

# HYDRO VISIONS



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GROUNDWATER RESOURCES ASSOCIATION  
OF CALIFORNIA

Winter 2003

## "Subsurface Vapor Intrusion to Indoor Air: When is Soil and Groundwater Contamination an Indoor Air Issue?"

BY JIM STRANDBERG, MALCOLM PIRNIE

GRA's eighth symposium in the Groundwater Contaminant Series drew a total of 419 attendees at two locations (260 in San Jose and 159 in Long Beach) during back-to-back days on September 30 and October 1, 2003. Cooperating agencies assisting with the symposium were Cal/EPA Department of Toxic Substances Control (DTSC), San Francisco Bay Regional Water Quality Control Board (RWQCB), and U.S. EPA, Region 9. Attendees included regulators, industry professionals, consultants, lawyers, students, and interested citizens. The exhibit hall had 10 booths with companies offering various services pertaining to soil gas collection, analysis and consultation.

Prior to the symposium in San Jose, GRA's San Francisco Bay Area Branch held a dinner meeting featuring Roger Brewer of the San Francisco Bay RWQCB. His talk, entitled "RWQCB'S Newly Issued Environmental Screening Levels: New

Indoor Air and Soil Gas Screening Levels and Other Updates," provided a perfect introduction for the September 30 symposium.

GRA Directors Brian Lewis, Symposium Chair/ Moderator and Tom Mohr, GRA Seminar Chair, opened the symposium by welcoming the attendees and thanking the cooperating agencies, speakers, co-sponsors, and exhibitors. Brian provided an overview of the relevance of indoor air issues on a statewide basis. The goal of the symposium was to provide all parties with DTSC's and the RWQCB's perspective, and, in turn, solicit feedback from the attendees on this evolving subject. The symposium was organized into eight presentations, followed by a panel discussion.

The first presentation, with the theme of "Overview of Why Indoor Air is an Issue: The California Perspective," was given by two speakers: Roger Brewer, Ph.D., San Francisco Bay RWQCB; and David Berry, Ph.D., DTSC. In his presentation, Indoor Air Vapor Intrusion: SF Bay RWQCB Perspective (Is the Fog Lifting?), Dr. Brewer provided an overview of the magnitude of the potential problem in the San Francisco Bay Area. Heating systems, basements, and strong winds can exacerbate vapor intrusion by reducing the internal air pressure and creating a vacuum effect that enhances advective flow from underlying soils into buildings. Direct collection and

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analysis of indoor air samples is complicated by the presence of the same chemicals in many household goods (e.g., aerosol sprays, dry-cleaned clothing, cleaners, etc). Indoor air sampling is sometimes impractical due to the intrusive nature of the sampling in individual residences as well as the size of the plumes and number of structures potentially affected. As an alternative, the San Francisco Bay RWQCB has developed conservative screening levels for the evaluation of potential vapor intrusion and indoor air impact concerns. Screening levels for soil gas, soil and groundwater based on the use of the Johnson and Ettinger Model (JEM), are provided in the document, "Screening For Environmental

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

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# President's Message

BY JIM CARTER

I am writing my President's Message as I am preparing for the November Board Meeting, both my last ones as your President. It has been a tremendous honor and privilege to serve as your President these last two years. I am really excited what GRA has achieved in the past and what the Board of Directors, Branch Presidents and I have been able to accomplish these last two years. I would especially like to thank Vicki Kretsinger, Martin Steinpress and Tim Parker for their ongoing and tireless efforts. I also want to personally thank Kathy Snelson, GRA Executive Director, for her guidance, vision and patience as the association has grown. I also look forward to supporting Tom Johnson as he takes over the Presidency in January, and I am confident he will be an outstanding President.

GRA has had many achievements this year and have set several milestones, starting off with our conferences. We have gained a reputation for organizing top-quality conferences on timely subjects. When I was planning the first of our Series on Groundwater Contaminants, I felt GRA could take a leadership role in informing our industry with the latest and best scientifically-based information—especially in areas that are new, such as the emerging chemicals. I also felt it was important for regulators, consultants and affected private companies to have the opportunity to sit side by side, rather than across the table, on the new issues and challenges posed by emerging chemicals to our water quality and water supply. I am proud of the fine work that Tom Mohr and the rest of the Seminar Committee have been doing and I think we have been successful in meeting these goals.

The conference "Perchlorate in Groundwater: Occurrence, Analysis and Treatment" was the most financially successful conference GRA has organized to date, kudos to Tom Mohr, Rula Deeb and

their committee. Congratulations also to Brian Lewis and his committee as GRA also held our best attended conference, on "Subsurface Vapor Intrusion to Indoor Air" that had over 400 attendees combined in San Jose and Long Beach. We also held conferences this year on Artificial Recharge, Model Calibration using PEST, as well as our Lobby Day and Annual Meeting. GRA also has one more symposium scheduled for this year, "1,4-Dioxane and Other Solvent Stabilizers in the Environment", December 10th in San Jose.

GRA membership is at an all-time high of over 925 members, up from 684 members in 2001. I am especially gratified by our growth as an indicator that we are on the right track with the association. It was my personal goal when I started my term to focus on membership and to reach 1000 members by the end of my presidency. Although we may fall short of 1000, I am very pleased at how far we have come.

GRA will also have published the Second Edition of the Groundwater Manual before the year is out. I know you will all be pleased with the update of our very popular and informative manual. Last year we developed our on-line GRA Membership System, making it easier to renew your membership online and easier for GRA to track and keep organized. GRA has also made significant progress in meeting our mission in informing and influencing our State Legislators on issues affecting groundwater.

