

# HYDROVISIONS



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GROUNDWATER RESOURCES ASSOCIATION  
OF CALIFORNIA

Fall 2003

## Perchlorate in Groundwater: Occurrence, Analysis and Treatment — Highlights from GRA's Symposium

BY TOM MOHR, SANTA CLARA VALLEY WATER DISTRICT  
RULA DEEB, ELISABETH HAWLEY AND JIM STRANDBERG, MALCOLM PIRNIE, INC.

Perchlorate contamination of California groundwater was the hot topic discussed at the July 31, 2003 symposium sponsored by the Groundwater Resources Association (GRA) in Sacramento, CA. The event was the seventh symposium in GRA's Series on Groundwater Contaminants. Topics included perchlorate occurrence and sources, toxicity, treatment technologies, regulation and litigation. The conference was attended by over 300 participants, including regulators, industry and water supply professionals, consultants, lawyers, newspaper reporters, students and interested citizens.

In addition to the scheduled program of talks, the symposium included an exhibit hall with booths from approximately 20 companies, and poster displays on topics ranging from treatment technologies and analytical developments to risk communication to the public. GRA coordinated a sold-out pre-symposium tour

of the nearby Aerojet facility in Rancho Cordova, followed by a GRA Sacramento Branch dinner meeting and presentation by Tom Mohr of the Santa Clara Valley Water District. Mr. Mohr presented a case study of the San Martin perchlorate plume that originated from a safety flare manufacturing facility owned by Olin Corporation. Low-level perchlorate concentrations have reached Santa Clara Valley Water District wells, causing the district to shut the wells off. The San Martin plume exemplifies the impact of a regulatory standard on the magnitude of investigation, remediation and costs. In April 2003, only two wells exceeded the pre-2002 California health-based action level of 18 µg/L. However, 380 municipal and private wells exceed the current California action level of 4 µg/L. The area of detectable perchlorate in groundwater extends southward from the facility at least 7 miles. Residents in the area are currently being supplied with bottled water at a cost of \$50,000 per week. Due to a lack of water system infrastructure in the area, the ultimate solution to private well contamination will be costly, involving either the construction of a centralized water treatment system and distribution network or wellhead treatment units.

The perchlorate symposium was separated into four sessions, each of which is described in some detail below. GRA President Jim Carter and symposium co-chair Tom Mohr welcomed the group and

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provided comments on the relevance of perchlorate contamination of California groundwater.

### Session 1: Sources, Occurrence, Geochemistry, Fate and Transport, Analysis and Toxicity of Perchlorate

Two representatives from the Office of Environmental Health Hazard Assessment (OEHHHA) started the symposium with an overview of OEHHHA's risk assessment that resulted in the 2002 second draft Public Health Goal (PHG) of 2 to 6 µg/L perchlorate in drinking water. Robert Howd, Ph.D. and David Ting, Ph.D. described the risk assessment process and key PHG assumptions. The risk assessment was based on a 2002 study by Greer et al.

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*The Groundwater Resources Association of California is dedicated to resource management that protects and improves groundwater through education and technical leadership.*



# President's Message

BY JIM CARTER

**G**RA is gaining momentum as we enter into the last quarter of 2003. The perchlorate conference, held in Sacramento, was a huge hit for the association, and for their incredible efforts, I would like to thank the conference chairs, Santa Clara Valley Water District, the GRA Director and Seminar Chair, and Rula Deeb, Malcolm Pirnie, Inc. (And congratulations are in order for Rula for the birth of her twins! Way to go, and take it easy Rula!) I am very pleased that the one-day symposium was expanded to a second day, with a tour to the Aerojet facility and the Sacramento Branch dinner meeting, featuring a talk on the perchlorate issues that are being discovered and addressed in the Santa Clara Valley Water District.

Next on our calendar is the 24th Biennial GW Conference & 12th Annual GRA Meeting, scheduled for October 28-29 in Ontario. The conference is entitled "The Role of Groundwater in Integrated Water Management," featuring over 40 speakers, with concurrent policy and technical sessions. Art Baggett, Chair of the State Water Resources Control Board, will be our lunch speaker on Tuesday, and we will have sessions on Integrated Water Management, Desalination, and Emerging Contaminants, to name a few. So make your plans today to join us for our Annual Conference!

We are on track to publish and present the Second Edition of the Groundwater Manual! Many thanks to Tim Parker, GRA Director, and the rest of his team in pulling this together. We plan to issue it at the Biennial/Annual Meeting, so this is another reason to attend.

The conferences on Subsurface Vapor Intrusion to Indoor Air are taking shape, with one-day conferences in Southern and

Northern California that will explore the relationship between groundwater contamination and indoor air. We are pleased that the creators of the Ettinger Johnson Model, Robert Ettinger, Shell Oil Products US, and Paul Johnson, Arizona State University, are both confirmed to present at both locations. These conferences will be in San Jose on September 30th and in Long Beach on October 2nd. This one-day symposium will provide you with an overview of the issues, along with a summary of the state of the science and practice in California. The workshop will also familiarize attendees with recent and emerging regulatory guidance, along with various tools and strategies that can be employed to evaluate site-specific exposures, where site-specific evaluations are warranted. I expect this will be another very informative conference on this area that is generating a lot of attention. We already have 70 people signed up, so you had better register soon!

Further on in our calendar, we have a conference planned on 1,4-dioxane on December 10, 2003 at the Doubletree Hotel in San Jose, and we are already planning an event for 2005. Please keep your eyeballs peeled and check in on our web site at [www.grac.org](http://www.grac.org) for details!

I feel very enthusiastic about our association, both where we are and where we are headed. We have had a great year so far, and we have many exciting things to look forward to before 2003 is finished. Thanks for your support and it is an honor to serve as your President. 💧

Thanks,  
Jim Carter,  
GRA President

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## The Role of Groundwater in Integrated Water Management

OCTOBER 28-29, 2003

DOUBLETREE HOTEL, ONTARIO  
AIRPORT, ONTARIO, CA

For 48 years, the Biennial Groundwater Conference has provided policy-makers, practitioners, researchers, and educators the opportunity to learn about the current policies, regulations, and technical challenges affecting the use and management of groundwater in California. The theme of the 24th Biennial Groundwater Conference is "The Role of Groundwater in Integrated Water Management" and will emphasize the interconnected nature of water resources at basin-wide, regional, and global scales. Presentations will explore the role of groundwater in formulating water policies, planning and managing water resources, and optimizing beneficial uses.

The conference will be held October 28-29, 2003, at the Doubletree Hotel, Ontario Airport, Ontario, CA. Sponsors are the University of California, California Department of Health Services, California Department of Water Resources, California State Water Resources Control Board, Groundwater Resources Association of California, U.S. Geological Survey, and the Water Education Foundation. Cooperating Organizations are the Association of California Water Agencies, California Groundwater Association, International Association

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## Upcoming Events

## The 9th Symposium in GRA's Series on Groundwater Contaminants: 1,4-Dioxane and Other Solvent Stabilizer Compounds in the Environment

DECEMBER 10, 2003 DOUBLETREE HOTEL, SAN JOSE

The widespread release of chlorinated solvents to groundwater from vapor degreasing operations has kept hydrogeologists and remediation engineers focused on new and better cleanup technologies for the past 15 years, and indeed substantial progress has been made at many solvent release sites. However, at some sites, 1,4-dioxane has been found to be present at problematic concentrations, now that better analytical techniques are available. There are several implications to the discovery of this highly mobile unregulated contaminant at cleanup sites, including the need to revisit capture zones, monitoring networks, and treatment technology selection.

What are solvent stabilizers? Numerous additives are routinely included with most industrial solvents to ensure that the solvents perform as needed in their intended degreasing application. These additives are collectively known as solvent stabilizers, or inhibitors, and mitigate or prevent reactions with water, acids, and metals, and inhibit degradation from heat, light, and oxygen. Stabilizers are generally added at volumetrically insignificant proportions, often in the parts per million range; however, a few stabilizers are added in the percent range. For example, 1,1,1-trichloroethane (TCA) was stabilized with 1,4-dioxane at 2 to 5% by volume, but due to boiling point differences, degreaser wastes may contain the compound at 15% or higher.

1,4-dioxane is a cyclic ether compound that serves to inhibit reactions with metals, particularly aluminum salts. It is listed as a probable carcinogen and damages the kidney. California has a provisional action level for 1,4-dioxane at 3 ppb. Toxicologists have raised questions about whether such a low action level is warranted based on inconsistencies in the animal lab data. A large number of additional compounds have been used as stabilizers for the four main solvents, TCA, trichloroethylene (TCE), tetrachloroethylene (PCE), and dichloromethane (DCM). Are any of these also water quality concerns? How should these compounds be regulated at cleanup sites in the absence of legal standards?

This Symposium will focus on solvent stabilizers and 1,4-dioxane in particular. Attendees will hear from speakers on the nature of stabilizers, their behavior in the subsurface environment, analytical issues for identification of stabilizers, the toxicology of 1,4-dioxane and toxicity characteristics of other stabilizers that may pose problems, and the significant challenges to remediating this compound.

We are now organizing speakers to illuminate the myriad issues surrounding this extremely mobile compound. Plan on attending to learn where 1,4-dioxane has been identified at dozens of solvent release sites in California, with concentrations greater than 100 mg/L at some sites. 1,4-dioxane is a main driver of risk in the indoor air

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# The Law of Conjunctive Use: The Appellate Court Weighs in on Central Basin Storage

BY: RUSSELL MCGLOTHLIN,  
HATCH & PARENT

Everyone in the water community seems to agree: conjunctive use opportunities must be more fully implemented to satisfy California's future water needs. Unfortunately, this is where the agreement stops. The law of conjunctive use – particularly, legal rights to use underground storage space for storage of surplus surface water supplies – is not well settled. As a result, there is considerable disagreement in certain locales among the various stakeholders desiring to participate in and/or manage conjunctive use projects. One such location is the Central Groundwater Basin in western Los Angeles County.

