting to 26 vapor extraction wells. The entire system has been running smoothly for almost a year.

I wanted to take this opportunity to thank you for the "professional" job that was performed by the Mark Group. I appreciate that it was not an easy project to perform along a popular beach front community. The Mark Group demonstrated good project management from the excavation and laying of pipe to the control of beach traffic (vehicles and pedestrians) without any incidents.

The project was accomplished within the prescribed contract and time frames. Further, in my 20 years of experience, I have never experienced a local community putting on a "pot luck" party for contractors that had to disturb their community for several weeks. I think this is a testimony for a "caring" contractor.

I look forward to the opportunity to work again with the Mark Group.

Very truly yours,

L J Savaglio

LJS/jr

GROUNDWATER
TECHNOLOGY, INC. 20000/200 Mariner Avenue,Torrance, California 90503-1670 (213) 371-1394
Fax# (213) 371-4782

May 8, 1992

Mr. Dave Rogers
The Mark Group
3840 Buskirk #120
Pleasant Hill, CA 94523

Dear Mr. Rogers:

I would like to acknowledge the excellent work by the Mark Group to date on the Avila Beach project. I had the opportunity to visit the site on April 7, 1992 and found a highly professional crew installing the pipeline in a clean, safe and efficient manner. The townspeople and UNOCAL representatives who appeared on site were also very complimentary of the crew.

I would also like to apologize for the confusion regarding Mr. Hawkins performance at the start of the project. The problems which I brought to Mr. Solis's attention were simply normal logistical problems common to all projects. I was merely trying to sort out some minor concerns with Mr. Solis so that the project would run smoothly. I appreciate the cooperation of Mssrs. Solis and Hawkins in addressing these concerns, because the project is now running very smoothly.

In brief, the excellent performance and work to date is due primarily to the skill, experience, and dedication of Mssrs. Hawkins, Middleton, and Solis. When I visited the site, the pipeline was under construction at Front and San Luis streets. There were numerous line crossings at this intersections and some critical field decisions were needed. Mr. Hawkins took charge to investigate the lines and make responsible calls. His experience and skill were also evidenced in directing the crew in all aspects of the work including backfilling, testing, traffic control, and dust suppression.

Once again, Groundwater Technology appreciates the skill and expertise of the Mark Group. I hope that other opportunities arise where we can work together.

Sincerely,

GROUNDWATER TECHNOLOGY, INC.

Samuel Unger

Samuel Unger, P.E.

KINGS COUNTY WASTE MANAGEMENT AUTHORITY
Alcazar Building • 802 N. Irwin St., Suite 102, Hanford, CA 93230
(209) 583-8829 • FAX (209) 582-2757

By FAX & U.S. Mail

July 15, 1993

The Mark Group
Attn: Dave Rogers, President
Hookston Square, Suite 120
3480 Buskirk Avenue
Pleasant Hills, CA 94523

Subject: Letter of Recommendation

Dear Mr. Rogers:

The Mark Group has been under contract to this organization, the Kings County Waste Management Authority (KCWMA), on various environmental projects since 1988. These projects have included solid waste assessment tests, verification monitoring projects, evaluation monitoring projects, and plans for remediation projects at various inactive landfill sites in the County of Kings, California.

The Mark Group has demonstrated consistent high quality performance. All field work and resulting analyses have been thoroughly professional. Projects have been executed on time, in accordance with schedules, and projects have been performed on or under budget. In the few instances in which unanticipated requirements arose, timely notification and thorough documentation have been presented to justify increased costs.

Mark Group field personnel and management have been consistently responsive, both to normal project requirements and also to those unexpected requirements sometimes resulting from requests of California State regulators.

The KCWMA would not hesitate to hire The Mark Group for future projects. Please feel free to use the KCWMA as a reference at any time.

Sincerely,

KINGS COUNTY WASTE MANAGEMENT AUTHORITY

Donald E. Cluxton

Donald E. Cluxton
Executive Director

Dow U.S.A.

The Dow Chemical Company
P.O. Box 1398
Pittsburg, California 94565
510 · 432-5000

August 3, 1993

The MARK Group, Inc.
3480 Buskirk Avenue, Suite 120
Pleasant Hill, CA 94523

Attention: Mr. David K. Rogers, Principal

Subject: LETTER OF RECOMMENDATION

Gentlemen:

As you know, the MARK Group, Inc. has been under contract to The Dow Chemical Company, Pittsburg, California facility on various environmental projects since 1984. These projects have included:

- Site characterization (drilling, soil sampling and analysis, multi-level groundwater monitoring well design and construction, groundwater sampling and analysis, soil gas surveys, cone penetrometer tests, geophysical logging, air sampling and analysis);
- Comprehensive monitoring evaluations;
- Remedial Investigation/Feasibility Studies and documents (sampling plans, QA/QC plans, health and safety plans);
- Air/water Solid Waste Assessment Tests;
- Reports of Waste Discharge;
- Closure plans for Class I and Class III waste management units;
- Preliminary and final designs for closure construction;
- Preparation of plans and specifications for the construction of the Class I monolith landfill and closure of six Class I surface impoundments;
- Design assistance for groundwater pump and treatment systems;
- Construction management and geotechnical QA/QC for closure construction;
- Closure certification documents.