During my tenure, I felt the association had gained a critical mass and the Board of Directors needed to grow and change as GRA has. Historically, the Directors and Branch Presidents have been the "do-ers" relying mostly on ourselves to run the organization. Now, with our size and stature, the Board has been transitioning to a more professionally run organization with a greater reliance on our Committees and our contracted services. Over the

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## EXECUTIVE OFFICERS

President, Jim Carter  
EMAX Laboratories, Inc.  
Tel: 310-618-8889, ext. 105  
Email: [jcarter@emaxlabs.com](mailto:jcarter@emaxlabs.com)

Vice President, Thomas M. Johnson  
LFR Levine Fricke  
Phone: 510-652-4500  
Email: [tom.johnson@lfr.com](mailto:tom.johnson@lfr.com)

Treasurer, David Von Aspern  
Wallace Kuhl & Associates, Inc.  
Tel: 916-372-1434  
Email: [dvonaspern@wallace-kuhl.com](mailto:dvonaspern@wallace-kuhl.com)

Secretary, Paul Dorey  
Vista Irrigation District  
Tel: 760-597-3140  
Email: [wn6k@cts.com](mailto:wn6k@cts.com)

## DIRECTORS

David Abbott, Todd Engineers  
Tel: 510-595-2120  
Email: [jorysue@msn.com](mailto:jorysue@msn.com)

Susan Garcia, Colin L. Powell Academy  
Tel: 310-631-8794  
Email: [ssgarcia55cs.com](mailto:ssgarcia55cs.com)

Jim Jacobs, Environmental Bio-Systems, Inc.  
Tel: 415-381-5195  
Email: [augerpro@sbcglobal.net](mailto:augerpro@sbcglobal.net)

Vicki Kretsinger, Luhdorff & Scalmanini  
Tel: 530-661-0109  
Email: [Vkretsinger@lsce.com](mailto:Vkretsinger@lsce.com)

Brian Lewis  
Cal/EPA, Dept. of Toxic Substances Control  
Tel: 916-255-6532  
Email: [blewis@dtsc.ca.gov](mailto:blewis@dtsc.ca.gov)

Tom Mohr, Santa Clara Valley Water District  
Tel: 408-265-2607  
Email: [tmohr@valleywater.org](mailto:tmohr@valleywater.org)

Tim Parker, CA Department of Water Resources  
Tel: 916-651-9224  
Email: [tparker@water.ca.gov](mailto:tparker@water.ca.gov)

Bill Pipes, Geomatrix Consultants, Inc.  
Tel: 559-264-2535  
Email: [wpipes@geomatrix.com](mailto:wpipes@geomatrix.com)

Scott Slater, Hatch and Parent  
Tel: 805-963-7000  
Email: [sslater@hatchparent.com](mailto:sslater@hatchparent.com)

Martin Steinpress, Brown & Caldwell  
Tel: 925-937-9010  
Email: [msteinpress@brwncald.com](mailto:msteinpress@brwncald.com)

Jim Strandberg, Malcolm Pirnie, Inc.  
Tel: 510-735-3020  
Email: [jstrandberg@pirnie.com](mailto:jstrandberg@pirnie.com)

Robert A. Van Valer, Roscoe Moss Company  
Tel: 323-263-4111  
Email: [ravanvaler@earthlink.net](mailto:ravanvaler@earthlink.net)

## EXECUTIVE DIRECTOR

Kathy Snelson  
(916) 446-3626 - Email: [executive\\_director@grac.org](mailto:executive_director@grac.org)

## EDITOR

Floyd Flood  
Email: [editor@grac.org](mailto:editor@grac.org)

## WEB AND DATABASE MANAGER

Kevin Blatt, ihappi Web Design  
Tel: (510) 845-9623 - Email: [grac@inreach.com](mailto:grac@inreach.com)

## Upcoming GRA Events - 2004

BY TOM MOHR,  
GRA SEMINAR CHAIR

GRA is looking forward to its final event of 2003, **"1,4-Dioxane and other Solvent Stabilizers in the Environment"** to be held December 10 at the Doubletree Hotel, San Jose. This seminar will profile 1,4-dioxane releases in a variety of industry and hydrogeologic settings, and how this contaminant, most commonly present where releases of 1,1,1-trichloroethane occurred, is being addressed in remedial actions. Speakers from across the country will be on hand to profile case studies, the debate of 1,4-dioxane's carcinogenicity, and treatment technologies. A survey of 1,4-dioxane occurrence at San Francisco Bay Area solvent release sites will be featured, and a panel discussion will focus on the recurring theme of the legal and regulatory policy aspects of managing unregulated contaminants in remedial action projects and water utilities.

GRA is looking forward to another eventful year. Surveys of branch officers, directors, and members have indicated that the events we're planning for 2004 will serve members' interests well. We welcome your ideas for seminars and workshops. All of GRA's activities are organized by volunteers. If you wish to contribute your time and energy to assisting with the planning of GRA's events, please e-mail us.

Our first major seminar in 2004 will focus on **"Investigation and Remediation of Dry Cleaner Release Sites"**, to be held in Sacramento, tentatively set for April 1, 2004. The well-documented potential for dry cleaners using perchloroethylene to impact soil and groundwater has not been met with a commensurate regulatory response for water quality protection. Typically, dry cleaner releases are only discovered in the course of Phase II investigations for property transactions, or

when PCE shows up in a nearby groundwater investigation, for example, at fuel leak sites. Unfortunately, in too many instances, the first indication of a dry cleaner release has been detection of PCE in water supply wells. While dry cleaners are held to stringent regulatory standards for air emissions, sewer discharges, and hazardous materials handling, there are currently no California regulations requiring ongoing monitoring of groundwater to detect releases from dry cleaners.

When PCE is detected in a supply well or on a neighboring property, it can be very difficult to attribute the release to a specific dry cleaner. PCE is used by many businesses, including automotive maintenance, printing, electronics manufacturing, and high temperature degreasing for various metal fabricating businesses. Dry cleaners have occupied many locations, sometimes for only a few years before moving to a new location, leaving multiple potential sources. Even as equipment upgrades and improved solvent handling practices have led to major improvements in minimizing solvent losses, a number of avenues remain by which PCE may escape operating dry cleaners.