The Central Basin covers approximately 275 square miles, from Culver City to Long Beach. Because of the expansive population growth of that region through the early and mid 1900's, the Central Basin was significantly overdrafted, with almost 1 million acre feet of groundwater storage space dewatered. Portions of the Basin were intruded with seawater. To prevent destruction of the Basin, the water right holders adjudicated their water rights in superior court in 1965. The resulting water rights judgment successfully controlled pumping, and with augmented replenishment, the Basin now reliably yields approximately 250,000 acre-feet per year.

Still, the Basin contains approximately 650,000 acre-feet of dewatered storage space, a substantial portion of which can

be used for conjunctive use. Because the Basin is managed under the judgment, in 2001 a group of groundwater right holders petitioned the court to amend the original judgment to allow for greater conjunctive use of the Basin's storage space under the judgment. First, the motion sought relief from the judgment's pumping restrictions to allow storing entities to recapture the water they store underground. Second, the motion sought to implement a comprehensive management plan under the court-appointed watermaster to coordinate conjunctive use projects with all other basin activities. The legal means of returning to court to make this request was a reservation of continuing court jurisdiction that was written into the original judgment.

The Water Replenishment District of Southern California (WRD) objected to the motion arguing that the original adjudicated water rights did not include a right to use the Basin's storage space and that the motion allegedly infringed on WRD's rights to manage the storage space. The parties differed in their characterization of the motion. The groundwater rights holders characterized the motion as an effort to provide them the "opportunity" to store water in the basin under a coordinated framework. WRD characterized the motion as a bid to take an "ownership" interest in the Basin's entire available storage space. The trial court agreed with WRD and dismissed the motion. In a recent published opinion, the Second District Court of Appeals affirmed the trial court's ruling. (Southern California Water Company v. Water Replenishment District (2003) 109 Cal.App.4th 891.) The appealing groundwater rights holders have petitioned the California Supreme Court to review the appellate court's decision.

The principal reason for the appellate court's decision was its view that adjudicated water rights in the Central

Basin judgment do not include a proportionate right to use the available dewatered storage space in the Basin. The court also explained that WRD had certain management powers over the Basin's storage space in relation to its replenishment activities. However, the court also suggested that WRD's management powers were not exclusive, meaning that WRD likely has no power to regulate use of storage by others. Further, the court was careful to explain that its ruling was limited to the specific motion to amend the Central Basin Judgment, and that its opinion should not be interpreted as to prevent the water right holders from using the storage space.

The appellate court's decision leaves many questions unanswered. In regard to Central Basin specifically, it is not clear whether a water right holder can store water and extract such water free and clear of the judgment's pumping restrictions. If storage and extraction privileges are available, how are conjunctive use projects to be coordinated so as not to interfere with other Basin activities? Central Basin stakeholders are now engaged in a facilitated mediation process in hopes of settling many of these outstanding issues without further litigation.

More broadly, the opinion may also set precedent that will shape conjunctive use projects elsewhere in the state. Although the court expressly recognized that parties may generally stipulate to settle storage issues, the opinion suggests that, absent such a stipulation, the right to store water in an underground reservoir cannot be based on preexisting water rights. Instead, the opinion seems to suggest that rights to use storage space are established by "first in time, first in right," similar to the State's appropriative water rights system.

However, a first in time rule is not entirely satisfactory for several reasons. Initially, such a rule does little to promote

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# Chromium 6+ Concentrations in Drinking Water Wells and the Effects of Chlorination

BY TARRAH D. HENRIE,  
VERONICA SIMION, CHET AUCKLY,  
JEANNETTE V. WEBER, CALIFORNIA  
WATER SERVICE COMPANY

## Summary

The California Water Service Company (Cal Water) conducted a one-year study on the occurrence of chromium 6+ in groundwater and the effects of chlorination on speciation in 12 California communities. Due to health concerns raised by the media and the public, the California Department of Health Services instituted a statewide chromium 6+ study. Within the Cal Water service areas, chromium 6+ was found in the northern portion of the Central Valley and in the Bay Area. The majority of total chromium is chromium 6+, and not chromium 3+, as previous thought by public health professionals. In addition to sampling unchlorinated water, we also concurrently sampled chlorinated water, and found very little difference.

## Methods and Materials

Samples were collected from 76 wells before and after chlorination. Two rounds of sampling were performed six months apart. Total chromium was analyzed at the Cal Water in-house certified laboratory in San Jose, California, by EPA Method 200.8. BSK Analytical Laboratory, in Fresno, California, analyzed chromium 6+ by EPA Method 218.6.

## Technical Corner

### Results

The results from all of the communities where we serve water were grouped in order to draw meaningful conclusions on a statewide basis. Figure 1 shows a linear correlation between total chromium and chromium 6+. Although the correlation coefficient is only 0.83, the graph does demonstrate that the concentration of chromium 6+ can be reasonably approximated from the total chromium level.

Note that the slope of the line is 0.818, which indicates a higher proportion of chromium 6+ than previously thought. The amount of chromium 6+ ranged between 0% at low concentrations up to 100% (the latter based on a single investigation, in 1999).

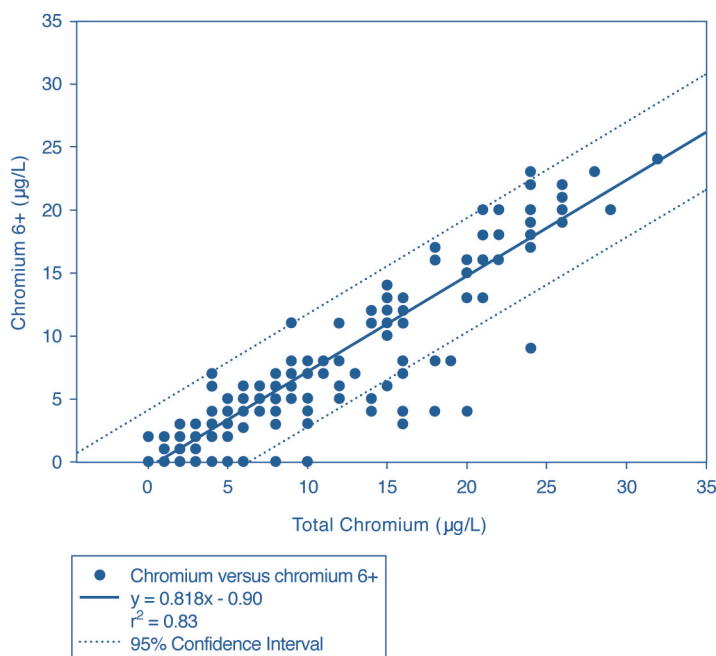
Chromium 6+ concentrations in chlorinated and unchlorinated water were compared. A linear regression fits

the data well and yields a correlation coefficient of 0.95. The slope of the line is 0.99, demonstrating that chromium 6+ concentrations are essentially unchanged by chlorination.

The Department of Health Services required that samples be taken from each source twice, six months apart. This data would establish whether or not chromium 6+ concentrations vary seasonally. Interestingly, chromium 6+ concentrations do not appear to vary (the slope is 1.02), however, total chromium concentrations may vary seasonally; they were slightly higher in the third quarter.

The complete article will be available in the forthcoming CRC publication Hexavalent Chromium Handbook ([www.crcpress.com](http://www.crcpress.com)). Tarrah may be reached at [thenrie@calwater.com](mailto:thenrie@calwater.com), 1720 North First Street, San Jose, CA 95112.

Figure 1. Total chromium versus chromium 6+ in 12 California communities.



## GRA Participates in Legislative Hearings

BY TIM PARKER AND CHRIS FRAHM

GRA continues to meet its mission of resource management that protects and improves groundwater through education and technical leadership by providing information to state policy makers in Sacramento. GRA helped organize and participated in two legislative hearings in July and August.

The first of these hearings, held July 10 at the Capitol, Life Cycle of a Contaminant – Tracing a Contaminant Through the Environment to Our Drinking Water Supplies, was the focus of the Assembly Select Committee on Groundwater Quality and Availability. The Committee is chaired by the Honorable Carol Liu, who sponsored AB 599, the Groundwater Quality Monitoring Act of 2001. Legislative members and legislative staff were provided informational presentations on the contaminants nitrates, MtBE, and perchlorate, and how maximum contaminant levels are developed. The hearing was closed with a discussion of emerging contaminants.

The July 10 hearing began with statements by Carol Liu on the committee purpose and the need for better groundwater quality information in California. Tim Parker, GRA Board Member and Legislative Chair, provided an introduction to the hearing through a brief overview on GRA and general groundwater issues in the state. Randy Marx of Brown Caldwell presented an abbreviated history of state and federal Superfund programs, and how California evolved to its current status of regulation and law pertaining to groundwater contamination. Roy Schneider of the U.S. Geological Survey gave an interesting overview of the number one contaminant affecting groundwater supply wells, nitrates; how

nitrates occur and move in the subsurface, and sources of nitrate contamination. The life cycle and movement of Methyl-tert-Butyl-Ether (MtBE) through the environment was the subject of the presentation by Clinton Church of the U.S. Geological Survey. Kevin Mayer, U.S. Environmental Protection Agency, discussed perchlorate, its characteristics, sources, movement, distribution in groundwater, and current federal thinking on this contaminant. David Spath of the California Department of Health Services provided an overview of the California state approach to the development of maximum contaminant levels (MCL) for drinking water. Tim Parker discussed the issue and perception of the “new contaminants” we continue to see that are a result of looking closer at groundwater quality and better analytical laboratory methods, and the emerging contaminants on the horizon, including personal care products.

