TETRA TECH, INC.

February 4, 1991

Mr. Scott Seery
Alameda County - Health Care Services Agency
Department of Environmental Health
Hazardous Materials Program
80 Swan Way, Room 200
Oakland, CA 94621

Subject: Site Investigation Work Plan for
Caltrans Hayward Maintenance Station
21195 Center Street
Castro Valley, California

Dear Mr. Seery:

As per our conversation on Friday, February 1, 1991, I have prepared the following items for inclusion in the Caltrans Hayward Maintenance Station Work Plan prepared by Tetra Tech:

1) **SIGNATURE PAGE** - We have prepared the attached signature page to be inserted before the Table of Contents of the Work Plan. The signature page includes a signature and seal by the Registered Geologist that will be on-site supervising the field program, and by the Registered Engineer who will be reviewing the data and participating in the final report preparation. Resumes for each of the key project personnel are attached.

2) **ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT PERMIT** - We have contacted the Alameda Flood Control District and completed application permits for the borings at the Hayward Maintenance Station. The completed permits have been filed with Mr. Wyman Hong at the Flood Control District. Copies of the completed permits are attached.

3) **LABORATORY TO BE USED FOR ANALYSIS** - Each of the samples collected will be forwarded to:

Eureka Laboratory, Inc.
6790 Florin Perkins Road
Sacramento, CA 95828
916-381-7953
Calif. DHS Lab. Certification # 765

4) **SELECTED LABORATORY ANALYSIS** - As per our discussion, each of the soil samples will be analyzed for total petroleum hydrocarbons (TPH) using LUFT method modified 8015, and aromatic volatile organic compounds (AVOC) using EPA Method 8020. The TPH analysis will be completed using a GC-FID for gasoline and diesel as outlined in the May 1988 LUFT manual. We have attached a "Summary of Method" to be used for performing the modified 8015. An excerpt from the State Water Resources Control Board LUFT Manual has been attached outlining the technique Eureka Laboratory will use in analyzing for TPH compounds.

We currently scheduled to be drilling at the Hayward Maintenance Station on February 7 and 8, 1991. If you have any questions or require additional information regarding the work plan please feel free to contact me at (818) 449-6400.

Sincerely,

Dan Batrack
Program Manager
Tetra Tech, Inc.

ATTACHMENTS

cc: Charles Noyes, San Francisco - RWQCB
Mary Cooper, Office of the State Architect

TETRA TECH, INC.
SITE INVESTIGATION WORK PLAN

for

HAYWARD MAINTENANCE STATION
HAYWARD, CALIFORNIA

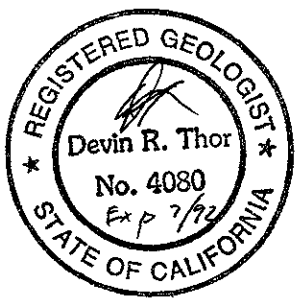
January 31, 1991

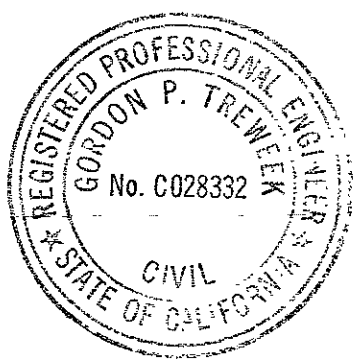
Prepared by: Tetra Tech, Inc.
670 N. Rosemead Blvd.
Pasadena, CA 91107

Dan Batrack
Project Manager

Devin Thor, R.G.
Project Geologist

Gordon P. Treweek, Ph.D.
Director, Environmental Services





ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
5997 PARKSIDE DRIVE ♦ PLEASANTON, CALIFORNIA 94588 ♦ (415) 484-2600

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT CALTRANS HAYWARD MAINT. STATION
21195 CENTER STREET
CASTRO VALLEY, CALIFORNIA

CLIENT
Name OFFICE OF THE STATE ARCHITECT
Address 400 - P Street Phone 916-323-5819
City SACRAMENTO Zip 95814

APPLICANT
Name TETRA TECH, INC.
c/o Dan Batrack
Address 670 N. Rosemead Blvd Phone 818-449-6400
City PASADENA Zip 91107

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection	___	General	XXX Soil Borings
Water Supply	___	Contamination	XXX Petroleum
Monitoring	___	Well Destruction	___

PROPOSED WATER SUPPLY WELL USE - No Well to be Installed -
Domestic ___ Industrial ___ Other ___
Municipal ___ Irrigation ___

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger XXX 8" Hollow Stem
Cable ___ Other ___

DRILLER'S LICENSE NO. C-57 #554979

WELL PROJECTS
Drill Hole Diameter ___ in. Maximum
Casing Diameter ___ in. Est. Depth ___ ft.
Surface Seal Depth ___ ft. Number ___

GEOTECHNICAL PROJECTS
Number of Borings 10 Max. Maximum
Hole Diameter 8 in. Depth 40 ft.

