HYDRO VISIONS

GROUNDWATER RESOURCES ASSOCIATION OF CALIFORNIA

Volume 3, No. 1 January/February 1994

ANNUAL MEETING SUMMARY

The following abstracts are from some of the presentations made at the GRA Annual Meeting held in Sacramento:

Considerations in Ground-Water Remediation at Superfund Sites and RCRA Facilities — Update

–Provided by Matthew Hageman

Purpose

This updated Directive clarifies and expands OSWER's general policy concerning remediation of contaminated ground water, especially with regard to non aqueous phase liquid (NAPL) contaminants. This document promotes a consistent and sound approach to ground-water remediation at both Superfund sites and RCRA facilities and reinforces OSWER's commitment to cleanup ground-water contamination at these sites to the fullest extent possible.

Background

This Directive does not supersede or replace previous Superfund or RCRA Directives regarding ground-water remediation policy. The 1989 and 1990 Directives address Superfund sites only and should continue to be consulted with regard to Superfund policy and Record of Decision

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Legislative Day • World Water Day March 22, 1994

The Second Annual Legislative Day has been set for March 22, 1994, at the State Capitol. This years' event will feature a discussion of the GRA/ACWA sponsored legislation dealing with well log confidentiality, and a panel discussion on Hydrogeologist certification.

This year is the second half of the 1993-94 legislative session. We will be brought up to date on not only the new bills introduced this year, but also the carry-over legislation from last year. Because of the carry-over bills, this year will be a very hectic one with a tremendous amount of legislation to follow.

The Well Log Confidentiality Bill is GRA's first attempt at introducing legislation. It is very important to show a united front and strong support to assist in its passage.

The date for this years' event coincides with WORLD WATER DAY as declared by the United Nations. This day was set aside to devote to activities such as the promotion of public awareness of the conservation and development of water resources. The first World Water Day was celebrated last year during the UNESCO Hydrology conference in Paris.

Mark your calendars now for March 22, and look for the sign-up sheet that will be coming to you soon.

Well Log Confidentiality

The Groundwater Resources Association has joined with the Association of California Water Agencies (ACWA) to Co-sponsor legislation that will allow greater access to well logs filed by drillers with the Department of Water Resources. The proposed law will allow the kind of access necessary for the evaluation and protection of groundwater resources as well as the evaluation of seismic hazards throughout the state.

The measure, AB 2530, which was introduced by Assemblyman Bernie Richter, does not open the drillers' logs to public inspection. Access will be granted to public agencies, geologists, geophysicists and civil engineers, registered in the state of California. Current law limits this information to governmental agencies and the property owner. Over the past ten years, increasing environmental concerns, including both

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PRESIDENT'S MESSAGE

–by Vicki Kretsinger

By the time you receive this issue, my term as GRA's Charter President will have drawn to a close, and our first Director's meeting of 1994 will have been conducted under the capable direction of your new President, Anthony Saracino. It is with great satisfaction that I look back at what the Officers, Directors, committees, members, and others have accomplished in the last two years. We have achieved state and national recognition as a leader in the groundwater industry. We have had rapid growth (581 current members, 654 total members), including development of four of nine branch areas which have stable, active memberships and initial development of two other branches. We have strived for planned development, while always being sensitive to the quality of materials and services provided to our members.

One of the things that I have appreciated beyond words is the dedication, enthusiasm, and future vision of so many people who have been involved in making GRA what it is today. The time volunteered by these individuals has, I am sure judging by my own experience, undoubtedly exceeded their expectations. I hope in return they have achieved great personal satisfaction in knowing that they have been important in a team effort to promote an organization that has as its basic mission the management, development and protection of California's groundwater resources through development of educational programs; dissemination of scientific information; provision of technical assistance to legislators, regulators and others who influence policies and regulations concerning groundwater; and, professional development of its members. And, further that those members who have been involved since GRA's conception find personal accomplishment in creating a governing structure that allows for the fair and equal participation of all professionals in the groundwater industry.

Not to get too carried away with our success, the Directors especially recognize that we have accomplished many of our initial objectives, but not all. We have more to do to increase the functionality of committees, to increase communication from the Directors to the Branches and communication from the Branches and members back to the Directors. We have room to improve on our timeliness. We have been in the position of starting well in advance of planned events, but have provided notice of those events sometimes too close to the time of the function. Unlike other organizations that tend to provide numerous announcements of events long before their occurrence, we have been trying to economize by announcing events through the newsletter, one mailer, Branch meetings, and word of mouth.

Given that GRA is a non-profit grass-roots volunteer organization of our current magnitude, and without the assistance of paid staff, our accomplishments have been astounding. We are at a point in our development, however, that calls for more effort, not less, to provide strong future growth and continued development of GRA. GRA is somewhat akin to a small business expanding to moderate and even big business nearly overnight. As a result, we have been experiencing some growing pains, and GRA's structure and organization need to expand to accommodate its rapid growth. The new state and local officers of GRA have many challenges ahead that will call for a lot of hard work and commitment to the process and to the members.

I encourage the new state and local branch officers and committee members to work together to define goals that are ambitious but attainable, set schedules and try your best to keep them, implement mechanisms to disseminate information and improve communication, set high standards for yourself and GRA, and raise the vision, expectations and performance of those around you. Most of all, organize and build for GRA's future.

1993 Highlights

GRA had a very active year in 1993. Bimonthly branch meetings of the four active branches included the following speakers/ topics:

Mike Murray; Legislative Process and Highlights of Important 1992 Environmental Bills

Kevin Neese; Groundwater Adjudication Sources

Don Zuroski; Hydrogeologic setting of the Casmalia Resources Waste Disposal Site

Dr. Lorne Everett; Vadose Zone Characterization, Monitoring, and Remediation

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HYDROVISIONS is the official publication of the Groundwater Resources Association of California (GRA). GRA's mailing address is P.O. Box 355, Davis, California 95617-0355. Any questions or comments concerning the contents of this publication should be directed to the newsletter editor.

Walter Loo; Advanced Soil Vapor Extraction Techniques

Rod Farrell; Site Cleanup and Some Problems Encountered in Remedial Action Programs

Steve Ritchie; Future Directions for California Groundwater Cleanup Policy

Jane Faria; Interpretation of VOC Migration to Groundwater from Vertical Soil Gas Distribution

Panel Presentation; All You Ever Wanted to Know About Sacramento County's Well Grout Policies...

John Farr; A Better Approach to Soil Cleanup Level Determinations

Steve Reynolds; Forensic Modeling of One of the Nation's Largest Pump and Treat Systems

Dr. Winona Vickery, Matthew Small, and Joe Greenblot; Activities of USEPA

Region IX Office of Technology Transfer and Regulatory Support

James Yost; Groundwater Ramifications of California Water Bank Water Transfers

Clifton Davenport; Geologic Constraints on Groundwater Contaminant Plume Migration

Dr. Jacob Bear; The Role of Models in Making Environmental Decisions

Kevin Sullivan; Site Assessment and Remediation in Japan

Robert Stollar; Remedial Approach Used at a Superfund Site Contaminated with Dissolved TCE

Dr. C. Bruce Godfrey; Technically and Legally Defensible Data

Phil Hall; Technical and Regulatory Issues Surrounding Wellhead Protection

Open Forum Discussion; Groundwater and California's Economic Climate

Michael John Miguel; A Legal Perspective on Dating and Fingerprinting of Petroleum Hydrocarbons (Teleconference)

Seminar

Vadose Zone Monitoring and Remediation Techniques
June 28 and 30, 1993 in Los Angeles and San Francisco areas

Input to State and local agencies on regulatory and guidance documents

Education

Sponsor of the 1993/1994 Water Education Calendar published by the International Office for Water Education; this calendar is a resource and teaching guide about water and the environment for elementary schools.