On Thursday, August 21st, the Assembly Select Committee on Water Management, Storage, Conservation and Supply held a public hearing, on Perchlorate in Groundwater, at the Capitol. This hearing was commenced by Assembly member Ron Calderon with a discussion on the committee purpose and need for better groundwater quality information in California. Tim Parker, GRA Board Member and Legislative Chair, provided an overview on groundwater hydrology (GW 101) specific to the state. John Gaston of CH2MHill presented an overview of state and federal regulations, state regulatory framework, a discussion of how Superfund is implemented by US EPA and funding mechanisms, some of the current and emerging groundwater contamination issues related to clean up and setting MCLs, and risk management. David Spath of the

## California Legislative Corner

California Department of Health Services provided an overview of the California state approach to the development of maximum contaminant levels (MCL) for drinking water, the primary and secondary effects of perchlorate related to health, agriculture, and the economy, and how DHS proposes to regulate perchlorate in California water supplies. Grace Burgess, Executive Director of the San Gabriel Basin Water Quality Authority discussed the challenges and current solutions regarding perchlorate contamination in groundwater and drinking water supplies in the San Gabriel Valley, as well as some funding issues the basin authority is facing in the future to remedy the problem. The hearing was closed by Steve Hoch, attorney with Hatch & Parent law firm, with a presentation on the challenges that the water purveyors are facing related to perchlorate in drinking water supplies. Issues included public perception of public health goals; action levels and media attention; water utilities not being public health scientists; the Hartwell decisions and claims; strict product liability issues; and suggestions for specific legislative assistance for water utilities.

It appears that GRA's reputation as being the “go to” state organization for unbiased technical information on groundwater continues to grow, thanks to the support of the membership and continued efforts of the Legislative Committee and our Legislative Advocates, Hatch and Parent. GRA especially wishes to thank the committee members, our legislative advocates Chris Frahm and Jennifer Carbuccia of Hatch and Parent, as well as all the volunteer speakers and participants for putting together educational and fruitful hearings at the state capitol. 💧

# HIGHLIGHTS — California Council of Geoscience Organizations An Advocate for the Profession in the Public Interest

BY JANE H. GILL, R.G., CCGO  
EXECUTIVE DIRECTOR

## CCGO well represented at the July 9 Retirement dinner for State Geologist, Jim Davis

**A**l Franks (CCGO supporter and consultant), Rick Blake (CCGO Vice President and President-elect), Jim Jacobs (CCGO Past President and a GRA Board member), Pat Berge (Treasurer of the SF Bay Chapter of Association for Women Geoscientists, a CCGO member organization), and Bob Tepel (CCGO Founder and member of the State Mining and Geology Board) all attended the Retirement Dinner in honor of California State Geologist, Jim Davis, held on July 9 in Sacramento. Davis retired June 30 after 25 years as State Geologist. Under the quarter century of Davis' leadership, the California Division of Mines and Geology (DMG) became the California Geological Survey (CGS), whose mission is to provide information and advice to the public on the geology, geologic hazards, and mineral resources of California. Jim Davis has overseen the assembly of a dedicated and quality professional staff to further this mission, especially to provide information for the improvement of public safety, including the design and

oversight of DMG geologic mapping and geohazards programs.

Davis leaves behind an impressive legacy of contributions to the field of geology and even in retirement he will stay involved in a number of organizations, such as the American Geophysical Union, the Geological Society of America, the American Geological Institute, and the Consortium of Organizations for Strong-Motion Observation Systems. And, we hope, CCGO, too!

CCGO has long been an ardent supporter of the CGS, and a recent email and letter campaign to retain funding for the CGS was enormously successful.

## CCGO provides much needed support for CGS Programs with email and letter writing campaign

After a rapid flurry of emails and letter requests to support the Strong Motion Instrumentation Program (SMIP) and Seismic Hazards Mapping Program (SHMP) of the California Geological Survey, we received the good news that both programs were retained, at least for a year. Both programs were in danger of being cut in the recent legislative session due to the state budget crisis. The good news is that SMIP was granted a \$1.0 m. augmentation to the current budget of \$3.4m. This program provides instrumentation to measure the motion of structures during seismic events critical in assisting emergency response to locations impacted by the strongest ground motion and to assist in retrofit activities. In addition, SHMP was granted a reprieve by passage of the Governor's proposal, which augments this program by \$1.2 m. to back-fill the funding gap for one year. The SHMP program is funded by building fees

dedicated to seismic safety and funded by those fees at the \$1.9m level in FY 02-03. The Governor would be expected to continue supporting his proposal for these two programs. To be notified for future support requests, please contact [janehgill@ccgo.org](mailto:janehgill@ccgo.org).

## Legislative analysis on 29 new bills provided by CCGO member organization, Association for Engineering Geologists

The current legislative session ends September 12, 2003 and the Governor has until October 12th to sign or veto bills. A list of 29 new bills that have been monitored for AEG this session are posted on the CCGO website, [www.ccgo.org/legislation1.html](http://www.ccgo.org/legislation1.html). Please look over the analyses, and respond to CCGO or the AEG Sacramento Section contract legislative advocate at [jwolen@aol.com](mailto:jwolen@aol.com).

## Applicants Still Sought for Legislative Research Grant

CCGO is continuing to seek someone to assist us in researching and compiling information from existing lists of geoscience-related regulatory databases. CCGO will provide a stipend of \$1000 for this work, and the applicant will be considered for future paid work. For more information, please go to [www.ccgo.org](http://www.ccgo.org) or contact the CCGO Executive Director at [JaneHGill@aol.com](mailto:JaneHGill@aol.com). Email only, please. 💧

# Current Happenings at the U.S. Environmental Protection Agency

BY JOHN UNGVARSKY, USEPA

## New Acting Administrator and Acting Deputy Administrator

Two top EPA officials have been named by President Bush to serve as Acting Administrator and Acting Deputy Administrator for the Agency, replacing the positions recently vacated by former Administrator Christie Whitman and former Deputy Administrator Linda Fisher. Marianne Lamont Horinko, who formerly served as Assistant Administrator for Solid Waste & Emergency Response, will now serve as EPA's Acting Administrator. Stephen Johnson, who served as Assistant Administrator for the Office of Prevention, Pesticides and Toxic Substances, will serve as EPA's Acting Deputy Administrator.

## EPA's 2003 Ground Water Report

EPA's 2003 Ground Water Report to Congress is in Final Draft. EPA is also required every three years to evaluate funded State programs and report to Congress on the status of ground water quality in the United States and the effectiveness of State programs for ground water protection. The draft can be viewed at <http://region5.rti.org>. The publication is expected to be completed in November 2003.

## Review of Drinking Water Regulations

On July 11, EPA announced that it had completed its review of 69 National Primary Drinking Water Regulations (NPDWRs) that were established prior to 1997, including 68 chemical

NPDWRs and the Total Coliform Rule. The purpose of the review was to identify those NPDWRs for which current health risk assessments, changes in technology, and/or other factors, provide a health or technological basis to support a regulatory revision that will maintain or improve public health protection. This action briefly describes the major comments received, other new information, and EPA's current revise/not revise decisions for the 69 NPDWRs.

## Contaminant Candidate List

The Safe Drinking Water Act (SDWA) directs EPA to publish a list of contaminants (referred to as the Contaminant Candidate List, or CCL) to assist in priority-setting efforts for the Agency's drinking water program. SDWA directs the Agency to select five or more contaminants every five years from the current CCL and determine whether or not to regulate these contaminants with a NPDWR. On June 3, 2002, EPA published preliminary regulatory determinations for nine contaminants (67 FR 38222). The nine contaminants include manganese, sodium, sulfate, aldrin, dieldrin, and metribuzin, hexachlorobutadiene, naphthalene, and acanthamoeba. The Agency decided that no regulatory action is appropriate, at this time, for the nine CCL contaminants.

## National Source Water Protection Conference

From June 2-4 over 450 people gathered in Washington DC to attend the 2003 National Source Water Protection Conference. Participants came from 47 states, the District of Columbia, and two Canadian provinces. They represented all levels of government agencies from local to federal, utilities, technical assistance providers and health care workers, and private citizens.

# Federal Legislative Corner

## Treatment for Arsenic at Small Systems

The Arsenic Treatment Technology Evaluation Handbook for Small Systems is now available to help small systems and technical assistance providers evaluate appropriate treatment technologies. To learn more, visit [http://www.epa.gov/safewater/small/sys/arsenic\\_treatment\\_handbook\\_lo.pdf](http://www.epa.gov/safewater/small/sys/arsenic_treatment_handbook_lo.pdf).

## EPA Awards Security Planning Grant to Help Small Drinking Water Utilities

To help small drinking water utilities assess their vulnerabilities to terrorist attack, EPA announced on July 22 the award of nearly \$2 million to the National Rural Water Association (NRWA). NRWA will assist small community water systems serving populations between 3,300 and 10,000 people with security planning. By June 30, 2004, these drinking water systems are required to submit vulnerability assessments to EPA under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. Through a combination of training sessions, onsite technical assistance, and internet based tools, the NRWA will educate system personnel about the Act and provide assistance in preparing vulnerability assessments and emergency response plans. For more information on EPA's water infrastructure security efforts go to: <http://www.epa.gov/safewater/security/>.