ESTIMATED STARTING DATE 2/7/91
ESTIMATED COMPLETION DATE 2/8/91

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] Date 2-4-91

FOR OFFICE USE

PERMIT NUMBER ___
LOCATION NUMBER ___

PERMIT CONDITIONS

Circled Permit Requirements Apply

A. GENERAL
1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
3. Permit is void if project not begun within 90 days of approval date.

B. WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

D. CATHODIC. Fill hole above anode zone with concrete placed by tremie.

E. WELL DESTRUCTION. See attached.

Approved ___ Date ___

121989

DEVIN R. THOR, R.G. **GEOLOGIST/HYDROGEOLOGIST**

EDUCATION

M.S. Geology, California State University, Northridge - 1977
B.S. Geology, California State University, Northridge - 1972

QUALIFICATIONS

Mr. Thor is a California Registered Geologist with 14 years professional experience in marine geology, engineering geology, and environmental geology. Mr. Thor has designed and managed projects to assess siting of offshore facilities such as platforms and pipelines, and has assessed offshore geological hazards. He has utilized geophysical data to explore for petroleum, sand and gravel, and conducted hydrogeological investigations of hazardous waste sites. Mr. Thor has experience with project management, collection and interpretation of geophysical and bore-hole data, and environmental assessment regulations. Mr. Thor previously served as a senior project geologist for Exxon Production Research Company and as a research geologist for the U.S. Geological Survey, Marine Branch.

RELEVANT EXPERIENCE

UNDERGROUND STORAGE TANKS

Characterization of CalTrans Tank Farm Site
Drilled 12 boreholes to determine the depth and lateral extent of petroleum contamination from leaking storage tanks at CalTrans Site 5, Los Angeles.

Characterization of Underground Storage-Tanks Site
Drilled four boreholes to determine the vertical and horizontal extent of contamination and three monitoring wells to determine the hydraulic character of the contaminated sediment to assess the feasibility of in-situ remedial action, Fort MacArthur Air Force Base, San Pedro, California.

REMEDIAL INVESTIGATIONS/FEASIBILITY STUDIES

Characterization of CalTrans Landfill Site
Drilled 21 boreholes to determine depth, areal extent, and type of soil contamination at CalTrans Site 16 landfill, which is along the Century Freeway right of way, Los Angeles.

Evaluation of Aquifer Characteristics
Drilled 9 monitoring wells to evaluate aquifer characteristics and to test for aquifer contamination at proposed tunnel site at the Century Freeway/San Diego Freeway interchange, Los Angeles.

MARINE ESTUARINE STUDIES

Hydrographic Survey, Morro Bay, California
Managed and executed detailed hydrographic survey for an erosion control study. Collect 35 trackline miles of fathometer data and 12 cores to determine sedimentation rates, sediment volumes, and changes in bay morphology, Morro Bay, California.

ENVIRONMENTAL ASSESSMENT STUDIES

Geological Investigation of Offshore Platforms and Pipeline Routes in Santa Barbara Channel, California
As Senior Project Geologist, designed and directed the geological evaluation for five platform sites and associated pipeline routes for the Santa Ynez Unit, Santa Barbara Channel, California.

Dredged Material Monitoring, San Francisco Bay
Designed and managed 15 day monitoring program of non-hazardous suspended particulate pollution from dredge dumping in San Francisco Bay, California. Collected and analyzed 78 water samples and data from 6 nephelometer stations to determine if dredge dumpings were falling to the bottom or being suspended and redistributed.

Beach Erosion Study, Alaska
Assessed beach erosion by measuring 124 beach profiles and collecting 124 trackline miles of fathometer data for a beach-erosion study, Barrow, Alaska.

Seismic Risk Evaluation, California
Provided quality control and data management of 450 trackline miles of geophysical data for a seismic-risk evaluation study, Hausgri Fault, offshore central California.

Geophysical, Geological, and Environmental Study of Offshore Platform Site
Served as Project Geologist interpreting geophysical data for a geological and environmental assessment of a platform site in the Molino Field, Santa Barbara, California.

Evaluation of Geophysical Data
Interpreted geophysical data to evaluate storm damage to an artificial island, San Pedro Bay, California.

Geophysical Survey for Beach Replenishment Program, Santa Barbara, California
Collected geophysical and core data to evaluate quality and extent of potential offshore sand deposits for a beach replenishment program, Santa Barbara Channel, California

Evaluation of Geophysical Data for Huntington Harbor, California
Interpreted geophysical data to locate the Newport-Inglewood Fault, Huntington Harbor, California.

Facility Siting/Geological Engineering in Foreign Waters
Conducted engineering-geological assessments for facilities siting in the south China Sea, North Sea, and offshore Argentina.

Geophysical and Geological Data Interpretation for Environmental Condition in the Bering Sea
Interpreted geophysical and geological data to assess and characterize the geological-environmental conditions of the northern Bering Sea.