The MARK Group, Inc. has consistently provided a high quality work product. Both field and management staff have been responsive to requirements of both Dow and the regulatory agencies. Projects have been completed on time within schedule deadlines. MARK management systems have kept Dow informed of unanticipated changes affecting budgets and schedules. There have been no significant construction claims on the closure projects for which MARK provided construction management services.

MARK has been helpful in training Dow personnel to take over monitoring functions originally initiated by MARK at the Pittsburg site. I recommend The MARK Group, Inc. and the sister company The MARK Group, Construction Engineers, Inc. for environmental restoration and closure activities.

Sincerely,

Jeff MacDougall, Ph.D.
E/H/S Supervisor
Chlorinated Nitrogen Products Department

USS-POSCO INDUSTRIES

P.O. Box 471
Pittsburg, California 94565

August 2, 1993

Dean Marachi
Mark Group
Hookston Square, Suite 120
3480 Buskirk Avenue
Pleasant Hills, CA 94523

Subject: Letter of Recommendation

Dear Mr. Marachi:

The Mark Group has performed a variety of services for the USS-POSCO Industries (UPI) facility at Pittsburg, CA since 1986. These services have always been rendered in a professional manner with a focus on good communication between our organizations.

The Mark Group has achieved very good performance in meeting UPI's objectives, schedules, and compliance with all applicable regulatory requirements.

The list of work that the Mark Group has prepared and or performed for UPI includes the following:

- Hydrogeologic Assessment Report (HAR)
- Solid Waste Assessment Test (SWAT) reports
- Report of Waste Discharge (ROWD)
- Design report for a landfill following the subtitle D Guidelines
- Closure plans for impoundments
- Closure plans for landfills, (hazardous and non-hazardous)
- RCRA Part A and Part B Hazardous Waste permit application
- Groundwater and contaminant transport modeling
- Construction contract work for closure of impoundments
- Construction contract work for partial closure of landfills
- Construction work associated with some of the plant modifications

I look forward to maintaining our excellent business relationship in the future.

Sincerely,

L.P. Hellman, Manager
Environmental and Project
Administration

USS-POSCO INDUSTRIES

P.O. Box 471
Pittsburg, California 94565

November 24, 1993

Dean Marachi
The Mark Group
Hookston Square, Suite 120
3480 Buskirk Avenue
Pleasant Hill, Ca 94523

Subject: Environmental Improvement Project

Dear Mr. Marachi:

The Pittsburg Planning Commission passed two resolutions on Tuesday evening, November 23, 1993 related to UPI's environmental improvement project. Both the design review and grading permit, plus the CEQA document were adopted.

Concluding this major milestone within a year's period is outstanding and I wish to thank you and your associates for their valuable assistance. Tom Reilly has been most helpful in his technical presentations, particularly at the Public Workshop on November 16.

Sincerely,

W. M. E. Haley

W.M.E. Haley
Vice President

cc: C.A. Conkling
K.R. McMahon

Lawrence Livermore National Laboratory

August 5, 1993

To whom it may concern;

RE: **Recommendation for the Mark Group**

In 1991, the Mark Group was awarded the contract to construct a retention basin at Lawrence Livermore National Laboratory (LLNL). The purpose of the retention basin is to prevent the recharge of collected rainwater runoff. The retention basin is located directly above an area of volatile organic compound (VOC) contamination and recharge into this area would significantly extend the time required to remediate this area.

From the beginning of this project, the principals and engineering staff of the Mark Group were responsive to the special needs of LLNL. The tasks required to complete this project were organized, scheduled, and managed competently and professionally. The Mark Group's estimate of the total cost of the project was within less than one percent of the total cost.

During the course of the project, weather delays presented significant challenges to the Mark Group. The Mark Group, however, took the initiative to discuss each potential delay and presented alternatives to LLNL to minimize the impacts of the delays that were well received.

Despite the weather problems, the Mark Group completed the retention basin per the agreed upon schedule and within cost. The engineering staff were communicative and a pleasure to work with. The principals of the Mark Group were personally involved with the project and responsive. When construction had ended, contract close-out activities with the Mark Group were completed efficiently and professionally. Possession of the retention basin was then accepted by LLNL with no outstanding contract issues remaining to be resolved.

I would strongly recommend the Mark Group to any individual who needs construction, especially in a contaminated or potentially contaminated area, completed with quality, within cost and responsive to the needs of the customers.

Sincerely,

Anthony J. Boegel
Nuclear Facility Safety Office
Lawrence Livermore National Laboratory

AJB:kla

July 8, 1993

Tom Lindemuth
The Mark Group
3489 Buskirk Avenue Stuite 120
Pleasant Hill CA 94523

Dear Tom,

Cisco's San Jose buildings are underway and the paperwork is completed.

The enclosed memento shows our appreciation and gratitude for all of your efforts towards bringing this project to realization.

Sincerely,

John Russell
Vice President
Finance & Administration

Cisco Systems, Inc
P O Box 3075
1525 O'Brien Drive
Menlo Park, California 94025-1435
Tel 415-688-8200
Fax 415-688-8211