This seminar will focus on technologies for rapid and effective screening and subsurface characterization of former and current dry cleaning operations, forensic techniques for identifying contributors to PCE contamination, and a wide variety of innovative technologies for the remediation of PCE releases from dry cleaners. Case studies will be featured representing the gamut of challenges dry cleaners pose for consultants and regulators alike. The Santa Clara Valley Dry Cleaner Study will present a county-wide view of dry cleaner impacts, and a panel discussion will include regulators, consultants, attorneys, water purveyors, and dry cleaning industry representatives. A featured presentation will profile the Lodi dry cleaner cases. A call for abstracts

## Upcoming Events

will be announced in early December; check GRA's website for updates. Depending on the success of the April 1 seminar, a second event focusing on Dry Cleaners may be held in Los Angeles in November, 2004.

Three workshops are planned for 2004. GRA is planning to hold a workshop on **Low Yield Aquifer Testing** in April or May, to be held in both northern California and Southern California. A workshop on **Calculating Aquifer Storage** is being planned for May 2004 in cooperation with USGS and the Department of Water Resources. Finally, a workshop on **Characterization and Remediation of DNAPL Source Zones** is being planned, to be taught by leading academic and consulting hydrogeologists. Full information on these events will be posted in December 2003.

**Perchlorate 2004** will be the title of GRA's next perchlorate symposium. The demand for current information on perchlorate has only grown since GRA staged its first two highly successful perchlorate events. "Perchlorate 2004" will be held in Glendale in June 2004. The planning committee for this event is now forming. Please contact us by e-mail or phone if interested.

The level of commitment to organize a seminar involves participating in teleconferences at least monthly, contributing your ideas, soliciting speakers, designing the program, and providing logistical requirements to GRA staff, Loretta Kinnicutt and Mary Megarry. They also take care of hotel arrangements, binder preparation, and the countless other logistical details that make GRA's events successful. A Call for Papers and Posters will be announced on GRA's web site in mid-December. To participate in GRA's seminar planning, send an e-mail stating your interests and providing your full contact info to: [tmohr@valleywater.org](mailto:tmohr@valleywater.org), or call Tom Mohr at 408-265-2607 x3760. 💧

# "California Groundwater Management" Handbook scheduled for release in December, 2003

The second edition of the "California Groundwater Management" handbook, a reference book and guidance manual published by the Groundwater Resources Association (GRA), is scheduled to be released in December 2003. Handbook chapters include a systematic guide on preparing groundwater management plans and local wellhead protection programs, as well as reference material on California hydrogeology and groundwater quality. The handbook also provides an extensive discussion of the political, institutional, legal, and technical issues that are part of the groundwater management process.

The handbook is intended to be used as: 1) a reference for public officials who need a fundamental understanding of groundwater issues as they determine policies for the comprehensive management of water resources, and 2) general guidelines for the hands-on development of groundwater management plans.

The regular handbook cost will be \$35 for GRA members and \$45 for non-members. To order the handbook, use the publications order form at the GRA web site — [www.grac.org](http://www.grac.org). 💧

## Technical Corner

### GRA TECHNICAL COMMITTEE REPORT

BY JIM JACOBS

The GRA Technical Committee has been busy recently taking the existing papers and articles on the GRA web site and organizing them. In an effort to focus the formats, the existing articles and papers were reviewed and placed into one of four categories: overview articles, technical papers, position papers and recommended reading from outside organizations.

#### Description of GRA Articles and Papers:

**Overview Articles:** 2-5 pages of what we know, what we don't know, and what we need to know about a subject. A "quick read" or fact summary of a subject, these papers are useful for someone trying to get up to speed on the issues. These papers should have references and web links. Current articles include MTBE, hexavalent chromium and low concentrations of organic chemicals in the hydrologic system. These papers are in a PDF file form.

**Technical Papers:** These detailed papers go into significant depth on a specific topic. These papers can be 10 pages to over 100 pages. The topics currently on the web site include developing, managing and sustaining the state's groundwater resources and a GRA Advisory regarding active soil gas investigations. Both papers are in the PDF file form.

**Position Papers:** These papers can be one or two pages or more detailed, as needed. They reflect a position of the organization on a technical subject. Press releases would fit into this category. These policy papers may relate to controversial issues and are a

way for a GRA board of directors to disseminate the information to the rest of the GRA membership or to the outside. Currently there are position papers related to MTBE; New papers will be considered.

**Recommended Reading from Outside Organizations:** These articles are from other organizations or agencies. These general interest papers might include papers from the water board or the U.S. EPA. Frequently these papers relate to some technical issue that the GRA membership might find useful and meaningful. Several interesting papers include topics such as NDMA-related activities, hexavalent chromium and environmental data quality. The papers are in the PDF file form.

#### New Technical Articles Sought

Over the next six months, overview papers on arsenic, perchlorate, indoor air, and other topics are being planned. Some of these topics are related to GRA seminars, while others are related to controversial environmental topics. The Technical Committee requests topic and article suggestions from the membership.

Anyone wishing to join the Technical Committee should contact the author at [augerpro@sbcglobal.net](mailto:augerpro@sbcglobal.net)

*Jim Jacobs is the Technical Committee Chair and is on the GRA Board of Directors. He is a hydrogeologist for Environmental Bio-Systems, Inc.* 💧



# Peering into California's Water Future: California Water Plan Update 2003 (Bulletin 160)

BY SARAH GOLDBERG, CENTER FOR COLLABORATIVE POLICY

On the surface, coming up with a long term water plan for a state as enormous and diverse as California seems not only daunting but like an exercise in frustration. With the nation's most prolific agricultural sector, not to mention the world's fifth largest economy, California's water needs are immense. By the year 2030 California's population is expected to grow by more than 17 million. Add in other factors, like planning for uncertainties such as droughts, potential climate change impacts, or catastrophic events, and coming up with a water plan that peers into the future becomes even more of a challenge.