MISCELLANEOUS

Geoarchaeologic Investigations
Conducted geoarchaeologic investigations at Church Plaza, Los Angeles, California; Colleguas Creek, Mugu Lagoon, California; and several sites on Catalina Island, California. Work included identification of depositional environments, radiocarbon dating of artifacts, and identification of artifact provenance.

PROFESSIONAL RECOGNITION AND AFFILIATION

Registered Geologist, California, 1985 (No. 4080)
Certified Well Inspector, Ventura County, CA, 1989
Sigma Xi
Association of Groundwater Scientists and Engineers
National Water Well Association
California Groundwater Association

SPECIAL TRAINING

Hazardous Waste Management
Clastic Facies Depositional Environments
Bore-Hole Environment
Basin Analysis
Petroleum Geochemistry

EMPLOYMENT HISTORY

1989 - Present	Tetra Tech, Inc. Pasadena, California
1985 - 1989	Thor Geological Consulting Paso Robles, California
1980 - 1985	Exxon Production Research Company Houston, Texas
1977 - 1980	U.S. Geological Survey, Marine Branch Menlo Park, California

REFERENCES

Dr. Jan Rietman
1315 Green View Drive
Orange, California 92666
(714) 532-1731

Dr. Peter Fischer
MESA VERDE
P.O. Box 4733
Whittier, California 90607
(213) 945-7607

Dr. Eugene Fritsche
Department of Geosciences
California State University, Northridge
18111 Nordhoff Street
Northridge, California 91330
(818) 885-3541

GORDON P. TREWEEK, P.E. **PROGRAM MANAGER**

EDUCATION

Ph.D. Environmental Engineering, California Institute of Technology - 1975
M.S. Engineering Science, California Institute of Technology - 1971
B.S. Civil Engineering, U.S. Military Academy, West Point - 1964

QUALIFICATIONS

Dr. Treweek is an Environmental Engineer with over 20 years experience in civil and environmental engineering and science. He specializes in managing and providing quality assurance for site investigations, feasibility studies, remedial design, and remedial actions at hazardous waste sites. He has over 5 years experience as a civil engineer with the U.S. Army Corps of Engineers including design review and construction management of roads, runways, drainage channels, and field water supply installations.

RELEVANT EXPERIENCE

REMEDIAL INVESTIGATIONS/FEASIBILITY STUDIES

Hazardous Waste Assessment, Argonne National Laboratory, IL
Served as Program Manager for a nationwide DOE program to determine the extent of hazardous waste contamination at DOE and DOD facilities. The scope of work included preliminary assessments to ascertain past disposal practices, site investigations to determine the areal and vertical extent of contamination, feasibility studies to evaluate cleanup alternatives, and remedial designs of cleanup facilities.

Hydrogeological Assessment and Impoundment Replacement Design, TRW, CA
Served as Project Manager for performing a hydrogeological investigation to determine if contaminants had leaked from seven surface impoundments at the TRW Capistrano Test Station (CTS). The investigation included 14 soil borings immediately under the impoundments, and 3 wells extending down 500 feet below the impoundments. Soil samples were analyzed for a variety of organic and inorganic contaminants. After the investigation, the impoundments were closed in accordance with the California Toxic Pits Cleanup Act (TPCA) and replacement, double-containment systems were designed and constructed. An industrial wastewater treatment plant, including lime precipitation and reverse osmosis treatment of recirculating cooling water, was designed and constructed.

Defense Environmental Restoration Account (DERA) Investigations, U.S. Army Corps of Engineers, CA
Served as Project Manager for performing preliminary assessments and site investigations at former waste disposal sites located on DOD property in southern California, Arizona, and Nevada. The sites contained construction debris, trash, and hazardous waste. The investigations included a review of disposal practices, discussions with long-time employees, and

study of aerial photographs to determine where wastes were disposed. If necessary, subsurface audits were performed by installing soil borings and groundwater monitoring wells.

Subsurface Environmental Audit, Paramount Petroleum Corporation, CA
Served as Project Manager for identifying the nature and extent of organic and inorganic soil contamination resulting from 40 years of operations at the Paramount refinery. Organic contamination consisted of refinery product leakage through the soil column down to the underlying perched aquifer. Other localized contamination consisted of PCBs from leaking transformers and tetraethyl lead from gasoline blending. Inorganic contamination resulted from disposal of cooling tower blowdown (chromates), application of pesticides (arsenic based) during early farming operations, and asbestos fibers from mastic manufacture. Four alternatives for site remediation were developed, along with their associated costs and environmental effects.