Working in cooperation with the Water Education Foundation and the Department of Water Resources to develop a groundwater map of California; this project is being funded by the Kellogg Foundation.

Participated at a community meeting entitled "Foothill Groundwater: Is it a Reliable Source?" which was organized by the Water Education Foundation.

First Annual Legislative Day on April 27 at the Capitol.

Followed 38 bills introduced as legislation in 1993.

Directory

Published our first membership directory.

Liaison Activities

Co-sponsored Sacramento Branch meeting with the Sacramento County Environmental Management Department.

Co-sponsored meeting with the Association of Engineering Geologists. Planning future co-sponsored events with the American Institute of Hydrology.

Second Annual Meeting and Conference

Applied Hydrogeology: Innovative Techniques and Approaches, October 1993.

Co-sponsors included Department of Water Resources, Water Education Foundation, Cal EPA Department of Toxic Substances and State Water Resources Control Board, Association of California Water Agencies, University of California at Davis, Sacramento State University and the American Ground Water Trust.

Optional Field Trip to McClellan AFB included a lunch program with discussions on base environmental management and future cleanup and a tour of the groundwater treatment plant and soil vapor extraction facilities.

1994 Plans

GRA's Directors and several Branch officers have been working on activities for 1994. Some of the events to watch for include:

- Second Annual Legislative Day; March 22, 1994
- GRA is co-sponsoring bill AB2530 to change the confidentiality requirement for accessing drillers' reports
- Applied Environmental Statistics Seminar; May 1994
- Groundwater Data: Collection, Analysis and Presentation (a Practical Workshop); Fall 1994
- Bi-monthly publication of Hydrovisions Newsletter
- Third Annual Meeting and Conference; September 29 and 30, 1994

GRA is also participating in a California Ground Water Consortium which has as its objective the development of a groundwater education program to inform the citizens of California concerning their water resources, and in particular, the importance of ground water in contributing to and maintaining a desirable quality of life. The participants in the program include the Department of Water Resources, Cal EPA Department of Toxic Substances Control, Cal EPA State Water Resources Control Board; USGS; USEPA; Water Education Foundation; GRA; and the University of California Water Resources Center. More on this program in future newsletters.

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(ROD) language. This updated Directive reiterates and clarifies technical recommendations from prior Directives and expands upon them to address remediation problems associated with NAPLs. Also, this Directive is consistent with the principles of the 1991 EPA Ground-Water Protection Strategy, but does not specifically address how ground-water remedial activities are to be prioritized.

Ground-Water contamination is one of the most prevalent and challenging problems at hazardous waste sites in both the Superfund and RCRA Corrective Action programs. Ground-water contamination is present at more than 70% of the sites on the National Priorities List and almost 50% of the permitted RCRA land disposal facilities. The Office of Emergency and Remedial Response (OERR) completed a study in 1989 which evaluated the performance of ground-water extraction systems operating at 19 sites. Recently, an update and expansion of this study has been completed for 17 of the original and five additional sites. These evaluations identified hydrogeologic and contaminant characteristics as well as system design factors that may impede the ability of extraction systems to achieve appropriate cleanup levels over the entire area of contamination. These characteristics, listed below, are probably more common at hazardous waste sites than previously realized and should be considered during site characterization and conceptual model development.

1. Hydrogeologic factors: such as significant subsurface heterogeneity, numerous low permeability layers, fractured or karst aquifers, or other hydrogeologic complexities.
2. Contaminant factors: such as continued leaching of contaminants from source areas, partitioning of contaminants between ground water and aquifer solids, or presence of NAPL in the subsurface.
3. System design factors: such as poorly designed or improperly located extraction wells, or inefficient pumping schemes.

"NAPL usually enters the subsurface as a separate liquid phase, and may penetrate to significant depths."

In particular, this Directive addresses EPA's approach at sites involving non aqueous phase liquid (NAPL) contamination. Virtually all NAPLs are organic compounds (or mixtures of compounds) that are immiscible (resistant to mixing) with water. The distinct interface resulting from the water-NAPL contact does allow some NAPL to dissolve, with the degree of aqueous solubility varying dramatically among NAPL compounds. The term NAPL refers to the undissolved liquid phase of a compound, such as Trichlorethylene (TCE), and not to the aqueous phase dissolved in water. NAPL usually enters the subsurface as a separate liquid phase, and may penetrate to significant depths. As NAPL moves through the subsurface, a portion becomes trapped in soil pore spaces (or rock fractures) and a portion may continue to migrate. "Free-phase NAPL" is the migrating portion, which can flow into a well. "Residual NAPL" is that portion trapped in pore spaces by capillary forces, which can not generally flow into a well or migrate as a separate phase.

In the unsaturated zone (subsurface zone above the water table), NAPLs may release vapor phase organic contaminants to soil pore spaces and dissolved contaminants to infiltrating waters. In the saturated zone, NAPLs that are less dense than water (light NAPLs or LNAPLs) will tend to float on the water table while those more dense than water (DNAPLs) sink downward, through ground water. DNAPLs may exhibit varying behavior depending on local geologic conditions. For example, DNAPLs can move downslope along the upper surfaces of low permeability layers or along fractures, can form pools in stratigraphic or structural depressions, and can sometimes penetrate low permeability layers via fractures. Since DNAPLs are driven by gravity, they may move across or in the opposite direction from ground-water flow. LNAPLs tend to migrate along the water table surface. Both residual and free-phase NAPLs dissolve slowly, supplying potentially significant concentrations of contaminants to ground water over very long time periods. Therefore, the presence of NAPLs will have a significant influence on the time frame required or likelihood or achieving cleanup standards, and should be evaluated when selecting appropriate remedial actions.

"Cleanup standards for contaminated ground water are generally based on protection of human health and the environment.."

Cleanup standards for contaminated ground water are generally based on protection of human health and the environment. For Superfund sites, site-specific ground-water cleanup standards are established based on applicable or relevant and appropriate requirements (ARARs) for the use classification of the ground water and/or acceptable human health and environmental risk levels for current and future pathways of exposure. (ARARs include standards established under the Safe Drinking Water Act, Clean Water Act, or applicable State standards.) Under RCRA, facility-specific "media cleanup standards" for ground water are established for Corrective Action facilities using applicable human health and environmental standards and/or acceptable health/environmental risk levels. In this Directive the term "cleanup standards" will be used in reference to appropriate cleanup levels for both the Superfund and RCRA program.

Objective

Recommendations are provided for investigation and remediation of contaminated ground water for both Superfund sites and RCRA Corrective Action facilities. This recommended guidance is presented for each response stage, including investigation, early or interim action and remedy implementation. Actions at each site should be tailored to the specific conditions and applicable requirements at that site.

In addition to data collected during site investigation, data obtained during response actions (interim and final) should be considered for use in: 1) further characterizing the site and refining the conceptual model for site contamination; and 2) evaluating the design and operation of remedial actions for the site.

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Evaluation of Intrinsic Bioremediation at Field Sites

–by Timothy E. Buscheck, P.E., Kirk T. O'Reilly, Ph.D., and Sheldon N. Nelson, R.G.

Abstract

"Intrinsic bioremediation" has been defined as degradation of organic compounds by indigenous microbes without artificial enhancement. The terms "passive bioremediation" or "natural bioremediation" are also used to describe utilization of natural biodegradation as a remedial action.

Chevron Research and Technology Company reviewed groundwater analytical data from 11 sites. The analytical data was evaluated to quantify the change in contaminant attenuation. In order to distinguish the contribution of intrinsic bioremediation, it is necessary to quantify the role of dispersion and sorption as these mechanisms also contribute to overall contaminant attenuation. By measuring certain indicator parameters, such as dissolved oxygen, oxidation potential, and alternative electron acceptors, it is possible to estimate the contribution of intrinsic bioremediation to contaminant disappearance.