Given these challenges, how could the California Department of Water Resources, mandated by law to update its water plan every 5 years, come up with something "useful"? Defining the purpose of the California Water Plan Update was relatively easy: State policy and decision makers need a strategic water plan, planners need guidance for managing and developing California water, and there is the need for a framework for investing public funds. The hard part was figuring out how to approach it all.

Given the diverse opinions on water planning around the state how do you take the concerns of passionate growers, environmentalists, tribal representatives, rural and city planners all into consideration?

The answer? Put them all at the same table. It's a process called collaboration. Beginning in 2000, the DWR set out on a new planning approach for the Update- a combination of strategic planning and strong public participation based on an open and transparent process seeking collaborative recommendations. This has resulted in substantial reformulation of the planning process used for development of the current edition of the Update. The approach also reflects the state's affirmation that the regions are the front line for planning.

The engine driving this approach continues to be the 65-member public Advisory Committee, which meets regularly and is comprised of representatives from across the state. The Department also created the Extended Review Forum open to everyone to further invite input and share information through emails and public briefings.

The draft California Water Plan Update 2003 will be released at the end of 2003. Here's a brief summary of what you will find in the plan:

- 💧 **Water Portfolios** – estimates of water supplies and uses for recent years using actual data.
- 💧 **Regional reports** – descriptions of conditions, challenges, responses and planning efforts for the hydrologic regions in California (based on Senate Bill (SB) 672-Machado)
- 💧 **Multiple scenarios** – consideration of several plausible "futures" to account for uncertainties and risks (not single forecast)
- 💧 **Diverse strategies** – Assessment of potential benefits, costs, implementation issues and solutions for two dozen resource management

## Technical Corner

strategies (using the 3E's — economics, environment, equity)

Packed into four volumes, the Update aspires to be useful on multiple levels. Of course planning for the future is not a perfect science. Challenges the Advisory Committee has had to deal with include: significant data and information gaps; modeling tools not yet fully developed, documented or tested; and the need for significant resources and time to develop the new collaborative process and planning framework. Additionally, the State's budget crisis has reduced the Department's staff and budget for Water Plan activities. Still, with the input of hundreds of people from diverse communities the new planning framework is exciting many around the state. To see the draft as well as details and timelines for addressing the limitations go to the website: [www.WaterPlan.water.ca.gov](http://www.WaterPlan.water.ca.gov)

*Sarah Goldberg is with the Center for Collaborative Policy, part of CSU Sacramento, which is providing facilitation assistance to DWR on this project. 💧*

# Legislative Update and Year in Review

AS OF NOVEMBER 1, 2003

**A**nother extremely busy year has passed, and GRA continues to implement its primary objectives in the legislative arena, including:

Actively participating in crafting statewide water policy concerning the development, management and protection of the state's groundwater resources, soil and groundwater remediation, and environmental assessments.

Gaining continued recognition by the legislature as an authority and resource on technical groundwater issues.

Taking a proactive leadership role in communicating the needs and values of our membership to government officials and the public.

While the vast majority of the 2003 Legislative Session was consumed by the state budget deficit and recall election, GRA continued to educate and provide technical information to the Legislature on groundwater resource issues and follow and/or lobby a number of bills that were signed into law. In spite of all that was going on last year, there were still a large number of groundwater bills and issues that made it through the legal machinery, or transformed into the two-year track. This article is to provide you with an update on 2003 GRA accomplishments, and a report on significant legislation. Bills that are "chaptered" have been signed into law by the Governor and will be effective on or before January 1, 2004; "two year bills" are expected to be brought up again in early 2004. Due to space considerations in this publication, the current summary and status of significant bills are posted on the GRA website.

## California Legislative Corner

### 2003 Legislative Accomplishments and Overview

Over the past year, the Legislative Committee and your Legislative Advocates drafted and obtained Board approval of Legislative Guidelines to assist our ongoing legislative efforts, whether through pending bills or groundwater related legislative committees. The Guidelines — which address broad policy principles, including groundwater management, water quality protection, watershed management and groundwater funding issues — are posted on the GRA website.

As part of another highly successful annual Legislative Symposium and Lobby Day, GRA members made visits to nearly two dozen legislators and staff and conducted a 2-hour staff briefing attended by more than a dozen staff members from the water and health committees. We are continuing to grow our efforts at the capitol, and are already planning our annual legislative day at the capitol for May 2004. Watch for an announcement soon and hopefully you will be able to join us next year.

Our Legislative Advocates and Committee members also organized and made presentations to the Assembly Select Committee on Water Reliability, Storage and Management and at a series of Assembly Select Committee Groundwater Quality and Availability hearings. These hearings included technical discussions on basic groundwater concepts, life cycle of contaminant/fate & transport, and a focused hearing on the contaminant, perchlorate. Additional hearings are planned in the next several months to cover the topics of groundwater law/management, and results of the AB 599 report and recommendations.

GRA also participated in the National Ground Water Association's Annual Washington DC Fly-in.

Typically the process is dominated by well drilling companies and well manufacturers. Although there were only a handful of groundwater scientists visiting members of Congress in 2003, we have hopes this number will grow each year. This was our first trip to the national assemblage, and it appears likely to be a good match for GRA and NGWA, where we can both leverage our resources, connections and technical knowledge to provide information and have a voice in groundwater policy.

Another national connection has been to assist NGWA in working on policy and a white paper on groundwater sustainability. This particular topic and effort is being prepared to provide a focus for the NGWA Fly-in next year.

We have also established a new Legislative Committee structure and membership. Due to the wildfires in Southern California, we cancelled the meeting that had tentatively been scheduled for this month; we will be rescheduling that planning meeting for the Committee later this year.

GRA continues to track and disseminate information on groundwater-related bills and activities, and provide recommended courses of action. We are pleased to provide the summary of the results of this year's legislative session related to pertinent groundwater legislation on the GRA Web Page at [www.grac.org](http://www.grac.org).