## Perchlorate Remediation Information

A new web page devoted to perchlorate remediation has been launched on EPA's Technology Innovation CLU-IN (Hazardous Waste Clean-Up Information) web site. This page provides access to over 40 technical reports, journal articles, web pages, and other materials from public and private sources. Representing the latest

*Continued on page 21*



# Perchlorate Data — How Reliable Is It?

BY BART SIMMONS, DTSC

Perchlorate, of course, is important because the health risk assessments have prompted action levels in the low parts-per-billion (ppb). The lab detection levels are typically in the low- to sub-ppb levels, so there has been concern about measuring below the action levels. However, a more dramatic problem has appeared: the misidentification of the perchlorate peak, resulting in false positive results.

## What's the problem?

The perchlorate issue has revealed a critical question: how reliable are the data? The typical test procedure for perchlorate in groundwater uses an ion chromatograph with a conductivity detector. An ion suppression system is used to attempt removal of the majority of interferences from the solvent. Perchlorate is identified by retention time – the time from sample injections until the peak is detected. If another peak elutes near the perchlorate peak, there is a risk of interference. For example, the perchlorate may appear on the shoulder of another larger peak, and because the retention time may vary during the day, the perchlorate could be mistaken for another peak, or vice versa.

A second problem appears to relate to sampling. Test results for split samples from the same well, and testing different samples from the same well, may show major discrepancies. Some results have been withdrawn after a review of the chromatograms and data show a misidentification of the perchlorate peak. Some results were confirmed by two other labs, including testing with liquid chromatography – mass spectrometry (LC-MS). LC-MS is a good confirmation technique because it uses the mass spectrum in addition to the retention time for identification.

LC-MS confirmed the lab results – one sample had about 40 ug/L (ppb), and the other had non-detect results, with a reporting limit of 0.5 ppb. The tentative conclusion is that there is some problem with the sampling or variability in the well chemistry that dramatically changes the perchlorate concentration.

Los Alamos National Laboratory (LANL) is investigating the problem and is working on a method using LC-MS-MS. The Environmental Lab Accreditation Program (ELAP) does not provide lab accreditation for LC-MS or LC-MS-MS.


What to do? Recent experience suggests that labs using EPA Methods 314.0 should include at least one matrix spike in a concentration similar to the perchlorate peak. If the spike shows perchlorate as a second peak, then the original perchlorate identification is in question. The method of standard additions should also be considered. This involves the addition of perchlorate in a range of

concentrations, and determining the result in the sample from the spiked results. Finally, LC-MS, LC-MS-MS, and IC-MS should be considered as confirmatory techniques. Although accreditation may not be available for these techniques, they are defensible because they are generally accepted in the scientific community.

Once again, risk-based action levels have challenged the test methods used for environmental samples. Some of the reliability questions need to be answered so that the public health and environmental impacts of perchlorate can be better understood.


*Bart Simmons is with the Hazardous Materials Laboratory, California Department of Toxic Substances Control (DTSC), California Environmental Protection Agency (Cal-EPA). Opinions are those of the author and are not necessarily those of DTSC or Cal-EPA. Mention of products or services does not constitute endorsement by DTSC or Cal-EPA. ♀*

## Chemist's Corner



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# 2003 NGWA/AGWSE Annual Meeting and Conference

## GROUNDWATER IN COASTAL ZONES: AVAILABILITY, SUSTAINABILITY AND PROTECTION

BY JULIE SHAW, NGWA  
PUBLIC RELATIONS/PUBLIC  
AFFAIRS MANAGER

Ground water issues in coastal zones will be the focus of the upcoming Annual Meeting and Conference of the Association of Ground Water Scientists & Engineers (AGWSE). The event will be held as part of the National Ground Water Association's 2003 Ground Water Expo, December 9-12 in Orlando, Florida, at the Orange County Convention Center. Among the conference highlights are invited speakers, technical interactive presentations (TIPs), and interest group sessions.

Cosponsors for the conference include the United Nations Educational, Science and Cultural Organization and its International Hydrological Programme; Florida Institute of Technology—Environmental Sciences Department; Northwest Florida Water Management District; Southwest Florida Water Management District, and South Florida Water Management District.

### Distinguished Lecturers will provide the following presentations:

- NGWA's 2003 Henry Darcy Distinguished Lecturer in Ground Water Science, Richelle Allen-King, speaking on "A Hydrogeochemist's Perspective on Organic Contaminant Transport in Ground Water." The lecture will be held Wednesday, Dec. 10.

## Alliance Corner

- Birdsall-Dreiss lecturer Barbara Bekins, speaking on "The Influence of Hydrogeology on 25 Years of Natural Attenuation at a Crude Oil Spill Site." The lecture is scheduled for Friday, Dec. 12.

### Expo Workshops Include:

- Profiling Hydraulic Conductivity with Direct Push Equipment
- Standard Penetration Test and Split Barrel Sampling with Direct Push Equipment
- Application of Geophysics to Ground Water Issues
- Optimizing Ground Water and Aquifer Characterization Through Improved Monitoring Approaches
- Well Development and Chlorination
- Automated Low-Flow Water Quality Monitoring
- Ground Water Microbiology and Well Rehabilitation

### Field Trip — Florida's Ground Water

A one-day field trip is planned on Friday December 12 to view innovative water projects and technologies throughout Florida's south-central region. Field trip leaders will include specialists from the U.S. Army Corps of Engineers, the U.S. Geological Survey, South Florida Water Management District, and the Florida Geological Survey. Cost for the event is \$60 if registration is made by November 1. After November 1, the registration fee is \$75. Seats will be filled on a first-come, first served basis, and NGWA reserves the right to cancel the field trip if there is insufficient enrollment. To register for the Expo and for this event, or to obtain more information, go to <http://www.ngwa.org/e/index.shtml#60> 10 or call NGWA customer service at (800) 551-7379.

## Regional Water Quality Control Board Announcement

### New "South Bay" Groundwater Protection Report

In early May, Regional Board staff released a report titled "A Comprehensive Groundwater Protection Evaluation for the South San Francisco Bay Basins". The report is the result of a two-year evaluation conducted by the Regional Board's Groundwater Committee in conjunction with the Alameda County and Santa Clara Valley Water Districts, and San Mateo County Environmental Health Services.

The report is the first comprehensive overview of existing groundwater protection programs in the South Bay, an area where 350 public wells supply groundwater to nearly two million people and provide up to half the drinking water supply. The report evaluates 1) major threats to groundwater quality, 2) existing groundwater protection programs, and 3) new statewide initiatives for protection and data sharing. The report also focuses on several topics that are typically not addressed by existing programs, including:

- Identifying and sealing vertical conduits;
- Leaking sewer lines;
- Dry cleaner remediation;
- Coordination with Department of Health Services' Drinking Water Source Assessment and Protection (DWSAP) Program;
- Surface water and groundwater interaction;

# Alliance Corner

- ◆ Emphasis on groundwater protection in city and county general plans; and
- ◆ Information management.

The report contains numerous findings and recommendations for improving groundwater protection programs, including a proposed interim approach to prioritizing groundwater protection efforts. Additional highlights include the latest regional groundwater quality data and location maps of drinking water wells, cleanup sites, and regional solvent plumes.

Regional Board staff are working with the State Board and local agencies to follow-up on several of the report's recommendations. Notable efforts include the Santa Clara Valley Water District's dry cleaner pilot study, designed to help prioritize threats to groundwater quality from historic drycleaner releases. Other efforts include an expanded electronic reporting program for solvent plumes in groundwater, and a proposal to establish a pilot project for identifying and sealing abandoned deep wells and other potential vertical conduits that threaten groundwater quality.

This is the third groundwater basin evaluation conducted by Regional Board staff. The first two evaluations involved San Francisco / northern San Mateo Counties and the East Bay from Hayward to Richmond. All three reports are now available on the S.F. Regional Board Web site at <http://www.swrcb.ca.gov/rwqcb2/> under "available documents". The South Bay report is also available on CD-ROM by contacting the Regional Board at 510-622-2300. Hard copies are available from East Bay Blue Print (ph: 510-261-2990, fax: 510-261-6077) at a cost of \$85. ◆

## Managing South America's Largest Aquifer

INTERNATIONAL ASSN OF HYDROGEOLOGISTS

The governments of Argentina, Brazil, Paraguay, and Uruguay, together with the World Bank, the Organization of American States, and the Global Environment Facility, have inaugurated the Guaraní Aquifer System Project.

The \$27 million project, which includes a \$13.4 million Global Environment Facility grant, will help these countries to jointly elaborate and implement a common institutional and technical framework for the management of the Guaraní Aquifer System. This transboundary aquifer system underlies the four countries and has a total surface area of 1.2 million square kilometers, constituting a strategic freshwater resource in South America.

This is the first time in South America that a group of countries has taken preventive action to protect a transboundary groundwater resource. About 15 million people live in the Guaraní Aquifer System region. In the long term, this project is expected to benefit these populations by helping maintain a sustainable supply of safe water for humans; high quality water for industry; a sustainable supply of thermal water for tourism, industrial, and municipal uses; and reduce conflict potential due to the use of the groundwater in transboundary areas.

Demographic pressures, as well as the pressures of economic growth and the pollution of surface waters, have resulted in increasing demands on the Guaraní Aquifer as a source of drinking water. In São Paulo alone, more than 60 percent of the population (or 5.5 million people), rely on Guaraní waters.