This paper describes the efforts to quantify intrinsic bioremediation of organic compounds at the sites of interest. Our evaluation, which includes plots for concentration versus time and concentration versus distance, demonstrates apparent first order decay rates at these sites. At three of these sites, measurements of dissolved oxygen, oxidation potential, and alternative electron acceptors suggest the role of intrinsic bioremediation in the disappearance of the contaminant.

Metropolitan Water District Groundwater Activities

–by Chuching Wang, Senior Engineer

Abstract

Urban Southern California was founded upon extensive development of local groundwater resources. Currently, about 2,800 square miles of groundwater basins provide over 1.3 million acre-feet per year, nearly one-third of the region's member agencies to improve regional water supply reliability by meeting four basic groundwater objectives:

- Expand conjunctive use;
- Reduce peak demands on Metropolitan;
- Recover contaminated groundwater; and
- Protect groundwater quality.

Metropolitan's long history of supporting conjunctive use of local groundwater basins for imported water storage began with discounted groundwater replenishment rates in the mid-1950's. Seasonal Storage Service (SSS) currently serves as Metropolitan's primary program for reservoir and groundwater conjunctive use with member agencies. Our new Cooperative Storage program will function to enhance SSS, allowing both Metropolitan and participating member agencies to share as partners in local storage arrangements.

Metropolitan has long sought to develop projects where it may pump stored imported water from local groundwater basins directly into its distribution system. Institutional and quality issues have made this goal difficult to accomplish. However, after having developed a consensus among numerous local agencies, Metropolitan recently entered into a Memorandum of understanding for conjunctive use in the Chino Basin. A demonstration test, pumping 4,800 acre-feet of imported water stored in the basin into Metropolitan's distribution system, should begin in October. A comparable conjunctive-use effort is under negotiation in the San Gabriel Basin.

Other programs have been tried with varying degrees of participation by member agencies. These include the 1993 Demonstration Local Storage program, one-time Drought Storage Agreements of 1991, and the Cyclic Storage Program of the 1970's which served as a model for the Cooperative Storage program.

In general, advances in groundwater development are not easily achieved because of contamination, cost, environmental, and institutional issues. Metropolitan is working with its member agencies to resolve these issues and to achieve the groundwater objectives mentioned earlier.

Identification of Recovered Petroleum Products

–by Larry W. Scott

Introduction

For a variety of reasons, it is frequently desirable to determine the identification and perhaps the source of hydrocarbons which have entered the environment. Information which may help accomplish this task can be derived from several sources in addition to the laboratory. This information should include a description of the hydrogeologic environment as well as any available history regarding the possible sources and products discharged into the area. The reason that this information is necessary is that identification schemes typically rely on the comparison of chemical data obtained from laboratory tests to those of suspected contaminants. For identification to be reasonably accurate, it is necessary to determine some characteristic of the sample which makes it unique within the suspected contaminants population.

Standardized Test Methods

A number of standardized test methods may provide sufficient information to allow discrimination between possible contaminants if there is sufficient difference in their physical or chemical properties. ASTM methods for distillation range, API gravity, metals content, UV absorption, sulfur content and oxygen content are only a few of the possibilities which may be examined for characterizing a hydrocarbon sample. ASTM D 3415 Practice for Identification of Waterborne Oils summarizes an approach to applying test methods for oil identification. EPA methods which are commonly employed which yield chemically specific information are for volatile organics (primarily BTEX) and polynuclear aromatics. Additional, information may be obtained from the analysis of total petroleum hydrocarbons by GC/FID if the analyst is sufficiently trained.

Specialized Fingerprinting Methods

A number of chromatographic fingerprinting techniques have been employed due to the chemical complexity of hydrocarbon,

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generally a function of the type of sample encountered. Knowledge of the distillation range of the hydrocarbons generally allows classification of the sample and may allow identification of the type of product. When limited amounts of material are obtained for analysis, this information can be obtained from a chromatographic "simulated distillation" (ASTM D 2887). For samples having boiling points within the naphtha or gasoline range (75 -400 Deg.F.) the maximum amount of component information can be obtained by chromatographing on a high resolution capillary system (50 - 100 meter) which can result in resolution and quantification of several hundred or nearly all of the components. For higher boiling samples, or full boiling range samples like crude oil, some component resolution is sacrificed in order to obtain selected component information throughout the boiling range. A example of this methodology is ASTM D-3328 for Comparison of Waterborne Oils by Gas Chromatography. In all of these cases the hydrocarbon distribution is recorded by the use of a flame ionization detector. Additional fingerprinting traces can be obtained by using alterant detectors specific for certain chemical compounds on properties. These detectors produce ECD, sulfur chemiluminescence FPD and PID chromatograms any of which may yield a distribution characteristic of a specific sample. The use of a mass spectrometer as a chromatographic detector may ultimately provide the most information and is commonly used in geochemical characterization, however, the data reduction and interpretation become significantly more complex.

"The use of a mass spectrometer as a chromatographic detector may ultimately provide the most information..."

In the event that the majority of the hydrocarbons are extremely high boiling compounds (B.P > 750 Deg. F.) other fingerprinting techniques are employed. These include HPLC with UV detection, ICP metal scans, infrared spectroscopy or fluorescence spectroscopy.

Sample Collection & Preparation

The fact that many samples are dispersed throughout the environment presents additional analytical challenges since the hydrocarbons need to be separated from soil or water before analysis. This step may involve simple cleaning up to remove the soil or aqueous phases or may necessitate concentration of the hydrocarbons. Several standard procedures are available for this purpose depending upon the condition of the sample and the future of the hydrocarbon contamination.

A simple solvent extraction may effect the desired separation if the hydrocarbon concentration is relatively high. If the concentrations are too low for a simple extraction then a soxlet or separator funnel extraction may be required with subsequent removal of the solvent by evaporation. This may result in the loss of lighter hydrocarbons if present and must be tolerated and recognized in the data interpretation.

Various thermal extraction procedures can be employed which avoid the loss of light hydrocarbons but have limitations on the recoveries of the less volatile components (B.P > 750 Deg. F.). These techniques may be typified by the extraction of diesel from drilling mud using a retort or by the purging of volatile compounds from an aqueous phase and trapping them on a tenax tube. Since many of these preparatory procedures affect the sample results the ideal situation is to recover free hydrocarbons in the field if possible.

Effect of the Environment

After obtaining the desired laboratory analyses, the results should be examined for environmental effects due to physical chemical and biological phenomena. The most obvious of these effects is sample loss due to vaporization of the more volatile components. Another effect is due to the different solubilities of various hydrocarbons in water. In general the aromatic compounds are more soluble than the saturated components and would be concentrated in an aqueous phase in contact with the product.

A sample may have been exposed to the environment for a sufficient length of time to allow for biological or chemical oxidation.

In the event of biological degradation, the relative abundance of the normal paraffins will decrease.

Data Reduction & Evaluation

Some compensation for the environmental changes can be performed prior to comparison of data. For example, component concentrations can be corrected for vapor losses or ratios so components of similar volatility can be compared in stead of their actual concentrations. Similar mathematical manipulation can be performed with solubility or chemical reactivity.

Assuming all steps in the analysis have been carefully performed and evaluated, a decision must now be made regarding the comparison of the data. The first question to be answered is "Have sufficient parameters been identified to uniquely characterize or identify the sample?" The second question is "How well do the data need to agree to define a match?" The answer to both of these questions generally relies on the ability and experience of the analyst.