Evaluation of In-Situ Soil Remediation Process, Toxic Treatments Ltd., CA
Served as Project Manager for conducting a performance evaluation of an in-situ soil remediation process. This process injected hot air, stream, or oxidizing chemicals into the soil at depths up to 22 feet in order to oxidize and strip organic contaminants from the soil. The stripped organics were captured in a metal shroud at the surface, then cycled through a condenser and GAC adsorber. The capabilities of the treatment process were evaluated in terms of percent removal, soil hydrocarbon concentration before and after treatment, and organic vapor level in the shroud. Recommendations were made for improving the efficiency and effectiveness of the process.

Site Investigation and Feasibility Study, Stringfellow Class I Disposal Site, Santa Ana Regional Water Quality Control Board, CA
Served as Project Engineer for evaluating whether the Stringfellow Class I Disposal Site (Superfund) for inorganic and organic industrial wastes should be reopened or permanently closed. Following the regulatory decision to close the site, developed design criteria for construction of an impermeable groundwater barrier, calling upon knowledge of site chemistry and groundwater hydrology. Subsequently, managed the Stringfellow Leachate Treatability Study, which selected treatment chemicals and processes for precipitating the heavy metal fraction from the extracted groundwater. Following the treatability experiments, served as Project Engineer for the Stringfellow Predesign Study which specified the process train (lime precipitation followed by GAC adsorption), equipment sizes, and construction costs for the Stringfellow Groundwater Pretreatment Plant. This plant, currently in operation, removes inorganic and organic contaminants from groundwater pumped from downstream extraction wells.

Soil Contamination at Del Amo Site, Cadillac Fairview, CA
Served as Project Engineer for the initial site investigation of waste evaporation ponds at the Shell refinery on Del Amo Boulevard, Torrance, California. Since World War II, this 40-acre site had been used to evaporate liquid wastes from a refinery and for evaporation and disposal of waste and off-specification products generated in refinery and synthetic rubber operations. The wastes partially migrated into the alluvial soils underlying the evaporation ponds. The site investigation consisted of soil borings and sampling for organics and heavy metals (principally chromates from cooling tower blowdown). Alternatives for excavating or capping the contaminated soils were developed, and cost estimates prepared.

Hydrocarbon Recovery System, China Lake Naval Weapons Center, CA
Served as Project Engineer for the predesign of a hydrocarbon recovery and groundwater treatment system at the China Lake Naval Weapons Center. This project involved extracting and treating (air stripping) the groundwater beneath a fuel lens. The treated groundwater was then percolated back through the soil, recharging the aquifer. The fuel layer migrated into the cone of a depression created by the groundwater withdrawal and then was pumped to the surface for reuse in boilers.

WATER AND WASTEWATER TREATMENT

Treatability Studies of Eklutna Lake Water, Anchorage Water Department, AK
Served as Project Engineer for a 12 month pilot plant comparison of direct filtration with complete treatment for the removal of fine glacial flour, originating from Eklutna Lake, Alaska. The pilot plant facilities were setup in a large tractor trailer and included flow measurement, chemical injection and mixing, sedimentation, and filtration. The trailer also contained lab equipment for turbidity and particle size distribution measurement. As a result of the pilot plant investigation, the direct filtration option was selected. A direct filtration plant was designed and constructed, incorporating innovative treatment concepts.

Performance Evaluation of Activated Sludge Processes, Lehigh County Wastewater Authority, Allentown, PA
Served as Project Engineer on a four month performance evaluation of complete-mix activated sludge, staged activated sludge, and pure oxygen activated sludge in treating high strength brewery and cheese processing plant effluents. Particular problems encountered were wastewater flow and strength surges, and filamentous growths. As a result of the pilot plant investigation, a pure oxygen activated sludge plant was designed and constructed; based largely on the ability of the process to effectively treat high strength wastewater.

Waste-As-Fuel Pilot Plant Operations, Industrial Environmental Research Lab, U.S. EPA, Cincinnati, OH
Served as Project Engineer in developing alternatives for the treatment of wastewater originating at refuse-to-energy facilities. Subsequently, became Project Manager for design, construction, and operation of two trailer-mounted pilot plant units treating oil shale recovery wastewaters. In a bench-scale testing phase, investigated the use of anaerobic filters to breakdown oil shale wastewaters over a six month period. The pilot plant units, consisting of precipitation, clarification, and filtration processes, have been widely used by U.S. EPA IERL to develop treatability standards.

Reuse of Reclaimed Wastewater in Cooling Towers, Office of Water Research and Technology, CA
Served as Project Engineer for the design, construction, and operation of pilot plant facilities evaluating the reuse of filtered secondary effluent as makeup to industrial cooling towers. Chemicals and operating procedures were modified to overcome problems of scaling, fouling, and corrosion of the heat exchangers.

CORROSION CONTROL

Corrosion Mitigation Study, Portland Bureau of Water Works, OR
Served as Project Engineer for evaluating the internal corrosion of distribution and consumer plumbing systems for Portland, Oregon. Directed the project team performing an 18 month pilot study investigating alternative pipe materials and disinfectants, conducted "at-the-tap" water quality surveys, and recorded the long-term effects of corrosion in pipe samples removed from consumers' homes. Developed recommendations for mitigating the health and economic effects of corrosion, via changes in pipe materials, solders, and water treatment practices.