### Governor-elect Schwarzenegger

As you are all well aware, the 2004 Legislative Session will bring with it a new Governor whose positions on water and environmental issues are not fully known. Governor-elect Schwarzenegger has stated that he considers himself a friend to the environment. He has been described by

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# CCGO Highlights — Winter 2003

SUBMITTED BY JANE H. GILL,  
CCGO EXECUTIVE DIRECTOR

## Annual CCGO Review of CGS and BGG

As an advocate for the Profession in the Public Interest, it is CCGO's responsibility and obligation to critique the CGS on an annual basis. These reviews have been provided by CCGO Former President and Membership Chair James Jacobs of AIPG. The complete CGS and BGG Reviews are online at [www.ccgorg.org](http://www.ccgorg.org), and have been sent to subscribers of the CCGO email list.

### CGS Review

In spite of budget cuts and attempts by others in the legislature to damage the CGS by funding cuts, the CGS has maintained the numerous important programs they provide to the state. Although there has been a change in leadership (Dr. Jim Davis, California State Geologist for 25 years, retired in June), it appears that the programs will all continue. Obviously, the CGS is doing a lot with less funding and employees. We believe that areas to improve include other sources of funding. One potential source of revenue that has been discussed is to associate the data, maps, and other resources with specific property addresses, allowing the public to obtain digital versions of this information for a fee. This digital service could be performed on-line by contracting with an outside vendor to manage and orchestrate the database service.

Michael Reichle is currently the Acting Director and Acting State Geologist of the CGS. Three CGS geologists, Ron Churchill, Chris Higgins, and Bob Hill have been selected by the Association of American

State Geologists and the Geological Society of America to receive the John C. Frye Memorial Award for 2003 for best paper on environmental geology. CCGO congratulates the CGS and the winners of the award.

### BGG Review

Because of recent budget cuts, all but three full time positions were eliminated from the BGG during the past year. In spite of this, the Board, under Executive Director Paul Sweeney, continues to do exemplary work in maintaining the quality of professional standards practiced by geologists, geophysicists, and hydrogeologists in California.

During this last year, Senator Figueroa, who also chairs the Business and Professions Committee, sponsored two bills on the Board's behalf. Senate Bill 1079, which reduces the experience requirement for admittance into the Board's Registered Geologist licensing examination, was signed into law by Governor Davis and becomes effective on January 1, 2004. Governor Davis recently signed SB 363, which increases licensing fees. This should improve the Board's fund condition.

Enforcement remains the Board's highest priority. During the last year, more than \$40,000 has been collected by the Board due to enforcement actions. The Enforcement Unit continues to pursue aggressive enforcement activity among licensees and non-licensees in the fields of environmental geology, engineering geology, site assessments and seismic mitigation areas.

The Board continues to administer the national examination for Registered Geologists with an additional California-specific test. The number of these, along with Certified Engineering Geologist, Certified Hydrogeologist and Registered Geophysicist applicants, showed a substantial increase from

previous years. Approximately 225 new licenses (RG, CEG, CHG and RGP) were issued this past year.

Outreach for consumers, students and the geologic community was enhanced with the improvement of the Board's website, which continues to be a significant source of information to the public about the Board's many activities.

CCGO is pleased with the progress in the enforcement actions and other outreach programs that the BGG has been running over the past few years. The BGG is serving the California public well by performing the appropriate duties in an excellent manner

### Education Alerts

#### *Call for Nominations for 2004 Teacher of the Year Award*

CCGO member organization AAPG (American Association of Petroleum Geologists) Foundation is presenting a \$5,000 national award, to be given to a K-12 teacher for Excellence in the Teaching of Natural Resources in the Earth Sciences. Additional awards are being offered by the NCGS – for more information, go to <http://www.ccgorg.org/2004-NCGS-TOTY.pdf>

#### *Geologists needed for school field trip on December 12*

Geologists are needed to help lead nearly 100 middle school students on a field trip to Point Mugu State Park on December 12. We are in need of three (or more) geologists to lead us in a hike of the Newbury Park side of the Sycamore Canyon area in Point Mugu State Park. The hike would lead us down into the canyon, and up Fossil Trail to observe the fossil remnants of the ocean floor. Along the way we would stop to observe some of the geological formations visible along the road cuts and discuss the parks major

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

BY JOHN UNGVARSKY

## EPA's Ground Water Primer Web Site

**T**his updated Ground Water Primer educates users about the nature of groundwater and the principles of groundwater protection. It contains a detailed introduction to hydrogeology, information on numerous drinking water contaminants, and a section on what you can do to protect your groundwater. You can learn about groundwater protection programs in EPA and other government agencies, and find EPA contacts and hotline numbers. For more information see: <http://www.epa.gov/seahome/groundwater/src/ground.htm#toc>.


## U.S. Geological Survey Groundwater Information

The U.S. Geological Survey's (USGS) web site contains a wealth of information on groundwater resources of the Nation and groundwater activities of the USGS. Recent additions include the Proceedings from USGS' Artificial Recharge Workshop in Sacramento, California on April 24, 2002 and a new circular titled "Evolving issues and practices in managing groundwater resources Case studies on the role of science." The case studies include Owens Valley and Antelope Valley in California, and Rillito Creek near Tucson, Arizona. For more information go to: <http://water.usgs.gov/ogw/index.html>. The USGS also has an excellent web site entitled "Water Science for Schools" which tells the story of where, how much, and in what forms water exists on Earth. The site includes numerous groundwater topics. For more information go to: <http://ga.water.usgs.gov/edu/mearth.html>.