The project was officially launched on May 21-23 in Montevideo. A project web site has been launched at <http://www.sg-guarani.org/> which provides information on the project, the project plan, and a point of contact with the project team led by Luis Amore. ◆

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## Organizational Corner



### Message From the Executive Director

BY KATHY SNELSON

#### Accepting and Fulfilling A Member Role With GRA, Whatever That Might Be

I have often thought about why GRA members are GRA members, and I typically end up at the table of benefits perusing the menu. The bill of fare is full of variety and results, but I often think there must be something else motivating GRA members to be and stay members.

My curiosity about GRA members' motivation lead me to ask, "Why am I a member of the professional societies and the trade association that I am? These questions ultimately lead me to "what" causes me to be a member instead of why.

For the professional societies that I belong to, I have three realistic expectations of each (1) numerous offerings of pertinent educational programs, (2) informative publications, and (3) opportunities for volunteer participation. My expectations for the trade association I belong to are (1) educational and social opportunities where I can connect with professionals managing similar organizations to mine, and (2) informative publications. The above expectations have been fulfilled every year since I have been a member. Thus, I am pleased to fulfill my most important **member role** every year, which is renewing my membership punctually, dues increase or not. If my expectations are being fulfilled, and the

society or association is solvent, I believe and trust that the Board of Directors and staff are performing their duties of care and loyalty to their association.

While it may seem that I am not "holding" my professional societies and trade association to pursuing and providing only "cutting edge" and new ideas, I believe in the following notions provided by John G. Miller, author of *QBQ! The Question Behind the Question*. When presenting a story about a salesman who asks, "what's next" (innovative ideas on how to sell), he writes, "The problem is not a shortage of ideas, but a lack of understanding that the "old" ideas still work. This may not be true of technology, which changes every five minutes, but when it comes to the principles on which we can base our organizations and lives, the *old* stuff is the *good* stuff."

As GRA prepares to initiate the "old stuff", 2004 Director election process, to plan its 2004 calendar of programs and to distribute 2004 dues invoices, please take a moment to assess and define your expectations of GRA, and what you believe your member role is. GRA doesn't expect you to exceed your capacity to participate, but if each GRA member accepts and fulfills at least one member role, GRA's foundation will be powerful and adaptable based on the diverse strengths of each and every member. 💧



# Southwest Hydrology Merges with SAHRA

BY BETSY WOODHOUSE

Southwest Hydrology is pleased to announce its merger with the National Science Foundation Science and Technology Center for Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA), based at the University of Arizona. Beginning with the September/October 2003 issue, the two groups are combining resources to improve the quality of both the magazine and the Southwest Hydrology Web site. More good news: although the magazine will continue to rely on advertisers/sponsors to sustain its production, subscriptions will again be free. All paid subscribers will be receiving prorated refunds, and those who used to be on the mailing list but did not pay will again receive the magazine.

Southwest Hydrology will continue to be the same magazine with the same focus, except it will become bigger and

better. Betsy Woodhouse continues as publisher, and Howard Grahm is editorial consultant. The merger with SAHRA brings an increase in staff, a larger reporting network, and new departments that will cover international water issues and water education. The magazine will also include expanded coverage of water law and economic issues. Soon, back issues will be available on the Web site. In addition, readers will be regularly surveyed to ensure their interests are addressed and their needs met. Southwest Hydrology and SAHRA believe these improvements will further the primary goal of the magazine, to be the voice of the semi-arid water community.

Anyone wishing to receive Southwest Hydrology can contact the magazine's staff at (520) 626-1805, email [mail@swhydro.com](mailto:mail@swhydro.com), or visit the Web site at [www.swhydro.arizona.edu](http://www.swhydro.arizona.edu). 💧

## Organizational Corner

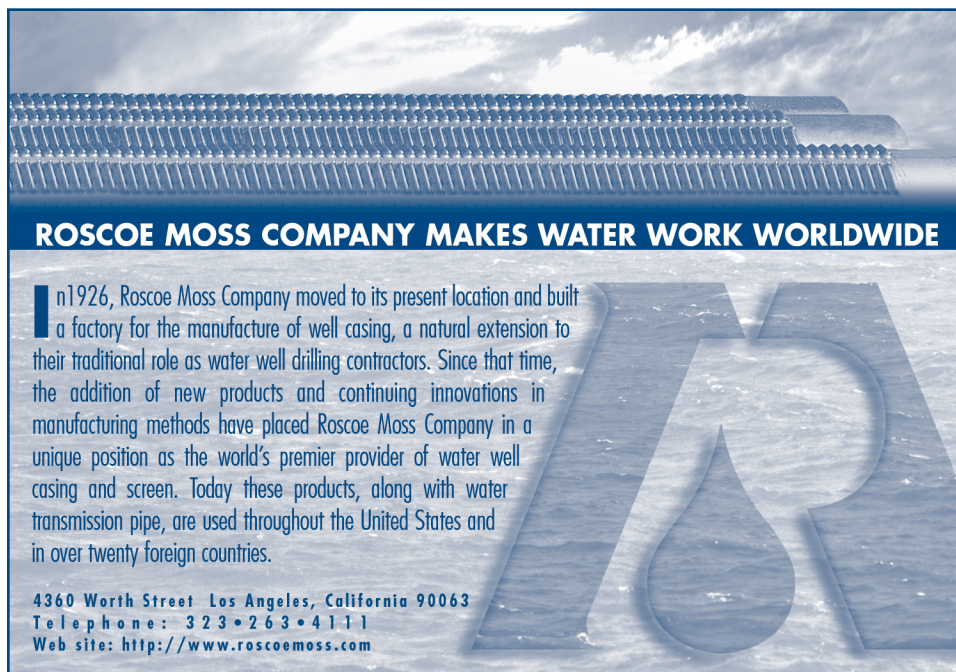
### Thanks to Don Kuhwarth and Kevin Blatt!

GRA extends its sincere appreciation to Don Kuhwarth of Midtown Computer Services in Sacramento and Kevin Blatt of iHappy Web Designs for their dedication and hardwork on GRA's Website/Database Integration Project. The project Kevin and Don developed and implemented upgraded GRA's membership database to provide greater accessibility for GRA members, leadership, and staff. Further, the project expanded the capability of members to renew memberships and update contact information online.

Please feel free to extend your appreciation or provide comments about the project to Kevin at [kblatt@ihappi.com](mailto:kblatt@ihappi.com) and/or Don at [info@midtown.net](mailto:info@midtown.net). Midtown Computer Services has hosted GRA's Web site, [www.grac.org](http://www.grac.org), and Kevin has been the Web master since the site's inception. 💧

### CORRECTION

Hydrovisions wishes to correct an error in the email address of the author of the Summer 2003 article, "Calculated Solutions to Common Ground Water Questions", Eugene E. Luhdorff, Jr. His correct email address is [ac6xq@amsat.org](mailto:ac6xq@amsat.org). We regret any inconvenience this may have caused.



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## Call for Nominations — GRA Directors

The Association is now soliciting nominations for GRA Board of Director candidates to run for seats that commence service January 1, 2004. The Nominating Committee has established the following criteria for nominating and selecting candidates for the final ballot that will be presented to the GRA membership for voting.

### Minimum Qualifications for Director Nominees

- Active Regular Members of GRA at the time of nomination.
- Recognized leader in a groundwater-related field, which may include regulation, evaluation, development, remediation or investigation of groundwater, groundwater supplies or related technology; science education; and groundwater law or planning.
- Significant contributor to the field of groundwater resources in California.
- Prior contributions and leadership role in GRA Branch, GRA committees or other similar GRA activities.

### Nominating Guidelines and Procedures

- Directors and members of GRA are eligible to nominate candidates for Board.
- Nominations must be submitted in writing to the Chair of the Nominating Committee and accompanied by a statement from the nominee addressing the following questions:
  - Why are you interested in serving on the GRA Board of Directors?

- What qualifications and experience do you have for serving as a Board member?
- What specific skills or expertise do you bring to GRA and the GRA Board (e.g., leadership skills, fund-raising, financial management, etc)?
- What experience do you have serving on similar boards of directors?
- What level of time commitment can you make to GRA?
- Current curriculum vitae.
- A letter of recommendation from a current Director or Regular Member.

- The Nominating Committee will review all nominations and evaluate the nominees based on their response to the above questions and their qualifications. The Committee will conduct interviews, if deemed necessary.
- The Nominating Committee shall recommend a slate of nominees for presentation to the GRA Board of Directors for approval. The recommended slate of nominees shall correspond to the number of available Director openings each year.
- The approved slate of nominees shall be presented to the GRA membership in ballot form in accordance with the GRA bylaws.

To declare your desire to be nominated or to nominate someone other than yourself, please follow the guidelines in section number two above and forward the material to GRA via email ([executive\\_director@grac.org](mailto:executive_director@grac.org)),

fax (916-442-0382) or mail (915 L Street, Suite 1000, Sacramento, CA 95814) by October 27, 2003. Please address any formal correspondence to Jim Carter, Chair, GRA Nominating Committee.