Copper Induced Corrosion of Galvanized Steel Pipe, Metropolitan Water District, Los Angeles, CA
Served as Project Engineer for several studies of the rapid pitting failure of galvanized steel pipe, eventually attributed to elevated copper levels in the water supply. The copper originated from the use of copper sulfate for algae control and the dissolution of copper pipe. These studies resulted from lawsuits between homeowners, developers, and water purveyors. Eventually, a two year pilot plant investigation of this phenomenon was conducted with the U.S. EPA and the Metropolitan Water District, with careful control of copper concentrations and galvanized steel pipe quality.

Corrosion Evaluation, VA Medical Center, Westwood, CA
Served as Project Engineer for analyzing a number of corrosion-related problems in the domestic and heating water systems at the Veterans Administration Medical Center in Westwood, California. Dr. Treweek provided recommendations, designs, and specifications for new valves, piping materials, dielectric couplings, and ice machine parts so that the corrosion problems associated with the use of 3 mg/1 of chlorine were mitigated.

Corrosion Evaluation, Mammoth Lakes Water District, CA
Served as Project Engineer and expert witness in determining why rapid pitting failure was occurring in galvanized pipe systems in a new condominium development.

Corrosion Evaluation, Mission Viejo, CA
Served as Project Engineer and expert witness in determining why rapid pitting failure was occurring in galvanized pipe systems in new housing developments.

ASBESTOS ABATEMENT

Asbestos Assessment, Union Pacific Realty Company
Served as Project Manager for determining the presence of asbestos containing materials in a 504 room hotel in Las Vegas, Nevada. Asbestos was found in vinyl asphalt tiles and spray on acoustic ceilings. Health risks associated with the asbestos were outlined, and costs for abatement developed.

Asbestos Assessment, City of Long Beach, CA
Served as Project Manager for determining the presence of asbestos containing materials in commercial buildings and apartments scheduled for demolition. Costs for removing the asbestos prior to demolition were provided.

Asbestos Assessment, California PTA, CA
Served as Project Engineer for determining the presence of asbestos containing materials in the California PTA headquarters building in Los Angeles. Operations and maintenance procedures were recommended, along with cost estimates for eventual removal.

Asbestos Abatement, Baxter Pharmaceal, Los Angeles, CA
Served as Project Manager for asbestos abatement oversight at a large pharmaceutical manufacturing facility. The asbestos insulation on the world's largest ethylene oxide sterilizer was removed and replaced with fiberglass insulation. Also 20,000 sq. ft. of vinyl asphalt tile with asbestos containing mastic were removed.

CONSTRUCTION MANAGEMENT

Water Supply Point, Pleiku, Viet Nam
Served as Project Engineer for locating, developing, and securing water supplies for 5,000 troops in the Central Highlands, Viet Nam. Treatment processes for surface water sources included diatomaceous earth filtration and chlorination.

Roads and Drainage Facilities, Pleiku, Viet Nam
Served as Project Engineer for designing and constructing roads, drainage channels, culverts, and helipads in the Central Highlands, Viet Nam.

Runways, Ammunition Storage Bunkers, and Maintenance Sheds, West Germany
Served as QA/QC officer for design review and construction management of roads, runways, and ammunition storage bunkers being constructed by the Construction Engineering Battalion in West Germany.

Road and Drainage Facilities, Thailand
Served as Project Engineer for providing crushed rock and hot-mixed asphalt for an all-weather road in northeast Thailand. Activities included locating, setting up, and operating a quarry face, three rock crushers, a hot-mix asphalt plant, and paving machines.

PROFESSIONAL RECOGNITION AND AFFILIATIONS

Professional Civil Engineer, California, 1977 (C028332)
American Society of Civil Engineers
American Water Works Association
Water Pollution Control Federation

PUBLICATIONS

Dr. Treweek is the author of more than 30 technical publications related to environmental science and engineering, including topics such as hazardous waste management and water resources engineering. In addition, he has authored three chapters in textbooks dealing with wastewater reclamation and reuse, groundwater recharge, and corrosion.

DAN L. BATRACK **ENVIRONMENTAL SCIENTIST**

EDUCATION

B.S. Oceanography, University of Washington - 1980

QUALIFICATIONS

Mr. Batrack is a Project Manager and Senior Environmental Scientist with over 8 years of experience. He has supervised and participated in investigations of asbestos and leaking underground tanks, groundwater contamination, hazardous waste monitoring programs, contaminated soil remediation, and has directed community relation activities on Superfund cleanup sites. Mr. Batrack has implemented innovative technologies for site investigations and remediation, including real-time soil gas surveys, and biological soil remediation. He has also served as Project Manager on various multidisciplinary international research projects supervising and directing hydrographic, oceanographic, and meteorological research programs in areas ranging from the Alaskan Arctic to Saudi Arabia.