Significant advances have been made which can assist the analyst in answering these questions. Some of these advances have been in the analysis and cataloguing of numerous hydrocarbon products and crude oils for comparison. Additional improvements have been made with the use of principal component and factor analysis along with clustering techniques to statistically evaluate the data. These developments have the potential to define an "expert system" to assist the analyst in providing meaningful results.

Dry Cleaners–A Major Source of PCE in Groundwater

–Presented by Victor Izzo

Abstract

Tetrachlorethylene (PCE), a known carcinogen, has degraded at least 215 wells in the Central Valley of California. The majority of these wells are large system municipal wells of 200 connections or more. The Chico, Sacramento, Modesto, Fresno, Turlock, Lodi and Merced areas all have wells with levels of PCE above 0.8 ppb which is the estimated one in a million incremental cancer risk. The Maximum Contaminant level (MCL) set by the Department of Health Services for drinking water is five ppb. Forty-seven of the 215 wells have PCE levels above the MCL.

The Well Investigation Program of the Central Valley Regional Water Quality Control Board so far has identified the likely PCE sources in 21 of the wells; in 20 of those wells, dry cleaners are the likely source. In areas where PCE well investigations were done, dry cleaners are the only present large quantity

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users of this volatile organic chemical (VOC). The Halogenated Solvent Industry Alliance 1987 white paper on PCE states that dry cleaners use 56% of the PCE used in United States (5). All dry cleaners in the vicinity of degraded supply wells show evidence of major ground water degradation. Monitoring wells drilled adjacent to dry cleaners had concentrations from 120 ppb to 32,000 ppb, well above the MCL.

The main discharge point for dry cleaners is the sewer line. The discharge from most dry cleaning units contains primarily water with dissolved PCE, but also contains some pure cleaning solvent and solids containing PCE. Being heavier than water, PCE settles to the bottom of the sewer line and exfiltrates through it. This liquid can leak through joints and cracks in the line. PCE, being volatile, also turns into gas and penetrates the sewer wall. Sewer lines are not designed to contain gas. The PCE then travels through the vadose zone to the ground water.

Where a source investigation has been done in connection with PCE contamination, the evidence has shown that dry cleaners have degraded the ground water. The data strongly indicate that leakage through the sewer lines is the major avenue through which PCE is introduced to the subsurface. With approximately 285 dry cleaners in just the metropolitan areas of Sacramento, Chico, Lodi, Modesto, Turlock, Stockton and Merced, one would expect that many more wells will be degraded by PCE in the future. Most of the wells degraded by PCE and most of the dry cleaners are in residential and retail areas. Based on the data collected to date and the location of most of the degraded wells with confirmed PCE, a great majority of these wells will have dry cleaners as the source.

The solution to part of the problem is to halt the disposal of waste from dry cleaning units to the sewer line. Regulation of this discharge to the sewer could be achieved through new legislation and city ordinance. Since this problem exists throughout the state, a statewide policy seems appropriate.

The other part of the problem is ground water cleanup which is required so that cities can continue to provide safe water. A state wide fund may be needed to help pay for cleanup.

Isotope Imaging in the Sacramento Valley

–by M.L. Davisson and R.E. Criss

Abstract

A dynamic image of a shallow (45-160 m below the surface) aquifer in a 25km^2 area in the southwestern Sacramento Valley, California has been obtained by $^{18}O/^{16}O$ and D/H determinations of groundwater from municipal wells. The regular summertime drawdown of the water table is strongly correlated with municipal-wide increases in the $\_^{18}O$ values, particularly in wells with shallow perforation levels, thus demonstrating that the high ^{18}O water resides in the upper reaches of the aquifer and penetrates more deeply with increased discharge rates. These 1.5% enrichments in the $\_^{18}O$ values are primarily attributed to infiltration of irrigation water that has penetrated to depths of at least 80 m. The increased $\_^{18}O$ values correlate with increased deviation from the meteoric water line and with increased nitrate levels, indicating that the high ^{18}O groundwater component represents local meteoric water that has been enriched by soil evaporation processes in nitrogen-fertilized, flood-irrigated cropland.

Isotopic gradients provide a new method for qualitatively determining subsurface permeability. Zones of low isotopic gradients, interpreted as high ^{18}O plumes, probably follow coarse-textured deposits of ancient stream channels. The ^{18}O gradients are primarily controlled by subsurface permeability, although additional influences may include: (1) the heterogeneous distribution of the high ^{18}O groundwater; (2) isotopic contributions from deeper groundwater; (3) variable perforation depths of the wells; (4) local differences in the water table level.

Deeper, sodium bicarbonate groundwaters (300-650 m below the surface) have lower $\_^{18}O$ values (to -9.4) than the more shallow magnesium bicarbonate groundwaters, suggesting derivation from ^{18}O depleted meteoric groundwaters of the Sierra Nevada. Minor mixing of the deeper groundwater into the municipal discharge occurs, even though previous workers considered the deeper groundwater to be confined.

Environmental Forensic Geochemistry: Identifying Sources of Escaped Petroleum Products

–by Issac Kaplan and Hossein Alimi

Abstract

Of greatest concern to litigators and legal negotiators is the identification of the various chemical pollutants in an environment and discovery of the parties responsible for releasing the chemicals. This report discusses how the various properties of refined petroleum and crude oil can be used to (1) identify the type of product which has been released, (2) establish mixing ratios of different products, (3) determine elapsed time for release occurrence, (4) assign probable responsibility for the source(s) of the pollutants and (5) compute relative responsibility among different PRP's.

To satisfy the requirements of the legal profession and especially trial lawyers who need to arm themselves with convincing evidence, Global Geochemistry Corporation has developed a series of analytical procedures, not for the laboratory identification and quantification of complex mixtures of hydrocarbons. These methods depend on a relatively large array of analytical procedures not generally practiced in environmental analytical laboratories, coupled with experience and a large data base for interpretation of the analytical results.

"Of greatest concern to litigators and legal negotiators is the identification of the various chemical pollutants..."

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Possible Bias for Contaminated Groundwater Investigation Studies

–by Christopher Palmer, CEG

Abstract

Site geology provides the fundamental basis to understand site hydrogeology. It is essential to know how to properly collect data, and review previous work on site geology to address regulatory questions and design proper remediation systems. The extent of contamination must be determined to satisfy any regulating agency; the vertical and horizontal extent in the unsaturated (vadose) zone and aquifer strata. Site geology must be physically determined by direct observation and sampling primarily in borehole logs. The data collected in the site investigation supplies the basic parameters for the remediation; contaminated soil and groundwater columns, groundwater capture, contaminant extent and site monitoring well design. Unless this information is carefully collected using a well thought out work plan, the site conditions could be biased; not adequately defining the problem, over or underestimating water volumes, etc.

"Site geology provides the fundamental basis to understand site hydrogeology. It is essential to know how to properly collect data, and review previous work on site geology..."

Oftentimes, one also must refer to field observations and/or reports done by others and must evaluate the accuracy and validity of that work, especially as it relates to your site. If inferior or inaccurate work is accepted, it may compromise the accuracy of your work and bias or add to previous bias. The site study should have sampling points covering the entire site, not based only on one area or to show favorable subsurface conditions. Typical causes of problems resulting from poor field data collection or previous study are: 1) Incompletely defined vadose zone contamination; 2) Cross contaminated aquifers; 3) Incompletely defining the "Zero" or None Detected line of dissolved constituents; 4) Quality of chemical data, both sampling procedures and chemical analysis; 5) Investigation work alleged to have been done (were investigation tasks actually carried out as planned by the previous consultant).