Should you have any questions or need additional information about the GRA Director Call for Nominations, please contact Kathy Snelson at (916) 446-3626. 💧

**GRA Extends Sincere  
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# Organizational Corner

## GRA Welcomes the Following New Members

JUNE 17, 2003 – AUGUST 26, 2003

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Allen, Elizabeth	TechLaw Inc.	Ning, Joan	Applied Materials
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Brandt, Randolph	LFR Levine-Fricke	Quillin, Jill	ERM
Brown, Bob	Baroid Industrial Drilling Products	Radom, Stanley	Rancho Marcelino Water & Service Co. Inc.
Brueckner, Dan	Rohm and Haas	Rawal, Dhananjay	Shaw Environmental
Buck, Michael	McDonough Holland & Allen	Ritchey, Peter	Calgon Carbon Corporation
Clarke, Joyce	SAIC	Robinson, Keel	Northgate Environmental Management, Inc.
Curran, Judd	United States Geological Survey	Roy, Sean	Prosonic Corporation
Custance, Ruth	GeoSyntec Consultants	Schafer, Sandi	Clayton Group Services, Inc.
Eaton, Andrew Drake	MWH Labs	Scotto, Hazel	League of Women Voters
Eck, Darrell	Sacramento County Water Agency	Smeeth, Kendal	SmeethCO
Elliott, Ken	International Risk Group	Smith, David	Calgon Carbon Corporation
Evensen, James	The Source Group, Inc.	Stewart, Edward	Clayton Group Services, Inc.
Feng, Terry	Parsons	Stubbs, Chris	ENVIRON International
Frankel, Avram	URS Corporation	Taylor, Gregory	Raytheon Company
Gailey, Rob	CH2M Hill	Trotta, Marcus	PES Environmental, Inc.
Girard, Tina	Parsons	Tsukamoto, Glen	Philips Electronics
Green, Richard	San Diego State University	Valdivia, Gustavo	Clayton Group Services, Inc.
Gurol, Mirat	Hackenberry Associates, LLC	Van Tassell, Lisa	GeoSyntec Consultants
Hackenberry, Paul	Sequoia Analytical	Wactor, Jon	Wactor & Wick LLP
Hague, Simon	Hromadka & Associates	Williams, Gary	Baroid Industrial Drilling Products
Hromadka, Laura	Lawrence Livermore	Williams, Jr., Forest Wesley	Sacramento County Water Agency
Hu, Max	National Laboratory	Zawislanski, Peter	LFR Levine-Fricke
Hurd, Michael	Clayton Group Services	Ziemba, Neil	International Risk Group-Assumptions
Hutchison, Neal	Tetra Tech EM, Inc.	Zweifel, Donald	Restoration Advisory Board
Johnson, Stephen Bruce	Stetson Engineers Inc.		MCAS Tustin
Kiel, Peter	Stoel Rives LLP		
Kolhatkar, Ravi	GEM/PB		
Kramer, Sam	Komex		
LaMontagne, Andre	Winefield & Associates		
Langager, Harv	Baroid Industrial Drilling Products		
Lewis, Bruce	ERM		
Lipson, David	Blasland, Bouck & Lee, Inc.		
Madrid, Kelly	Ambiente, Inc.		
Mapel, Gene	Baroid Industrial Drilling Products		
Marker, Timothy	Environmental Engineering		
Michener, Stuart	Parsons		
Min, Joon	Carollo Engineers		

## Banking on the Commons: An Institutional Analysis of Groundwater Banking in California's Central Valley

DOCTORAL DISSERTATION, UNIVERSITY OF SOUTHERN CALIFORNIA,  
SCHOOL OF POLICY, PLANNING AND DEVELOPMENT

BY NICHOLAS A. PINHEY, CITY OF TRACY, PUBLIC WORKS DEPARTMENT

**T**wenty first century California is facing a water shortage crisis challenge based on its increasing population growth and water demands. Effective institutions for the management of California's water resources are a vital component for avoiding the predicted water crisis. Groundwater banking, where surplus wet-year supplies are stored in underground aquifers, is offered as one piece of a water management strategy for averting this potential crisis.

This dissertation investigates groundwater banking programs in the Central Valley of California where imported surface-water is mixed with native groundwater, a common-pool-resource. The research seeks to determine how the introduction of imported surface-water into a groundwater basin influences the institutions governing the use of the groundwater basin in question. The dissertation also investigates the factors that influence the implementation of groundwater banking programs in California's Central Valley.

Groundwater banking is proposed as a potential component for addressing California's water needs, while avoiding a "tragedy of the commons" by sustaining groundwater resources. The Central Valley of California is identified as offering an opportunity for groundwater banking due to its geology and water conveyance systems.

The dissertation uses a modified version of the Institutional Analysis and Development framework (IAD framework) to accomplish the research, and specifically address groundwater banking. The physical uncertainties of groundwater basins, coupled with uncertainties related to California water rights and access, are proposed as significant driving forces in the development of institutions for groundwater banking. These uncertainties can be the driving forces for creating the institutional arrangements needed to implement a groundwater banking program.

The case studies review two operating groundwater banks, the Kern Water Bank and the Arvin-Edison Water Storage District groundwater banking program. The case studies also review one failed attempt to establish a groundwater bank, the Madera Ranch Groundwater Bank; and an ongoing attempt to implement groundwater banking, the Eastern San Joaquin Parties Water Authority Groundwater Bank #1.

The case studies indicate that institutional arrangements that facilitate the mix of imported surface-water and the native groundwater in a groundwater basin are those that reduce uncertainty by protecting the water rights of overlying users, provide protections for the groundwater basin, provide comprehensive monitoring, and provide for local control of the

groundwater basin. The case studies also indicate that the basic design principles for long-enduring common-pool-resource regimes also apply to groundwater banks. Trust and the local control of groundwater banking programs appear to be necessary precursors to successful groundwater banking programs in California's Central Valley.

The dissertation's findings have relevance for policy makers seeking solutions to California's water problems. Key findings include:

Local water user organizations (districts, joint powers authorities) can successfully develop programs for conjunctively managing groundwater surface water resources.

Local water user organizations can successfully establish effective operating rules and institutional arrangements to facilitate groundwater banking using imported surface water. Some of these rules and institutional arrangements include:

- 💧 Memorandums of Understanding and contractual arrangements between the water user organizations and groundwater banking participants.
- 💧 Foundational "no harm" criteria as a basis for operational arrangements ("Golden Rule" criteria).



Comprehensive monitoring arrangements for physical monitoring and for collective action related to monitoring (monitoring committees).

Operating rules for protecting the groundwater basin and the overlying users (percentage loss rules, compensation for overlying users).

State level agencies can best serve these local water user organizations by providing good scientific information on the local groundwater basin and by integrating users' local knowledge of the groundwater basin with regional information.

### Research Support:

Shui-Yan Tang, Ph.D., author of *Institutions and Collective Action: Self Governance in Irrigation* served as dissertation committee chair and advisor for this dissertation.

The Natural Heritage Institute provided the author with the opportunity to carry out the case study research as part of its Conjunctive Water Management Program, System Wide Investigation of Central Valley Conjunctive Use. The author is indebted to Mr. Gregory Thomas for his support in this research.

Nicholas A. Pinhey is currently serving as the Director of Public Works for the City of Tracy. He is a former Director of the Water Environment Federation and Past President of the California Water Environment Association. He may be reached at 520 Tracy Blvd, Tracy, CA 95376 or (209) 831-4431.

## The 9th Symposium in GRA's Series on Groundwater Contaminants: 1,4-Dioxane and Other Solvent Stabilizer Compounds in the Environment — Continued from Page 3

studies recently conducted at Moffett Field – does it emanate from the underlying solvent plume? Like the more familiar ether compound, MtBE, 1,4-dioxane is generally considered not suitable for in situ biodegradation. How does the discovery of 1,4-dioxane at solvent cleanup sites affect plans for dealing with asymptotic tailing of pump and treat systems using monitored natural attenuation or in situ bioremediation? Can stabilizers be used to distinguish different sources of the same solvents used for different purposes?

Invited speakers from across the country will profile these issues and provide a detailed examination of the stabilizers issue. We are also accepting abstracts for presentations on 1,4-dioxane, solvent stabilizers, and other additive compounds affecting existing cleanups. Please send your abstract for presentations and posters to Tom Mohr, GRA Seminar Chair, by October 17, 2003 at [tmohr@valleywater.org](mailto:tmohr@valleywater.org).

## The Law of Conjunctive Use: The Appellate Court Weighs in on Central Basin Storage — Continued from Page 4

certainty because investments in storage projects are not made for one time storage, but for cyclical storage projects involving use and reuse of a fixed quantity of storage space. Thus, the opinion leaves a critical question unanswered: Does a first-in-time rule entitle the storing entity to one-time use or to a cyclical right to use the storage space?

Moreover, if there are multiple parties storing water in the basin and the basin spills (i.e., causes water to flow out of the basin), or if water tables rise so high as to harm surface land uses or contaminate the basin's water supplies, which party is responsible? Whose water has been lost? How will storage, extraction, and other basin interests be coordinated? How will water managers avoid harm to one another and to the basin?

Given these unresolved questions, the courts will likely again address the law of conjunctive use in the near future. If the Supreme Court accepts review of the appellate court's decision, additional legal guidance may be provided in this case.



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## Perchlorate in Groundwater: Occurrence, Analysis and Treatment Highlights from GRR's Symposium — Continued from Page 1

in which low doses of perchlorate (0.007 to 0.5 mg/kg · day) were administered to human volunteers via drinking water. The effects on thyroid iodide uptake were then measured. OEHHA toxicologists assumed that approximately 80% of human exposure to perchlorate is from drinking water. An overall uncertainty factor of 30 was selected to account for differences in sensitivity in the population and other uncertainties not addressed in the Greer study.

The second speaker, Andrew Jackson, Ph.D. from Texas Tech University, provided the attendees with a glimpse at the potential scale of perchlorate occurrence nationwide. Low-level perchlorate was detected in several counties in the Texas panhandle area. Follow-up sampling to determine the extent of

perchlorate contamination resulted in a two-phase sampling plan of public water systems and private wells in nine counties. Dr. Jackson's results indicate aquifer-wide perchlorate contamination in the Ogallala Aquifer, underlying some of the nine counties. Known sources (military, industrial and

agricultural activities) are not correlated with the detections. Oil and gas exploration is widespread in the area but has not been linked with perchlorate occurrence. Other hypotheses include natural occurrence, formation in well systems due to cathodic protection systems, and formation during lightning.