RELEVANT EXPERIENCE

UNDERGROUND STORAGE TANK INVESTIGATIONS

Developed underground storage tank inspection form for the State of California. The inspection form is being used by all contractors and State Architect staff within California.

Served as Project Manager for the development of Leak Detection/Tank Monitoring plans (LDP/TMP) for the California Office of the State Architect. This program included developing separate LDP/TMPs for over 400 facilities and 1,000 underground storage tanks owned and operated by the State of California. Responsibilities included testing, monitoring, and remediation projects associated with the underground storage of hazardous materials. Conducted initial detection and subsequent site investigations of possible unauthorized discharges of hazardous substances. Additional responsibilities included regulatory compliance, client interface, and remedial alternative evaluation and implementation.

Performed underground storage tank survey at Makah Air Force Station on Neah Bay (WA) for the Northwest Division of the U.S. Army Corps of Engineers. Survey included tank testing and preliminary development of technical specifications for monitoring and removal.

Performed site investigation of petroleum product spills and leaking underground storage tanks at the Orange County Airport. This investigation included soil gas surveys, soil borings, groundwater monitoring and well installation, and remedial action plans.

SOIL REMEDIATION

Served as Project Manager for the development, implementation and completion of a soil remediation program at an industrial manufacturing facility in Los Angeles. This project included tank removals, site investigations, remedial actions, and the development and regulatory approval of an onsite soil remediation plan. The project's onsite soil treatment included biological treatment coupled with an aeration system.

Prepared conceptual design and development of a modular soil aeration system for the treatment of petroleum hydrocarbons in soil. The purpose of this design project was to develop a modular soil treatment system that was capable of reducing TPHC levels in contaminated soil below California State Action Levels. The project included conceptual design, and A&E submittals to regulatory agencies.

Conducted groundwater sampling coupled with a remedial investigation and feasibility study for groundwater cleanup at a municipal school district in the southern California Imperial Valley. Groundwater sampling was completed on a series of monitoring wells to define the aerial extent and level of a groundwater contamination plume. The groundwater sampling results were used to develop a list of efficient and cost effective groundwater remediation alternatives.

ENVIRONMENTAL AUDITS

Serves as Environmental Auditor for Union Pacific Realty Company. Currently conducting environmental audits of over 45 properties in southern California and Nevada. The properties include hotels, office buildings, warehouses, and industrial parks, which are being considered for sale or refinancing by the owner. Audits include inspection for asbestos-containing materials, bulk sampling, sample analysis, and assessment of response actions. To date, asbestos audits were conducted for over 1 million square feet of property.

Served as Proposal Manager for Property Transfer Audits for the City of San Diego, CA. Performed literature searches, historical aerial photo review, development and implementation of soil sampling program, and review of regulatory enforcement proceedings. Property audits included inspection for asbestos-containing materials and an investigation of health hazards presented by friable asbestos.

Evaluated environmental compliance requirements and development of cost estimates for achieving compliance at a chemical processing facility in Los Angeles. Hazardous materials present included asbestos, heavy metals, acids stored in underground storage tanks, PCBs, and wastewater treatment sludges.

Performed an environmental site assessment and audit for a lending institution to determine financial liability associated with the possible presence of hazardous materials

in the City of San Diego. Work included site visit, soil sampling, asbestos inspection, regulatory literature search, and historical aerial photograph review.

Performed an environmental audit of Normandy Lane Plaza, a 22-acre commercial property located in Jacksonville, FL. Conducted site inspections, including inspections for asbestos, visits to adjacent properties, reviewed public documents, and interviewed city and state officials in order to assess potential liability sources associated with contaminants found at the site. Contaminants found included chlorinated solvents, petroleum, hydrocarbons, and PCBs.

ASBESTOS SURVEYS

Serves as Program Manager for the identification and quantification of friable asbestos containing materials in selected buildings within the City of Long Beach, CA. Responsible for asbestos sampling, assisting the City in determining appropriate abatement actions, and providing consulting and management services during abatement activities.

Conducted an asbestos inspection for the Los Angeles (CA) office of the Southern California Parent Teachers Association. Collected bulk samples and performed analysis of materials for asbestos using polarized light microscopy.

MISCELLANEOUS

Served as Chief of Operations, responsible for a multi-national site staff of 45 individuals, including hydrographers, oceanographers, cartographers, biologists, technicians and support personnel. Directed and reviewed all technical work performed during a water resources program for the government of Kuwait. The program included oceanographic, meteorological, and hydrographic projects. Conducted research into oil spill dispersion rates, and sewer outfall plume migration along the Kuwait coastline. Responsibilities included daily interface with the Kuwait Institute of Scientific Research and their management consultants.