Aquifer analysis and computer modeling can be useful in the analysis of groundwater flow in that long term simulations of different pumping scenarios can be tried, and the effect on the capture cone estimated. However, if not used properly, models may radically bias the investigation approach and proposed remediation effectiveness. Freeze and Cherry (1979, pg. 349) state "Unless there is very clear geologic evidence to direct groundwater hydrologists in their interpretation, there will be difficulties in providing a unique prediction of the effects of any proposed pumping scheme." Any model, whether hydrogeological, aquifer or computer, is *only* as good as the data into it.

New and Emerging Technologies For Subsurface Characterization in Hydrogeology, with some Observations of the Petroleum Industry

–by Graham E. Fogg

Abstract

Our ability to determine the fate of subsurface contaminants hinges mainly on our ability to characterize the unknown spatial pattern of transport properties such as hydraulic conductivity and sorptive constants. In the recent past little research was devoted to the problem of characterizing heterogeneous subsurface materials. Now, however, interest in this topic among researchers is booming and is leading to new and emerging methodologies that unify geology, geophysics, geostatistics, modeling, chemistry, and biology. While much of this research is still in developmental stages, much of it is immediately transferable to real-world problems currently faced by the environmental consulting industry. In fact, the petroleum industry has been most successful in applying many of the techniques to characterization of reservoir heterogeneity on scales ranging from meters to kilometers. In terms of subsurface fluid transport, the petroleum industry faces virtually the same problems that environmental consultants face in groundwater contamination.

I will discuss new techniques for subsurface characterization that emphasize combined use of "hard data", such as direct measurements of a transport property, and "soft (semiquantitative) data", such as geology and geophysics. The soft data do not represent direct measurements of the target property that must be inserted into models, hence the adjective "soft". Importantly though, soft data provide crucial information on the spatial pattern of transport properties. In the past, modelers have been reluctant to incorporate much soft data into their models because of difficulty in quantifying this information and because of uncertainty over its reliability. Consequently, many a model has proven to be unreliable and has failed to provide an adequate predictive tool for design of the remediation program. New techniques in geostatistics allow one to combine both hard and soft data along with uncertainty to produce a more reliable, realistic characterization of the subsurface.

Find New Employees

Your search for new employees will be more effective if it is directed at the right audience. At the last Board of Directors Meeting, the board voted to allow members to advertise job openings in their operation. These adds will be business card size adds and will cost $100 per issue.

Because of space limitations, the board decided not to accept adds from those looking for work.

Contact the GRA to fill your next job vacancy.

Synopsis of California Ground Water

–by Carl Hauge

- Ground water reservoirs in Southern California were either partially full or near 'the top of their storage capacity' at the end of the 1987-1992 drought.
- Through spring 1993, we estimate that almost 15 million acre feet of ground water were removed from storage in San Joaquin Valley.
- Although many people call such extraction "overdraft," it is more accurately called a change in storage similar to a change in storage that takes place in a surface water reservoir.
- Overdraft is a negative change in ground water in storage over a long period of time as a result of existing surface water and ground water management.
- Ground water recharge will take place this year from 2 sources:
  deep percolation of applied irrigation water; and,
  irrigation with surface water rather than extracting ground water (in lieu recharge).
- Based on records showing recovery in ground water levels after the 1976-1977 drought, it will take several years for ground water levels in San Joaquin Valley ground water basins to recover to 1987 levels.
- Subsidence during the 1987-1992 drought has amounted to at least 2 feet in Tulare Lake and more than 2 and a half feet in western Fresno County.
- Ground water levels in most of Sacramento Valley had begun to decline only slightly at the end of the 1987-1992 drought.
- Ground water levels in San Diego are essentially at normal levels because they have had normal precipitation all through the 1987-1992 drought.
- About 37 agencies in the state are considering formation of a ground water management plan in accordance with AB 255, AB 3030, or some other section of the water Code. We expect this number to increase.
- Several resolutions of intention have been passed, as required by AB 3030, allowing the agencies 2 years to form a ground water management plan.
- AB 3030 (Section 10750 of the Water Code) can be applied only in ground water basins that are identified in Department of Water Resources' Bulletin 118, California's Ground Water, and its supplements.
- Salt water intrusion has reached almost 5 miles inland near Salinas as a result of ground water extraction. The salt water is now a threat to the municipal water supply of Salinas. The State Water Resources Control Board has notified Monterey County Water Resources Agency that the Board is considering initiating action under Section 2100 of the Water Code. Such action would require adjudication of the basin.
- The court has almost reached a decision on the adjudication of the ground water basin within the boundaries of Mojave Water Agency. Once the decision is approved by the court, the Mojave basin will be the 13th ground water basin in which extraction is restricted and is regulated by a watermaster.
- In a 14th basin, Santa Margarita River watershed, a federal court requires each water user to report the amount of surface water and ground water they use, but extraction of ground water is not restricted.

CSU Sacramento Hydrogeology Course

CSU Sacramento, Regional and Continuing Education, is offering an introductory hydrogeology course in the spring semester, February 2nd through May 25th. Class meetings will be from 6:00 to 8:45 p.m. each Wednesday. The course will provide the equivalent of an undergraduate class in hydrogeology or ground water hydrology, combining the theoretical foundations of the study of ground water with practical techniques of value to practicing professionals. The semester format provides a broad educational experience that can't be gained from short courses.

Participants will gain an understanding of the conceptual and mathematical foundations of ground water flow, the occurrence of ground water in various geologic settings in California, methods for conducting hydrogeologic investigations, well hydraulics and aquifer testing, contaminant transport and ground water remediation, problem solving with ground water models, and the regulations governing ground water quality and supply.

John Woodling, hydrogeologist with the California Department of Toxic Substances Control, is the instructor. He may be reached at (916) 255-2100, for more information. Participants will receive three academic credits from CSUS. Cost of the course is $375. To register, contact CSUS at 278-6984.

REMINDER

Have You Renewed Your GRA Membership for 1994?

ENACTED LAWS

STATUTES OF 1993

The first half of the 1993-94 Legislative Session has come to a close. The following is a listing of those measures that we followed that were passed, and signed into law. These measures went into effect on January 1, 1994.

SB 148 Boatwright: This measure increases specified application and renewal fees for a state contractors' license.
Status: Chapter 1188, Statutes of 1993.

SB 419 Wright: This measure provides that "reusable textile materials", such as shop rags, uniforms and towels, that become soiled with hazardous waste, are exempt from classification as hazardous materials.
Status: Chapter 912, Statutes of 1993.

SB 650 Kelly: Provides incentives, in the Coachella Valley Water District, to use reclaimed water or water from the Colorado River in place of groundwater.
Status: Chapter 1024, Statutes of 1993

SB 796 Wright: Exempts from the hazardous waste facilities permit requirement, a groundwater treatment facility, under certain conditions.
Status: Chapter 1203, Statutes of 1993

SB 990 Kelley: Directs the Water Resources Control Board to redefine the term "designated waste", and to evaluate the effects of a nonhazardous waste to determine whether the waste should be "designated".
Status: Chapter 705, Statutes of 1993

SB 1020 Mello: Authorizes the Monterey County Water Resources Agency to require the installation of flowmeters on groundwater extraction facilities and water distribution systems.
Status: Chapter 234, Statutes of 1993

SB 1033 Thompson: Enacts the Glenn County Groundwater Management District and authorizes the District to manage the groundwater within its jurisdiction.
Status: Chapter 72, Statutes of 1993

AB 340 Katz: Requires contractors to provide information in his or her bid package relating to the use of minority, women or disabled veteran business enterprises as subcontractors for any public contract.
Status: Chapter 1032, Statutes of 1993

AB 628 Frazee: This measure provides that when licensure is an issue in a court case, the burden of proving the existence of a proper license is on the licensee.
Status: Chapter 797, Statutes of 1993

AB 892 Frazee: Requires urban water suppliers to report on incentives to encourage water conservation and the implementation and use of water efficient irrigation and other devices.
Status: Chapter 720, Statutes of 1993

AB 1152 Costa: Authorizes a local public agency that provides flood control, groundwater management, or groundwater replenishment, to adopt and implement a groundwater management plan. Also prohibits imposing fees or assessments on the extraction and replacement of groundwater pursuant to a groundwater storage contract with the local agency.
Status: Chapter 320, Statutes of 1993

AB 1593 Cortese: This measure would authorize a water supplier to contract with other state or local water suppliers to transfer or store as part of a water transfer.
Status: Chapter 184, Statutes of 1993

AB 1935 Richter: Adds to the list of environmental laboratories that need to pay an annual certification fee, those that test pursuant to the National Primary Drinking Water Regulations.
Status: Chapter 1017, Statutes of 1993

AB 2235 McDonald: Requires the Water Replenishment District of Southern California to file monthly groundwater production statements.
Status: Chapter 52, Statutes of 1993.