The third speaker, David Spath, Ph.D., Chief of the Division of Drinking Water and Environmental Management at California Department of Health Services (CalDHS) described the California regulatory process for perchlorate. California is mandated to adopt a

perchlorate maximum contaminant level (MCL) by January 2004. To meet this deadline, CalDHS is considering adopting the MCL by emergency regulation. This would allow CalDHS an additional year to adopt a final MCL by the normal regulatory process. To place perchlorate contamination in perspective, Dr. Spath compared it to other contaminants of emerging concern, including MTBE, chromium (VI) and arsenic. Currently, perchlorate has been detected in 329 drinking water sources - more than MTBE.

The final Session 1 speaker was Andrew Eaton, Ph.D. of MWH. Since the 4 µg/L detection limit is currently driving the California action level, analytical improvements potentially have direct regulatory implications. The current US

EPA - approved method uses ion chromatography (IC) with conductivity detection (Method 314). Alternative methods include liquid chromatography coupled with tandem mass spectroscopy (LC-MS-MS) and IC with tandem mass spectroscopy (IC-MS-MS). However, these methods require expensive instrumentation.

Dr. Eaton investigated

sensitivity improvements to Method 314 including larger sample size, pre-concentration techniques and noise-reduction techniques. After presenting his results, he concluded that the development of a perchlorate-specific resin might be the key to future sensitivity enhancements of analytical techniques.

### Session 2: Treatment and Remediation

Session 2 began with a presentation from Bruce Rittmann, Ph.D., a Professor of Civil Engineering and Chemical Engineering at Northwestern University. Dr. Rittmann discussed the use of hollow fiber Membrane

Biofilm Reactors (MBR) to reduce perchlorate. The system achieves reduction by supplying bacteria with a membrane surface to stimulate growth and with hydrogen gas. Bacteria use the hydrogen gas as an electron donor to extract energy from perchlorate and other oxidized compounds, producing water and harmless chloride ions. The system has achieved removal efficiencies of 95% removal of perchlorate at an influent concentration of 60 µg/L. MBRs are operated so that hydrogen gas is the rate-determining factor in biological reduction; therefore, effluent concentrations are determined by hydrogen pressure. A 1.5-gpm pilot-scale MBR system is currently operating at La Puente, CA.

Peter Ritchey from Calgon Carbon Corporation described a variety of ion exchange system designs, including single-use versus regenerated resins and fixed-bed versus moving-bed reactor configurations. Single-use systems are costly to operate but may be the preferred option for sites that do not have disposal options for the brine produced during the regeneration process. Moving-bed reactors have a higher initial capital cost, but offer the advantage of producing consistently high-quality water over time. Calgon Carbon has pioneered several ion exchange technologies and currently has operating perchlorate ion exchange systems at several California locations, including La Puente, San Gabriel Valley, City of Riverside and California Domestic Water Company. Technology developments driven by the recent attention to perchlorate contamination include a high capacity perchlorate resin that was developed at Oak Ridge National Laboratory and is now commercially available.

During lunch, Colonel Daniel Rogers, Chief of Environmental Litigation & Legal Affairs, U.S. Department of Defense (DOD) gave a presentation. Colonel Rogers showed a brief public relations video to the group and emphasized the proactive role that the DOD has taken in researching perchlorate health effects and working cooperatively with other agencies. Colonel Rogers noted DOD's responsibility to taxpayers to use cleanup funding wisely.



*David Spath, Ph.D., of Cal DHS, discusses the regulatory process for perchlorate*

After lunch, William J. Guarini of Shaw Environmental and Infrastructure, Inc. described ex-situ and in-situ biological methods for degrading perchlorate. Ex-situ applications of fluidized bed bioreactors (FBRs) have been demonstrated at Aerojet, Longhorn Army Ammunition Plant and at a Navy site. FBRs successfully treat more than 7.0 MGD of perchlorate-contaminated groundwater and can meet effluent concentrations of less than 4 µg/L. In-situ perchlorate biodegradation is the topic of a current SERDP project. Preliminary results indicate that perchlorate-reducing bacteria are widespread in the environment, that biodegradation can be stimulated by adding electron donor materials such as acetate or lactate (using a field-tested horizontal flow treatment well delivery system) and that common electron acceptors such as sulfate and ferric iron do not inhibit perchlorate degradation.

### Session 3: Perchlorate in California — Case Studies

Alex MacDonald from the Central Valley Regional Water Quality Control Board updated the group on Aerojet site activities. Recent developments include the discovery of an additional area of contamination north of the site. The extent of contamination is currently being determined. The nearby City of Rancho Cordova is short on water due to closure of 13 water supply wells contaminated by perchlorate. The site is currently operating a 2500-gpm groundwater treatment system that discharges to the American River. Recent litigation over rights to the treated groundwater has ensued.

Perchlorate contamination affecting the City of Rialto, CA was the next topic. Brad Baxter, Public Works Director and Sheri Lasick of Sylvir Consulting, presented the City's story. The City's water is entirely supplied by 13 groundwater wells. Five of the wells were taken out of service due to perchlorate detections ranging from 4.6 to 74 µg/L. The loss to City water supplies was 10,200 gpm (14.6 MGD). The City of Rialto has identified several potentially responsible parties by investigating former missile manufacturing and storage sites in the area. Two weeks after declaring a water shortage emergency, the City had conserved water usage by 70%, by

working with residents on various conservation measures. Economic impacts to the City include the disruption of a major freeway construction project and loss of future growth due to water shortages. Mr. Baxter emphasized that litigation was not in the best interests of any of the concerned parties. Ms. Lasick has investigated funding sources to aid the City in maintaining water supplies, investigating contamination and identifying potentially responsible parties.

Evan Cox from GeoSyntec Consultants presented in-situ bioremediation applications for perchlorate reduction. Biobarriers have been used at sites such as Aerojet, Longhorn Army Ammunition Plant and McGregor Naval Weapons Industrial Reserve Plant. Mr. Cox presented design considerations such as plume width and depth; the frequency, method and type of electron donor supplied; and control of biofouling. In-situ bioremediation of soil hot spots was achieved by layering wet composted manure over the area to create an anaerobic environment while providing water and nutrients to perchlorate-degrading bacteria. Reduction ranged from 71% to 99.9%.

### Session 4: Panel Discussion

Panel members included Gary Carlton from the State Water Resources Control Board,

Steven Hoch, Esq. from the Hatch and Parent Law Firm, Dr. Spath from CalDHS and Mark Beuhler from the Metropolitan Water District. Panelists and audience participants discussed the larger context of perchlorate contamination, including legal, regulatory and technical challenges. The role of the precautionary principle in setting standards for emerging contaminants with unknown health effects was discussed. Water rights issues and the role of the RWQCB in moving towards conjunctive regulation of groundwater and surface water was also discussed. Finally, our limit as a society in regulating drinking water to lower and lower levels at increasing costs was presented for future thought.

This symposium was conducted by GRA in cooperation with the International Association of Hydrogeologists, the Association of California Water Agencies, Water Education Foundation, and the Strategic Environmental Research and Development Program & ESTCP Program Office. The event was co-sponsored by Alpha Analytical, Inc., Dionex Corporation, Geomatrix Consultants, Malcolm Pirnie, Pat Chem Laboratories, Shaw E&I, and US Filter. Additional information on the symposium, including binders with speaker contact information, slides, abstracts, and supplemental information can be purchased from GRA at (914) 446-3626. 💧

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## The Role of Groundwater in Integrated Water Management – Continued from Page 3

of Hydrogeologists, National Ground Water Association, and the National Resources Section of the California State Bar.

The keynote speaker will be Dr. Chip Groat, Director of the US Geological Survey. Dr. Groat will outline recent programs and publications of the USGS that address water resource issues, including groundwater sustainability, groundwater monitoring for long-term management of resources, importance of water availability assessment, and goals for the nation to collect and disseminate information for water resources management and planning.

A partial listing of talks and sessions offered is below. For the complete program, or for more information, visit these web sites: [www.grac.org](http://www.grac.org) and [www.waterresources.ucr.edu](http://www.waterresources.ucr.edu). Or contact Pamela Dick at the UC Center for Water Resources (CWRES@ucr.edu) or (909)787-4327.

### Tuesday, October 28

**8:15 – Welcome and Opening Remarks**  
Henry J. Vaux, Jr., Associate Vice President, Agriculture and Natural Resources, University of California

**8:30 – Groundwater and Surface Water: A Single Resource**  
Chip Groat, Director, U.S. Geological Survey

**9:00 – Water Follies: The Impact of Groundwater Pumping on the Environment**  
Robert Glennon, Morris K. Udall Professor of Law, University of Arizona, Author, *Water Follies: Groundwater Pumping and the Fate of America's Fresh Waters*

**9:30 – Worldwide Groundwater Banking**  
Anthony Saracino, Principal, Saracino-Kirby-Snow

**10:00 – Groundwater in California: Bulletin 118**  
Jonas Minton, Deputy Director, California Department of Water Resources

#### TRACK 1

**Session: Regulatory and Legislative Actions that Affect Groundwater**

Moderator: Leah Walker, Senior Sanitary Engineer, Drinking Water Technical Programs, California Department of Health Services.