SPECIAL TRAINING

Completed the Petro-Tite Certification Course for underground storage tank precision tank testing, 1986

Completed post graduate seminar on Groundwater Treatment Technologies, UCLA, 1987

Completed OSHA Advanced Hazardous Waste Health and Safety Training, required for project managers on federal Superfund cleanup sites.

2. Summary of Method

a. This method involves the determination of volatile hydrocarbons (gasoline) by the headspace method (EPA 5020) or the purge and trap method (EPA 5030) (2) and the determination of semivolatile organics (diesel) by the extraction method. A sample, after headspace, purge and trap, or extraction treatment, is injected into a GC, and compounds in the GC effluent are detected by an FID. Blanks, duplicates and spikes must be analyzed at a minimum of once for every batch of samples (5) or each type of matrix or every 20 samples whichever is more frequent.

b. The sensitivity of this method usually depends on the level of interference rather than on instrument limitations. Table 3-6 below lists the limits of detection established by the Department of Health Services in the absence of interferences for water and soil samples.

TABLE 3-6

TPH METHOD DETECTION LIMITS

Parameter	Matrix	Extraction Method	Headspace Method
Gasoline	Aqueous	0.5 mg/l	5.0 mg/l
	Soil	10.0 mg/kg	5.0 mg/kg
Diesel	Aqueous	0.5 mg/l	
	Soil	10.0 mg/kg	

3. Interferences

a. Solvents, reagents, glassware, and other sample-processing hardware must be demonstrated to be free from interferences under the conditions of the analysis by running method blanks.

b. Before processing any samples, the analyst should demonstrate daily, through the analysis of a solvent blank, that the entire system is interference-free.

4. Apparatus and Materials

   a. Gas-tight syringe: One cubic centimeter (cc) with chromatographic needles.

   b. Vial with cap: 40 milliliter (ml) capacity screw cap (Pierce number 13075 or equivalent). Detergent wash, rinse with tap and distilled deionized water, and dry at 105°C before use.

   c. Septum: Teflon-faced silicone (Pierce number 12722 or equivalent). Detergent wash, rinse with tap and distilled deionized water, and dry at 105°C for 30 minutes before use.

   d. Separatory funnel: 2-liter with Teflon stopcock.

   e. Kuderna-Danish (K-D) apparatus.

   f. Boiling chips: Solvent extracted approximately 10/40 mesh.

   g. Water bath: Heated, with concentric ring cover, capable of temperature control. The bath should be used in a hood.

   h. GC: Analytical system complete with programmable GC suitable for on-column injection and all required accessories, including FID, column supplies, recorder, and gases. A data system for measuring peak area is recommended.

   i. GC column: 6 feet by 1/8 inch ID glass column packed with 5% SP-2100 on Supelcoport 60/80 mesh.

   j. Detector: FID.

   k. Microsyringes: 10 µl, 100 µl, 200 µl.

   l. Erlenmeyer flask: Pyrex, 250 ml capacity with a screw cap.

   m. Mechanical shaker.

5. Reagents

   a. Stock diesel standard solutions: Prepare a commercial diesel standard in carbon disulfide. Place 9 ml of CS_2 into a 10 ml glass-stoppered volumetric flask. Allow to stand for a few minutes. Weigh the flask to the nearest 0.1 mg. Using a 100 µl syringe, immediately add an amount of diesel to the flask, then reweigh. Be sure that the liquid falls directly into the CS_2 without contacting the neck of the flask. Dilute to volume, stopper, mix by inverting the flask several times. Calculate the concentration in µg/l

from the net gain in weight. Secondary working standards can be prepared from the stock standards.

b. Stock gasoline standard solutions: Gasoline stock standards can be prepared as above using commercial gasoline as standard in dodecane.

c. Sodium sulfate, anhydrous, ACS, granular.

d. Carbon disulfide, glass distilled, high purity. Another solvent such as ethyl acetate or methylene chloride may be used provided that the solvent can extract the petroleum hydrocarbons and does not interfere with the resulting gas chromatogram of the TPH. This must be demonstrated by spike and recovery prior to the analysis of samples.

e. Dodecane, purified.

6. Procedures

a. Organic Liquid

Organic liquid can be analyzed by dissolving a known amount of sample into a certain volume of carbon disulfide in a volumetric flask.

b. Water

(1) Transfer one liter of sample to the two liter separatory funnel.

(2) Add 60 ml of solvent to the separatory funnel.

(3) Seal and shake the funnel for 60 seconds with periodic venting to release vapor pressure.

(4) Allow the phases to separate for minimum of 10 minutes. If emulsion occurs, the analyst must employ mechanical techniques to complete the phase separation.

(5) Collect the extract and repeat the extraction two more times using fresh portions of solvent.

(6) Combine three extracts and dry by passing through a column of anhydrous sodium sulfate.

(7) Collect the dried extract in a K-D evaporative concentrator equipped with a 10 ml collection ampule.