To obtain a copy of any of the above, contact Jim Graham at 916 979-1330.

President's Message

Continued from page 3

Thank You

I would like to take the opportunity to thank all those who assisted me during the last two years and contributed to GRA's growth and development. Thanks are also due to the numerous individuals who have made voluntary monetary contributions to GRA.

I especially want to thank Gene Luhdorff who provided wisdom and guidance as the Charter Board of Directors set about the task of starting GRA. I also want to thank Wendy Ernst of Gordian Business Solutions for her contribution to GRA's membership administration.

I am looking forward to my future involvement as a Director and Past President. I'll continue to work with the Branch officers, committees, and members of GRA to support the new President in achieving the short and long term goals established to further recognition of GRA as an active leader in groundwater protection, development, and management.

BRANCH ACTIVITIES

San Francisco Bay Branch

"Site Assessment and Remediation in Japan"

–by Adarsh Kulshrestha

The fifth dinner meeting of the San Francisco Bay Branch was held on September 15 at the Old Spaghetti Factory in Jack London Square, Oakland, and was attended by approximately 55 people. Kevin Sullivan of Groundwater Technology, Inc. (GTI, Concord, CA) gave an excellent presentation on the regulations and social issues affecting "Site Assessment and Remediation in Japan." Mr. Sullivan works as GTI's Country Manager for Japan. GTI collaborates with Kurita Water Industries of Japan to implement remediation of groundwater and soil.

"In most cases, Japanese corporations would rather be up front and invest in cleaning up environmental problems associated with the operations, than publicize their problem and face public disgrace"

The hydrogeology of Japan is very similar to that of California. Japan has shallow low-permeability alluvial units frequently overlying larger regional aquifers, and a depositional environment with stratified lithology of sand lenses.

Japan is in the early stages of developing environmental regulations. Existing regulations are not as litigation intensive, as in the U.S. Individual regulators have considerable freedom in interpreting regulations. Regulators often appear to base cleanup goals on a corporation's ability to pay remediation costs, making them more stringent for large corporations. The focus is on getting the job done, without being mired in excessive paperwork. Environmental cleanup often proceeds without the knowledge of local residents. In most cases, Japanese corporations would rather be up front and invest in cleaning up environmental problems associated with the operations, than publicize their problem and face public disgrace; for the same reason, potentially responsible parties may tend to insist on adherence to good house-keeping practices and deny any association with the spill or the cleanup.

Mr. Sullivan presented a case study of soil and shallow groundwater contamination at a dry-cleaning shop in a densely populated town on the Southern island of Kyushu. The spill was due to a leaking tank in a sandy soil with clay lenses. Free product was observed at a depth of 1 meter. The spill had very significant impact on the immediate vicinity. Most houses surrounding the site had groundwater supply wells installed in their backyards. These wells were screened in the contaminated zone; extracted groundwater was used for household consumption. Local residents appear to be unaware of the spill and its impact on their health. The buffer space surrounding the location of the spill was extremely small. All sampling and remediation activities were limited to within the site boundary. Local residents could not be contacted for groundwater samples. The town did not have an organized database of wells and soil types. Therefore, information on offsite geology was largely unavailable. Thus, the offsite extent of contamination could not be accurately predicted. Contaminant mass was removed using soil vapor extraction.

"In Japan, analytical methods differ from those used in the U.S. Degradation products, such as DCE of DCA from TCE, are often not reported."

In Japan, analytical methods differ from those used in the U.S. Degradation products, such as DCE of DCA from TCE, are often not reported. Projects typically have small budgets. Electricity, labor and equipment are very expensive. Budgets are often not enough to adequately assess the nature and extent of the spill and to conduct remediation. One of the Cases involved extremely high vinyl chloride concentrations, but because vinyl chloride was not regulated, the site was not considered for remediation.

In shaping its environmental regulations, Japan is drawing on the initial lessons learned in the U.S. In Japan, the focus is more on source control, than on aquifer restoration. Gasoline-station type spills will probably not be remediated, which suggests that benzene will not be a contaminant of major concern.

Continued on page 13

The American Institute of Hydrology

Individuals from a wide diversity of backgrounds, and sometimes minimal hydrologic experience, are now performing hydrologic investigations because of the increased need for personnel to work on contamination, water supply, and flood control problems. This has led to work that has questionable quality because of lack of training and experience. Thus, the need is growing for professional registration to help ensure the quality of hydrologic work.

The American Institute of Hydrology (AIH) was founded in 1981 to promote hydrology as a profession. The purpose of AIH is to:

- Establish standards and procedures to qualify individuals in hydrology and hydrogeology.
- Establish and maintain ethical standards to protect the public from irresponsible work.
- Provide education and training in hydrology.

If you would like to join us or receive more information please contact the:

American Institute of Hydrology
3416 University Ave. S.E., Minneapolis
Minnesota 55414-3328
Tel. (612) 379-1030
Fax (612) 379- 0169

ACWA Sponsors Ground Water Mini-Conference

A Ground Water Mini-Conference titled "Ground Water Management in California" will be sponsored by the Association of California Water Agencies (ACWA) on March 17-18, 1994, at the Beverly Garland Hotel, Sacramento. ACWA is a statewide organization whose members are responsible for about 90% of the water delivered in California.

ACWA's Ground Water Mini-Conference will feature numerous speakers, including federal and state officials, lawyers, engineers and agency general managers, who will provide two days of challenging, intense discussions.

The focus on Thursday, March 17, will be "Ground Water Management Options: Adjudication, Legislation and Technical Reality." A glimpse at the agenda includes the following topics: "Federal and State Roles in Ground Water Management"; "Local Ground Water Management"; a luncheon address titled "The Importance of Ground Water to California's Water Management"; "Conjunctive Use"; and "Ground Water Quality Management."

"AB 3030 As a Management Tool" will be the theme for Friday, March 18. The day's agenda offers an overview of AB 3030, case studies of how AB 3030 has been implemented, a luncheon address on AB 3030, and a look toward the future with the session, "AB 3030: What Next?"

For more information and/or a copy of the brochure, please call ACWA's Meetings and Membership Department at (916) 441-4545.

Mark Your Calendars for GRA's Annual Meeting!

Applied Environmental Statistics

Registration Forms Coming Soon!

COMMITTEE REPORTS

–by Anthony Saracino

1994 Education Program

The state officers recently met with the Water Education Foundation, the Department of Water Resources, and the State Water Resources Control Board to discuss the development of a wellhead protection education program. The purpose of the program will be to educate the general public and persons working in the groundwater industry on the importance of groundwater protection. We are in the process if identifying specific topics, such as well destruction, that will be addressed in the program. Once a specific program had been identified, the Water Education Foundation will help us write a grant proposal to fund the program. Our goal is to develop the program and have a commitment for funding by mid 1994.