## New Water Security Division

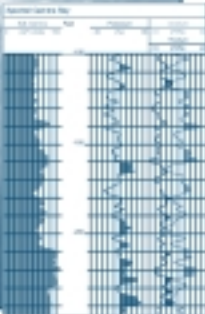
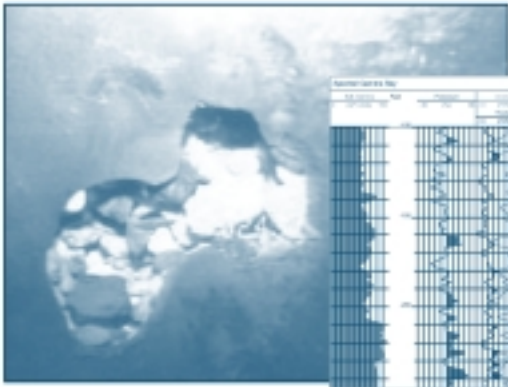
On September 9th, G. Tracy Mehan III, EPA's Assistant Administrator for Water, announced the Agency had taken strong steps to further protect and safeguard the nation's drinking water and wastewater systems from terrorist acts by forming a new Water Security Division, which will continue the work undertaken by the Water Protection Task Force established in October 2001. To date, the original Task Force has supported numerous activities to improve security of drinking water and wastewater utilities, such as awarding \$51 million in grants directly to large drinking water systems to assist compliance with the requirements of the "Public Health Security and Bioterrorism Preparedness and Response Act of 2002." For more information on water security go to: <http://www.epa.gov/safewater/security/>.

*Continued on page 20*



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# More Volatile Issues – Soil Gas Testing Update

BY BART SIMMONS, DTSC

In spring 1998, we discussed soil gas testing in this space, and it's time for an update. Soil gas testing has been used for decades as an indirect measure of soil or groundwater contamination. More recently, soil gas measurements have been used to model indoor air exposures to people.

The use of bags and canisters provides plenty of sample to concentrate and analyze to achieve detection limits in the low or sub part-per-billion (ug/L) level. Generally, turnaround time of 48 hours can be achieved with Tedlar® bags or Summa® canisters. An alternative is to sub-sample a bag or canister and directly inject the sample into a gas chromatograph (GC) or a gas chromatograph-mass spectrometer (GC-MS). The direct injection technique is cheaper, and has somewhat higher detection limits than the concentration technique.

In January, 2003, the Department of Toxic Substances Control and the Los Angeles Regional Water Quality Control Board jointly issued "Advisory-Active Soil Gas Investigations," [http://www.dtsc.ca.gov/PolicyAndProcedures/SiteCleanup/SMBR\\_ADV\\_activesoilgasinvst.pdf](http://www.dtsc.ca.gov/PolicyAndProcedures/SiteCleanup/SMBR_ADV_activesoilgasinvst.pdf). The document prescribes in some detail steps to be taken when doing soil gas investigations.

## Test Methods

EPA Methods TO-14A and TO-15 can measure ambient levels of "volatile organics." A direct injection technique has been used, with detection limits about 5 ppb and lower cost than full

TO-14A and TO-15 techniques, which involve pre-concentration before injection into a GC or GC-MS. Direct injection may be the technique of choice if you know what you're looking for, and 5 ppbv is an acceptable detection limit. If the objective is to identify unknown contaminants, GC-MS is usually the technique of choice. GC-MS methods, like TO-15, can identify (if requested), Tentatively Identified Compounds (TICs) and provide estimated concentrations. More accurate testing requires that the lab or the field testing to calibrate equipment with the compounds of interest. Pre-concentration may provide data at such low concentrations that the issue may become: What is the contribution from the ambient air, and what is the contribution of a particular site? Target compounds for site investigations may include volatile compounds which can be measured in ambient air around the globe, so distinguishing the ambient from a site source can be difficult. EPA Methods 8260 and 8021 are sometimes used for soil gas testing, but these methods are not written for air or soil gas analysis.

## Field Testing

If samples are collected and analyzed in the field, particularly using field portable GC-MS, holding times can be short, and Tedlar® bags or Summa® canisters can be used. The short turnaround times allow the use of adaptive sampling schemes, such as the Triad approach, which encourages decisions in the field based on field measurements. The Interstate Technology Regulatory Council (ITRC) has recently completed guidance for the Triad Approach.

## Accreditation

Lab accreditation for soil-gas or indoor air testing is not available from the Department of Health Services

Environmental Laboratory Accreditation Program (ELAP). Some labs have accreditation for EPA Method 8260B, but the method is written for water, soil, and waste samples, and is not intended for soil-gas or indoor air samples. Nevertheless, some agencies recommend accreditation for EPA 8260 (GC-MS for water, soil, or waste) or EPA 8021 (GC with photoionization and electrolytic conductivity detectors or water, soil, or waste). The National Environmental Laboratory Accreditation Conference (NELAC) has adopted standards for air analysis and for field testing, but this accreditation is not available in California at this time.

## Where from here?

The move to near-real time testing has encouraged the development of testing in mobile labs or field testing, so that test results can be used to guide sampling and testing in the field. Field sensors, including sensors using nanotechnology, are being developed and offer the promise of near real-time results for mixtures of volatile organics.

*Barton Simmons is Chief of the Hazardous Materials Laboratory in the Department of Toxic Substances Control (DTSC). The opinions expressed in this article are those of the author and not necessarily those of the Department of Toxic Substances Control. The mention of any products or services does not constitute endorsement by DTSC. 💧*

## Emergency Well Disinfection as a Part of Disaster Planning

BY STUART SMITH, MS, CGWP<sup>1</sup> AND STEPHEN RAGONE, PH.D., NGWA SCIENCE ADVISOR<sup>2</sup>

The National Ground Water Association (NGWA) concluded a study in 2002 for the U.S. Federal Emergency Management Agency (FEMA) of disinfection methods that would be suitable for use to improve water quality in wells that had been inundated by floodwaters. The study took place in response to the inundation problems that occurred during Atlantic Hurricane Floyd in September 1999. In the flooding, thousands of homes in North Carolina and adjacent Atlantic coastal areas were made uninhabitable by immersion, and flooding of wells created a public health emergency. To restore many of the 12,000 affected wells in North Carolina (over 2000 of which showed total coliform positive [TC+, or potentially unsafe] results), wells were disinfected in these areas. However, even after multiple treatments, a significant fraction of wells were still not providing TC-free water. Possible reasons include:

- Floodwaters contain very high loads of sediment, debris, and chemical and biological contaminants, compromising wells and making decontamination more difficult.
- Significant depth of immersion can force contaminants deep into the aquifer formation, making them more difficult to remove.
- Well construction deficiencies may let contaminated water return to the well intake.