**12:00 Lunch – Joint Session**, Protecting Groundwater, Art Baggett, Chair, State Water Resources Control Board

**Session: What's in a Good Groundwater Management Plan?**

Moderator: Carl Hauge, Chief Hydrogeologist, California Department of Water Resources

**Session: Integrated Water Management**

Moderator: Tim Parker, Senior Hydrogeologist, California Department of Water Resources

### Wednesday, October 29

#### TRACK 1

**Session: Tools to Help Quantify**

Moderator: Vicki Kretsinger, Principal Hydrologist, Luhdorff and Scalmanini Consulting Engineers

**Session: Working with the Public**

Moderator: Rita Schmidt Sudman, Executive Director, Water Education Foundation

**10:30 – Panel Discussion: Facilitating Public Input**

- John Rossi, Chief Executive Officer, Chino Basin Watermaster
- Virginia Grebbien, General Manager, Orange County Water District
- Lucy Eidam, President, Lucy & Company
- Jennifer Bowles, Reporter, The Press Enterprise (invited)
- Jeff Loux, Director, Land Use and Natural Resources Program, University of California, Davis, Extension

**Noon: Lunch Joint Session**

The Search for Water and Life on Mars, NASA scientist invited

**1:00 – Groundwater Resources Association of California Meeting and Awards**

**Joint Session: Transboundary Issues**

Moderator: Andrew Chang, Associate Director, UC Center for Water Resources

### Tuesday, October 28

#### TRACK 2

**Session: Emerging Contaminants**

Moderator: Eric Reichard, Supervisory Research Hydrologist, San Diego Field Office, U.S. Geological Survey

**Session: Desalination**

Moderator: James Giannopoulos, Chief, Clean Water Program, State Water Resources Control Board

**Session: Management of Waste Water**

Moderator: Sue McClurg, Program Director, Water Education Foundation

### Wednesday, October 29

#### TRACK 2

**Session: Transport and Fate of Contaminants**

Moderator: Sarah Raker, Engineering Geologist, San Francisco Regional Water Quality Control Board

**Session: Calculating a Groundwater Budget**

Moderator: Peter Martin, Hydrologist, U.S. Geological Survey

### Registration, Location, and Other Conference Information

The special early registration fee is \$195 for those registering by October 12. Late (after October 12) and on-site registration is \$250. Students are \$65. For hotel reservations, call (800)222-8733 or direct, (909)937-0900. Or log onto [www.doubletreehotels.com](http://www.doubletreehotels.com) (Ontario, CA). Until September 29 we have secured a special room rate of \$95 a night (plus taxes and surcharges). By phone, mention that you are attending the Groundwater Conference. On line, use Group/Convention code BGW. 💧



## Current Happenings at the U.S. Environmental Protection Agency –

Continued from Page 8

advancements in the research and application of perchlorate treatment technologies, these resources provide up to date information in a number of formats including treatability studies, cost and performance reports, case studies, presentations, and peer reviewed literature. View and download the perchlorate remediation resources on CLU-IN at <http://clu-in.org/perchlorate/>.

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*John Ungvarsky is an Environmental Scientist at the U.S. Environmental Protection Agency, Region 9. He works in the Water Division's Ground Water Office, and his responsibilities include Animal Feeding Operations Coordinator and Source Water Protection, with an emphasis on ground water issues. For information on any of the above topics, please contact John at 415-972-3963 or [ungvarsky.john@epa.gov](mailto:ungvarsky.john@epa.gov).* 💧

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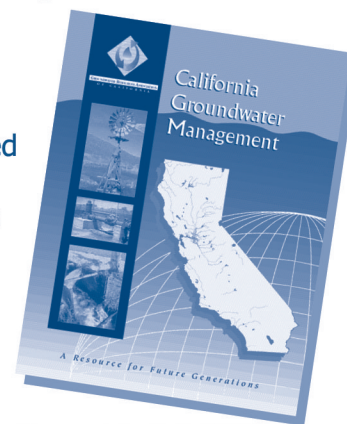
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## Sacramento Branch Highlights

BY STEVE PHILLIPS

On May 17, 2003, the Sacramento Branch held the second Aerial Photography Interpretation Workshop at the Red Lion Inn in Sacramento, California. The workshop was designed to train attendees on how to use stereo glasses to interpret stereo aerial photographs for environmental projects. Features that were covered in the hands-on part of the workshop included gas stations, landslides, flood inundations, faults, metals shop, industrial development and airports. This second workshop differed from the first in that it included both beginning and advanced questions for students at various levels of experience. Dr. Brian Hausback, Geology Chair at California State University, Sacramento was the lead instructor. Dr. Hausback began the workshop with a presentation on the history and use of aerial photography. John Burgess, Project Manager of Cartwright Aerial Photography Surveys, was also an instructor for the workshop. Mr. Burgess gave a presentation on digital aerial photography and its use in photo interpretation. Volunteers acted as teacher's assistants (Eric Price, John Burgess, David Von Aspern, Steve Lofholm, Roy Kroll, Patrick Fischer, and Linda Sinderson) to provide direction and hands-on guidance to students at each of the photo stations. Barbara Heinsch played a key role in organizing the event.

The speaker for the June Branch meeting was James Taylor, with the Central Valley Regional Water Quality Control Board's Federal Facilities (DoD) Unit in Sacramento, who presented information on the use of polyethylene diffusion bag (PDB) samplers for collecting volatile organic compounds (VOCs). James is an Associate Engineering Geologist and has been providing regulatory oversight of cleanup projects for over 10 years, including the former Mather and Mc Clellan Air Force Bases. PDB samplers are heat-sealed polyethylene flat tubes filled with DI water,

and are suspended in a well for a minimum of 2 weeks. VOCs in groundwater flowing through the screen where the sampler, or a string of samplers is hung, diffuse into the bag until concentrations in the bag reach equilibrium with those in the well. This method is appropriate for a wide range of VOCs, and is designed for long-term monitoring. The samplers are inexpensive, easy to deploy, and no pumps are involved. Results from side-by-side tests of PDB samplers and standard sampling methods in 33 wells at the former Mc Clellan AFB suggest that PDB samplers are a viable alternative for sampling a variety of VOCs. See the Web site "ITRCweb.org" for more information.

A special meeting on July 30, 2003, in conjunction with GRA's Perchlorate Symposium, featured "The San Martin Perchlorate Problem: Leveraging Local Government Resources for Rapid Response," by Thomas Mohr. Tom is the Solvents and Toxics Cleanup Liaison for the Santa Clara Valley Water District, where he provides stakeholder oversight for more than 100 solvents plumes. He is also a Director of GRA and a past president of the Sacramento Branch. 💧

## San Francisco Bay Branch Highlights

BY GARY FOOTE, PRESIDENT

The San Francisco Branch has been very active during the first half of 2003. The March Branch meeting was held in Oakland and the speaker was David Hanson, the NGWA 2003 McEllhiney Distinguished Lecturer. The title of Dave's presentation was "Introduction to the Year of the Professional." Dave delivered a very interactive and inspirational talk about the keys to success in the professional services business. Thanks to Jim Ulrich for making the arrangements.

The April Branch meeting was held in San Jose and it featured two presentations on perchlorate in public drinking water aquifers. Dr. W. Andrew Jackson, Assistant Professor of Civil Engineering at Texas Tech

University, spoke about the occurrence of perchlorate in groundwater aquifers in the panhandle of Texas. Tom Mohr and Jim Crowley from the Santa Clara Valley Water District spoke about the San Martin perchlorate groundwater plume and the District's public outreach program to address the impacted community. The District also presented information about its study of perchlorate in unburned highway safety flares. Nearly 90 people attended the meeting, making it one of the best-attended South Bay meetings ever. Kudos to Mark Wheeler, South Bay coordinator, for organizing the meeting.

Dr. David Keith Todd, one of the world's premier groundwater hydrogeologists, was the speaker at the May Branch meeting in Oakland. Dr. Todd is Professor Emeritus at the University of California, Berkeley, author of the classic textbook Groundwater Hydrology, and founder of the consulting firm Todd Engineers. Dr. Todd spoke about the interaction of surface water and groundwater, and how groundwater pumping can have unanticipated, far-reaching impacts. About 70 members attended the meeting. David Abbott and Bill Motzer made the arrangements for the speaker.

Professor Joseph Sax, one of the foremost authorities on water law, spoke at the July Branch meeting in Oakland. Professor Sax is the House & Hurd Endowment Professor Emeritus at the University of California, Berkeley. He is the author and co-author of numerous books and articles on water rights, public lands, and property rights. Professor Sax spoke about the many practical and legal challenges that can be expected with conjunctive use of water. Nearly 70 members attended the meeting. Thanks to Mary Morkin, Branch secretary, for making the arrangements.

J.C. Isham, Branch Vice President, has completed assembling the details for the Branch's student scholarship program. The Branch intends to award a "book scholarship" to each of five Bay Area universities. The program will be launched in time for the fall semester. 💧

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# Dates & Details

## GRA MEETINGS AND KEY DATES

(Please see page 3 or visit [www.grac.org](http://www.grac.org) for detailed information, updates, and registration unless noted)

GRA Symposium, Subsurface Vapor Intrusion to Indoor Air	September 30, 2003 San Jose, CA October 1, 2003 Long Beach, CA	GRA Board Meeting	November 8, 2003 Emeryville, CA
24th Biennial Groundwater Conference/ GRA 12th Annual Meeting	October 28-29, 2003 Ontario, CA	GRA Symposium, 1, 4 Dioxane and Other Solvent Stabilizer Components in the Environment	December 10, 2003 San Jose, CA



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