California Groundwater Map

The Water Education Foundation is still on track to have the map publicized in 1994. We have helped to edit some text and provide some graphics for the map. At our next scheduled meeting we hope to develop a rough cut of the general map layout.

California Groundwater Day

Groundwater Day continues to evolve. Secretary Wheeler, our keynote speaker at this year's conference, has expressed his support for the concept of a groundwater day. Our current thought is to coordinate Groundwater Day with the unveiling of the groundwater map; our dilemma is finding the time to organize and put on the event. While we have received encouragement and offers of support from both the Water Education Foundation and the Resources Agency, we desperately need someone with the time and ambition to make Groundwater Day happen. If you are that person, or if you know who is, please call me.

Well Log Confidentiality

Continued from page 1

supply and quality, are requiring greater and more expedient access to the well log reports. This legislation will widen access to those registered professionals responsible for evaluating the state's groundwater resources and for investigating and mitigating subsurface contamination.

Additionally, the legislation increases from 30 days to 90 days, the time in which a well log has to be filed with the DWR. This provision will bring the law into compliance with the Mechanics Lien Law. Also, it eliminates the requirement of filing an "Intent to Drill" notice with the Department.

The proposed new law was introduced on January 19 and is now in print. It may cannot be heard in committee before February 18, 1994. Further information concerning this measure can be obtained from the Legislative Committee. Contact Jim Graham at 916-979-1330.

BRANCH ACTIVITIES

Branch Activities

Continued from page 11

Central Coast Branch

-by Linda Jason

GRA's Central Coast Branch meets every other month at various locations in the Santa Barbara and Buellton areas. Meetings generally consist of a social hour, dinner, a brief business meeting, and a keynote speaker presentation. Meetings have been well-attended by 25 to 35 groundwater and related professionals from San Luis Obispo, Santa Barbara and Ventura Counties.

The branch met on September 22, 1993, at Jasper's Saloon in Goleta. The guest speaker was Dr. Lorne Everett, Chief Research Hydrogeologist for Geraghty & Miller, as well as director of the Vadose Zone Research Laboratory at UC-Santa Barbara. Dr. Everett's topic was vadose zone characterization, monitoring, and remediation. Issues related to VOCs and Soil pore liquid sampling techniques were evaluated. The presentation also included a discussion of regulatory changes to RCRA involving the vadose zone characterization and monitoring requirement, which will appear as interim guidance this year and as a final EPA rule within 12 month.

The Central Coast branch held its next meeting on November 17, 1993, at Zaca Creek Restaurant in Buellton. Mr. Rod Farrell was the guest speaker. Mr. Farrell is a Senior Environmental Chemist with Fugro-McClelland, Inc., and teaches the site remediation course for the UC-Santa Barbara Hazardous Materials Management Certificate Program. Mr. Farrell discussed site cleanup and some of the problems encountered in remedial action programs. These problems include the flooding of soil vapor extraction systems from the 1992/1993 rainy season, noise abatement, electricity and natural gas availability. Mr. Farrell presented a general discussion of site remediation technologies followed by case studies of some problem sites.

> *"Mr. Farrell discussed site cleanup and some of the problems encountered in remedial action programs. These problems include the flooding of soil vapor extraction systems..."*

Appreciation is extended to Rick Hoffman & Associates of Santa Barbara for sponsoring the September branch meeting, and to Barbour Well Surveying Corporation of Camarillo for sponsoring the November meeting. We also wish to thank Fugro-McClelland (West), Inc. of Ventura, for providing the branch with much needed administrative support.

Upcoming Central Coast Branch meetings are scheduled for Wednesday, January 12, 1994, in Santa Barbara, and Wednesday, March 16, 1994 in Buellton. Members interested in participating in the management of the branch during 1994 are encouraged to contact Linda Jason of Fugro-McClelland at (805) 650-7000 for more details.

New GRA Central Coast Branch Contacts:

President/Secretary:
Linda M. Jason
Fugro-McClelland (West), Inc.
(805) 650-7000

Treasurer:
Coleen Rowe
Hoover & Associates
(805) 965-3045

Southern California Branch

-by Pete Jalajas

The Southern California Branch is excited to announce that the September 15, 1993 Conference Call meeting went GREAT! Michael John Miguel, attorney with the law firm of Pircher, Nichols & Meek in Los Angeles spoke on "A Legal Perspective on Dating and Fingerprinting of Petroleum Hydrocarbons." His very timely and informative talk was heard across the country (not county!). Mr. Miguel discussed the different fingerprinting techniques including product typing, product constituent investigation, proprietary additives searches, and isotopic tracing. Dating can be performed by inventory record statistical evaluation, BTEX degradation, additives dating, and graphical techniques. Weaknesses in these techniques include common carrier cross-contamination issues, weathering, quality assurance shortcomings, and expert arrogance. Mr. Miguel emphasized that the technical people must be very forthcoming with the legal professionals. He recounted a situation in which the technical professional apparently allowed the attorney to get blind-sided in court by failing to warn the attorney of the weakness in the source-identification case—they lost millions! Mr. Miguel listed four questions that need to be answered up-front in these cases: 1) What are the assumptions? 2) How well recognized is the method in the scientific community? 3) How will the technique be attacked in court? and 4) Is the effort and expense going to be worth the result? In spite of these difficulties, Mr. Miguel emphasized the need, especially by his oil-company clients, for further development of these cutting-edge techniques. Feel free to write Mr. Miguel at 1999 Avenue of the Stars, Los Angeles, CA 90067. We look forward to having two more conference calls in '94! (Perhaps a follow-up, Michael?) High-quality audio tapes of Mr. Miguel's hour-long talk are available by sending a check for $15 payable to GRA to Pete Jalajas at Geraghty & Miller, Inc., 100 North Barranca Street, Suite 500, West Covina, CA 91791-1600.

> *"the technical professional apparently allowed the attorney to get blind-sided in court by failing to warn the attorney of the weakness in the source-identification case—they lost millions!"*

We did not hold our regularly scheduled meeting in November due to HazMat West and the branch officers hectic schedules. But, have no fear, we'll be back stronger than ever in 1994. We're starting off on Wednesday January 19 (remember, we meet the third Wednesday of odd-numbered months) with Joel S. Moskowitz, of the law firm of Gibson, Dunn & Crutcher, who will be discussing the

Continued on page 14

Branch Activities

Continued from page 13

"Liabilities and Opportunities in the Environmental Business" (location to be announced). We are currently seeking meeting/mailing sponsors; if you firm is interested in this vehicle, please contact Susan or Pete for details.

The long-awaited GRA Chromatogram Book will be going to press in the first quarter 1994. While we have received many packages of chromatograms, we are still seeking more—the more the better. Please send packages of chromatograms also to Pete Jalajas at G&M in West Covina (see Hydrovisions Summer, 1993 for details).

As a direct result of our July '93 dinner meeting (see Hydrovisions Summer, 1993, 2(2):11), Southern California Edison's Business Retention Program invited Pete Jalajas, the Branch Vice President, to the Program's Business Retention/Environmental Seminar on November 15, 1993, to discuss the results of the July meeting and to provide other tools to the business community. Besides offering our services as listed in the Summer Hydrovisions (involving permitting simplification, legislative lobbying to reduce regulation, reassessment of MCLs, public comparative risk education, and litigation reduction), Pete informed the 100-member audience of the creation in Washington, D.C. of the TCE Issues Group (telephone 202-223-5904). The TCE Issues Group's stated goals are to: 1) reduce the carcinogenic classification of TCE, 2) support now-possible physiologically based pharmacokinetic modeling, 3) raise TCE clean-up levels, and 4) allow use of TCE under the Clean Air Act.