*Some broadly applicable findings:* Although immersion of shallow wells may be a rare occurrence in California, the study provided some significant conclusions and observations that can

be applicable when responding to large-scale disturbances anywhere that affect large numbers of wells:

- Well water quality “signatures” can be profiled readily with field instruments. Such profiles are useful in identifying the aquifers and zones tapped by wells, especially when little other information is available. For example, wells finished in vulnerable aquifers, or wells that will have higher chlorine demand during treatment, can be identified. The advantage of field instruments is the ability to rapidly and economically test a large number of wells.
- Large-scale disturbances of ground water quality may leave “signals” years after acute symptoms such as TC detections subside. Three years since the 1999 inundation, surface-derived coliforms appear to have declined below detection by conventional methods in most wells. However, BART ([www.dbi.sk.ca](http://www.dbi.sk.ca)) reactions indicated that bacteria known as “environmental” coliforms (e.g., *Serratia*, *Aeromonas* and *Flavobacterium* known to be native to aquifers but likely to trigger TC+ results) were present in some well clusters. Heterotrophic bacteria in high numbers were present in all the tested wells. The BART profiles suggest that a residual effect of inundation on microbial ecology still persists. Such ecological profiling by BART methods could potentially be an easy-to-use and cost-effective method that is applicable to widespread study of the long-term effects of events such as aquifer

inundation, and in designating vulnerable areas. However, the practice requires verification.

### Recommendations for a well recovery Emergency Response Plan based on this work

- Rapid response is the key ingredient in the implementation of an Emergency Response Plan (ERP).
- Equipment and training must be provided well in advance to respond effectively at a local level.
- Wells should be pumped to remove several bore volumes of water or even up to several hours as a first step, prior to disinfection. For this reason, restoring pump function is a first priority.
- The involvement of experienced, trained people and effective well cleaning equipment is also crucial for success. This would be especially true for deep wells with heavy, high-powered pumps.
- In preparation for a future large-scale inundation event such as a large hurricane, emphasize prevention, such as through improved well code enforcement, starting now. The recommendation emphasis “starting now” was part of the 2002 report. The inundation associated with Hurricane Isabel during the 2003 Atlantic hurricane season offers a lesson that the timing of natural disasters does not always accommodate our planning pace or budget priorities.

*Continued on next page*

# Alliance Corner

## Emergency Well Disinfection as a Part of Disaster Planning – Continued

- Baseline data collection is recommended as part of the prevention and response process.

While not specifically based on the findings of this project work, the following are recommended:

- Local environmental health personnel would benefit from being trained and equipped to conduct the recommended well reconnaissance, supervise emergency treatment, and provide training oversight.
- Greater cooperation with and involvement of water well contractors (equipped to work on wells) is encouraged. A project management and funding process for this should be in place in case of need.
- Adapting response procedures for situations where supplies, expertise and equipment are not available should be an important priority.

<sup>1</sup>Partner with Smith-Comeskey Ground Water Science, 372 W Wyandot Ave., Upper Sandusky, OH 43351, stusmith@udata.com and member of the NGWA Microbial Ground Water Quality Interest Group

<sup>2</sup>Science Advisor, NGWA, 601 Dempsey Road, Westerville, OH 43081; sragone@ngwa.org.

## 33rd IAH Congress Groundwater Flow Understanding: From Local to Regional Scales

BY LENNY KONIKOW, IAH USNC CHAIRMAN

The city of Zacatecas is one of the most beautiful cities in Mexico and has received special UNESCO status because of its cultural heritage and beauty. The area was historically one of the most important gold and silver mining districts in the hemisphere. Zacatecas City will be the site of the next IAH Congress, to be held next year on October 11-15, 2004.

The overall theme of the meeting (which will be held jointly with the Latin American Association of Underground Hydrology for Development — ALHSUD) is “GROUNDWATER FLOW UNDERSTANDING: From Local to Regional Scales.”

The Congress themes will be covered through keynote lectures and technical sessions, as well as by associated symposia and round table discussions.

- T.1 Environmental issues of groundwater-flow scaling
- T.2 Chemical and isotopic data in local and regional flow definition
- T.3 Groundwater flow scaling in hard-rock media
- T.4 Role of flow systems in contaminant migration
- T.5 Recharge to local and regional systems
- T.6 Wetlands and groundwater flow dimensions
- T.7 Differential groundwater flow to coastal areas

- T.8 Modeling of groundwater flow systems
- T.9 Flow systems: Social, legal, economical, and educational aspects of groundwater management

In addition, Symposia are planned on the following topics:

- Transboundary groundwater flow
- Groundwater in thick aquifers
- Groundwater and hard rock metal mining
- Groundwater surface water interaction
- Flow and transport in materials of low permeability
- Arsenic in Groundwater
- Unintended recharge to groundwater

There will also be a number of special invited keynote lectures of broad interest. Several short courses are planned prior to the conference, and several field trips will be held during and after the Congress.

If you would like to submit an abstract on any of the above topics or related issues, the deadline for submission is December 15, 2003—so act quickly. A full manuscript will not be required. To find out more details about the meeting, go to the Congress Web site at: <http://www.igeograf.unam.mx/aih/>.

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## Organizational Corner



### Message From the Executive Director

BY KATHY SNELSON

### Can Looking Back Help In The Planning Process?

In the book "Golf Is Not a Game of Perfect," by Dr. Bob Rotella with Bob Cullen, the following appears in Chapter 17. Game Plan — "The best way to prepare a plan is to walk or mentally review each hole backward. Standing on the green and looking back toward the tee usually reveals much more about a hole than standing on the tee and looking at the green...it forces you to think strategically about where you want your ball to land on the green, what club would be best for landing it there, and what kind of tee shot will set this up."