(8) Add one or two clean boiling chips to the flask and attach a three-ball Snyder column. Prewet the Snyder

column by adding 1 ml of solvent to the top. Place the K-D apparatus on a steam or hot-water bath. Adjust the water temperature as required to complete the concentration in 15 to 20 minutes. When the volume of liquid reaches 1 ml, remove the K-D apparatus and allow it to drain for at least 10 minutes while cooling.

(9) Rinse the K-D apparatus with a small volume of solvent. Adjust the sample volume to 5 ml with the solvent to be used in instrument analyses.

c. Soil and Sludges

(1) Weigh 20.0 gram (g) sample into a 250 ml screw cap Erlenmeyer flask. Add 80 ml of solvent.

(2) Cap the flask and shake on a mechanical shaker for at least four hours.

(3) After the extraction is completed, filter the extract and dry it by passing through a column of anhydrous sodium sulfate.

(4) Collect the dried extract in K-D flask, fitted with a 10 ml concentrator tube and a three-ball Snyder column. Wash the extractor flask and the sodium sulfate with a portion of carbon disulfide and collect it into the K-D flask.

(5) Add one or two clean boiling chips and concentrate the extract to 5 ml as discussed in steps (8) and (9) above.

d. GC Conditions

The recommended GC column and operating conditions are:

Column: 6 feet by 1/8 inch ID glass column packed with 5% SP-2100 on Supelcoport, 60/80 mesh with nitrogen carrier gas at 20 ml/minute flow rate. Column temperature is set at 40°C at the time of injection, hold for 4 minutes, and programmed at 10°C/minute to a final temperature of 265°C for 10 minutes.

e. Calibration

(1) Establish GC operating parameters as specified in d. above. By injecting secondary standards, adjust the sensitivity of the analytical system for the analysis of gasoline and diesel in environmental samples. Detection limits for the extraction method and the

headspace method are listed in Table 3-6 (page 67). Calibrate the chromatographic system with the external standard technique. At least three concentration levels should be used for the preparation of the calibration curve. One of the external standards should be at a concentration near, but above, the method detection limit. The other standard should correspond to the expected range of concentrations found in real samples or should define the working range of the detector.

(2) Using injections of 2 to 5 µl of each calibration standard, tabulate total peak height or area responses against the mass injected. The results can be used to prepare a calibration curve for gasoline and diesel.

(3) The working calibration curve must be verified on each working day by the measurement of one or more calibration standards. If the response varies from the predicted response by more than ten percent, the test must be repeated using a fresh calibration standard. Alternatively, a new calibration curve must be prepared.

f. Analysis of Samples

(1) Extract

(a) Inject 2 to 5 µl of the sample extract using the solvent flush technique. Record the volume injected to the nearest 0.05 µl, and the resulting total peak areas.

(b) If the total peak areas exceed the linear range of the system, dilute the extract and reanalyze.

(2) Headspace Method [Note: Purge and trap (EPA 5030) may be used instead of headspace.]

(a) Place 20 g (ml) each of the waste sample into three separate 40 ml septum seal vials.

(b) Inject into one sample vial through the septum 200 µl of the gasoline standard in dodecane (concentration 7,500 µg/ml). Label this "spike".

(c) Inject into a separate (empty) 40 ml septum seal vial 200 µl of the same standard. Label this "standard".

(d) Place the sample, spike, and standard vials into a 90°C water bath for one hour. Store the remaining sample vial at 4°C for possible future analysis.

(e) While maintaining the vials at 90°C, withdraw 1 ml of the headspace gas with a gas-tight syringe and analyze by injecting into a GC.

(f) Analyze the standard and adjust instrument sensitivity to give minimum response of at least two times the background. Record and sum up all peak areas of the gasoline standard.

(g) Analyze the spike sample in the same manner. Record all peak areas.

(h) Analyze the undosed sample as in (g) above.

(i) Small sample size should be used if the concentration is found to be outside the concentration range of the instrument.

g. Standard laboratory quality control practices should be used with this method.

Determination of Organic Lead -- DHS Method

1. Discussion

Organic lead compounds constitute the largest single industrial application of organo-metallic chemistry. Estimates indicate that about 1,450 organic lead compounds were known in 1968, and the number has increased with synthesis of about 130 new compounds each year. The widespread presence of toxic, volatile, lipophilic organic lead compounds in the environment can lead to serious public health effects and damage to the aquatic biota. With the phasing out of leaded fuels, substantial amounts of lead compounds from petroleum sludges are being discharged into waste streams. There is also evidence to suggest that the more toxic organic leads such as tetramethyl-lead can be synthesized from lead salts and simple chemical reagents in aqueous solutions.

Caution: Some organic lead compounds are volatile and toxic. Process the samples in a well-ventilated hood.

2. Scope

The method describes the determination of organic lead compounds in various types of hazardous material samples. In this method, a rapid organic extraction technique is applied to separate the organic lead from a matrix with xylene, followed by reaction with