Susan and Pete have hired a management consultant (just kidding) to work with them on their delegation skills for 1994. Branch members interested in supporting them through this personal development are asked to call either of the subjects at their business offices.

"The pump and treat system has a design capacity of 10,000 gallons-per-minute and was constructed to remediate an approximate 17-square mile plume of volatile organic chemicals in groundwater."

Sacramento Branch

–by David Von Aspern

Since the last HydroVisions issue, the Sacramento Branch has held two regularly scheduled meetings, in August and December 1993. What would have been the Branch's regular meeting for October coincided with GRA's Annual Meeting and Conference and so the branch officers waived the October meeting.

The August meeting was sponsored by Levine - Fricke, Inc. and the evening's speaker was Dr. John Farr of that firm. Dr. Farr's abstract for the paper on which his branch presentation was based is included below.

The Environmental Law Practice Group of Downey, Brand, Seymour & Rohwer sponsored the December meeting. Steve Reynolds with the U.S. Army Corps of Engineers presented the evening's program entitled, "Forensic Modeling of One of the Nation's Largest Pump and Treat Systems." Mr. Reynolds discussed the remedial program occurring at the Toole Army Base in Utah. The pump and treat system has a design capacity of 10,000 gallons-per-minute and was constructed to remediate an approximate 17-square mile plume of volatile organic chemicals in groundwater.

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Branch Activities

Continued from page 14

What may well be the highlight of the Sacramento Branch slate of annual events also occurred at the December meeting and consisted of our door prize drawing. This year 22 firms donated prizes as summarized below. We all appreciate the generosity and participation of the firms in making the holiday meeting all the more enjoyable - Thank You Donor Firms! In addition to the evening presentation and door prize drawing, meeting attendants enjoyed a specially selected, premium menu of Chinese dinner items as well as table wines donated again this year by EMCON Associates.

The door prize donors included: EMCON Associates, Beylick Drilling, SHN Inc., Delta Environmental, Radian Corporation, Wallace - Kuhl & Associates, Inc., ANLAB, Layne-Western, Taber Consultants, Anderson Consulting Group, Diamond Well Drilling, Western Strata Exploration (WESTEX), Western Environmental Science and Technology (WEST), Kennedy - Jenks Consultants, RESNA Industries, West Yost Associates, B & F Drilling, Industrial Compliance, AEGIS Environmental, URS Consultants, ERM West and Sequoia Analytical.

The next regularly-scheduled Sacramento Branch meeting will occur on Thursday, February 10th at the usual place, Royal Hong King Lum restaurant, in downtown Sacramento beginning at 5:45pm. The program for the evening will include a presentation by Dr. Fletcher Driscoll of Geraghty & Miller, Inc., that should do us all some good, "How to Avoid Making Technical Errors." The evening is being sponsored by RESNA Industries.

A Better Approach to Soil Cleanup Level Determinations

–by Dr. John Farr

Abstract

The California Leaking Underground Fuel Tank Field Manual (LUFT Manual - SWRCB, 1989) is used by the regulatory community, consultants, and industry in California to determine acceptable cleanup concentration goals for the remediation of hydrocarbon-affected soils. The LUFT methodology is a semi-quantitative approach which used rating tables that consider the effects of local precipitation and the depth to groundwater from the deepest affected soils, as well as anthropogenic and geologic factors. These latter factors are evaluated subjectively, with only the effects of local precipitation and depth to groundwater accounted for quantitatively. To assess the effects of these variables on the hydrocarbon concentrations that could be left in soil while protecting groundwater quality, the State of California performed modeling using SESOIL and AT1233D. The results from a small number of simulations covering a very narrow range of input parameter values were then extrapolated to form the LUFT Manual rating tables, which cover ranges in precipitation and depth to groundwater of 0 to 40 inches per year and 5 to 150 feet, respectively. Although the use of these tables generally results in conservative cleanup level determinations, the extrapolation method used and the lack of consideration for extremely sensitive input parameters (other than precipitation and depth to groundwater) in the development of the tables calls into question their validity.

"The LUFT methodology is a semi-quantitative approach which used rating tables that consider the effects of local precipitation and the depth to groundwater from the deepest affected soils..."

The paper presents a sensitivity analysis on the model input parameter, which highlights several critical input parameters that greatly affect cleanup concentration determinations. The sensitivity analysis shows that certain parameters which were fixed at conservative levels for the development of the LUFT Manual rating tables (e.g., biodegradation rate and soil organic carbon content) are more sensitive than precipitation and the depth to groundwater. In many cases, site-specific analysis will thus yield higher soil cleanup concentrations that are still protective of water quality. In addition, in some instances the cleanup concentrations in the LUFT Manual tables are not protective of water quality. To provide a firm basis for soil cleanup level determinations, site-specific analysis is recommended whenever significant quantities of soil may require remediation. This will provide more cost-effective remediation and greater assurance of water quality protection.

"The paper presents a sensitivity analysis on the model input parameter, which highlights several critical input parameters ..."

HYDROVISIONS Publication Schedule

1994 will mark a change in the frequency that HYDROVISIONS will be published. In an effort to get the news to you in a more timely manner, the Board of Directors has authorized the publication of Hydrovisions six times per year. The 1994 schedule will be as follows: February, April, June, August, October and December. The newsletter will go to print the first week of each of these months. To ensure that your articles get into the newsletter, please provide them to the Editor by the 15th of the preceding month. Thank you for your cooperation.

IMPORTANT ANNOUNCEMENTS

Director Nominations

The GRA Board of Directors is considering the Board and will therefore be accepting nominations for Directors. If you are interested in becoming a GRA Director please submit your resume along with a statement of purpose, explaining your goals and anticipated achievements for GRA. Board terms are a minimum of three years and there are four required Board meetings per year. Please send your information to P.O. Box 355, Davis, CA 95617-0355

Board of Directors Meetings

April 30, 1994
Geraghty and Miller, West Covina

August 25, 1994
To be determined, Berkeley

November 13, 1994
Luhdorff and Scalamini, Woodland

Sponsor Acknowledgment

GRA operations at this time are primarily based on membership dues and contributions by sponsors. Financial support is appreciated to assist development of the Association.

To date, the following people and firms have contributed financial support to the Groundwater Resources Association:

Supporters ($10 - $24)
Kent Aue
John Blackburn
Ben Cahill
Valentin Constantinescu
Jim Curtis
Nancy Darigo
Tom Dea
Murray Einarson
Keith Farrell
Greg Fasiano
Trish Gomes
James T. Gross
Norman Janke
Linda Jason
Warren Jung
Garry Maurath
Brian McRay
Greg K. Middleton
Eamon Moriarty
Ana Nathe
F. Scott Nevins
Sharon Premzic
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Dr. Edward Israel
Wallick
Scott D. Warner
Wayne Drilling
Eugene B. (Gus) Yates

Sponsors ($25 - $99)
Barbour Well Surveying Corp.
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Bob Gansberg
Geothermal Surveys Inc.
Keith E. Green
Hoover & Associates, Inc.
HydroSource Technologies
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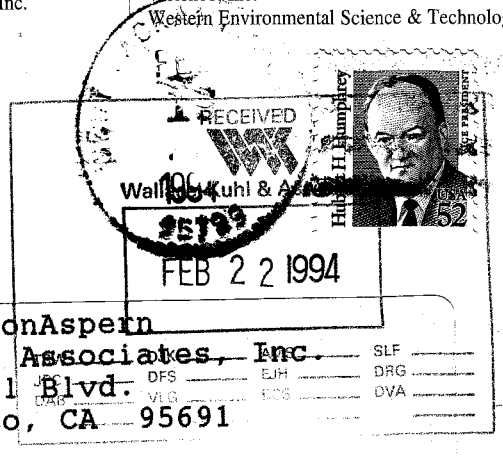

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