After reading this paragraph, I wondered if the concept could somehow apply to GRA's planning. Would looking back at the current year in some way be helpful in planning for 2004 (and beyond)? As I recalled the activities and events that occurred in 2003, the highlights and challenges of the year became markedly clear. First, the Board of Directors made huge steps to evolve into a strategic thinking and acting Board. This is a challenging process as it is easier and safer to splash in the status quo of minutiae. Second, the Board developed and embraced a Director nomination process that will

ensure that the "appropriate" leaders are in place. Third, the Series on Groundwater Contaminants continued to showcase priority issues in nonpartisan forums. Lastly, the second edition of GRA's California Groundwater Management handbook is complete and ready for release.

The greatest challenges have been reducing the percentage of nonrenewals for members of two years or less, and member participation on GRA committees. Pertaining to these two challenges, we can look back at the tee, pull a different golf club from our bag and swing away. If you know what club is best to use, please let me know as I would welcome the input!

Looking back can create great unease about what wasn't done or what could have been done, but if the information is used constructively to plan for the "next tee shot" (so to speak), strengths will be maximized to create desired results and shortcomings will be managed so as not to detract from results. As Dr. Rotella writes, "Courage is fear turned inside out. It is impossible to be courageous if at first you weren't afraid". Looking back is often viewed as regret, but the poet Percy Bysshe Shelley provides us with sensible guidelines, "Fear not for the future, weep not for the past." 💧



GRA Extends Sincere  
Appreciation to its Symposium  
Chair, Cooperators and  
Co-Sponsors for its 2003  
*Contaminant Series Symposium*,  
"Subsurface Vapor Intrusion to  
Indoor Air: When is Soil and  
Groundwater Contamination an  
Indoor Air Issue?"

Symposium Chair

Brain Lewis,  
California Environmental  
Protection Agency, DTSC

Cooperators

California Department of Toxic  
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Water Quality Control Board  
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## Organizational Corner

### 2003 Awards Presented at 12th Annual Meeting

GRA presented its annual Lifetime Achievement Award and a special appreciation award at its 12th Annual Meeting on October 28, 2003 in Ontario, CA.

The GRA Lifetime Achievement Award is presented to individuals for their exemplary contributions to the groundwater industry and for contributions that have been in the spirit of GRA's mission and organization objectives. Individuals that receive the Lifetime Achievement Award have dedicated their lives to the groundwater industry and have been pioneers in their field of expertise. The 2003 recipient is Rita Schmidt Sudman, executive director of the Water Education Foundation.

Rita joined the Water Education Foundation as executive director in 1979. She is editor of Western Water magazine, the Layperson's Guides and the many other publications the Foundation uses to reach the public and key decision-makers, and Rita directs a staff of nine in the development and production of television documentaries, school programs, press, executive and

attorney briefings and the many other Foundation programs.

A former radio and television reporter and producer in San Francisco, San Diego and Sacramento, Rita continues to produce programming on western water issues for public television, and she works with the media on reporting water stories. Her award winning work has been recognized by the Public Broadcasting System and National Geographic magazine.

Rita currently serves as chair of the California Educational Ground Water Consortium and serves on the steering committee of the National Groundwater Education Consortium. In California, she also serves on the board of directors of the University of California Water Resources Center and Archives, Water For People and is chair of the California Water History Project.

Also at the Annual Meeting, GRA awarded a special plaque of appreciation to Paul E. Dorey, a founding member of GRA and longtime GRA Director, who is retiring this year from the GRA Board of Directors and as Director of Water Resources at the Vista Irrigation District. During his tenure with GRA, Paul served as the Secretary of the Board and chair of the Membership Committee. 💧

### GRA Extends Sincere Appreciation to its 12th Annual Meeting Chair and Supporters

Annual Meeting Chair

Vicki Kretsinger,  
Luhdorff and Scalmanini

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# Organizational Corner

## GRA Welcomes the Following New Members

AUGUST 27, 2003 - NOVEMBER 5, 2003

Allee, Fred  
Amaral, Michele  
Applebury, Terry  
Archdeacon, Richard

Bate, Kevin  
Bennett, James  
Bentley, Harold  
Bice, Nancy  
Bowman, Monte  
Brenner, David

Broughton, Anita  
Brown, Christine  
Church, Andrew  
Cleary, Jack  
Clements, Steve  
Colman, Susan  
Damian, Paul  
Derby, Matthew

Duxbury, Jane  
Ferguson, Everett  
Gignac, Amy  
Goepel, Jim  
Grant, Peter  
Haddad, Elie  
Haddad, Nicholas  
Harrison, Michael  
Ho, Brian  
House, Brian  
Hutchens, Ashley  
Iger, Rick  
Karns, Michelle  
Kubis, Elizabeth  
Lehrman, Jim  
Liu, Sally  
Logan, Robert  
Lui, Alan  
Lunceford, Sandra  
Mackey, Linda  
McCarty, Jim  
Milne, Ray  
Moran, Zack  
Morrison, Paul  
Mullaney, Marc

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RMT, Inc.  
CDM  
SCS Engineers - EnviroNet  
Baseline Environmental Consulting  
Applied Process Technology, Inc.  
PW Environmental  
Philips  
ENSR International

Oliver, Dean  
Owsianiak, Lisa  
Peargin, Tom  
Pearson, Erik  
Rigby, Mark  
Roat, Robert  
Rush, Harold  
Seipel, Christopher  
Shamosh, Nathan  
Siembieda, Michael  
Smith, Ryan  
Smith, Zach  
Stejer, Warham  
Tabet, Eddy

Taylor, Travis  
Tremblay, Raymond  
Villalobos, Brian  
Vogler, Herbert  
Wang, James  
Williams, Sam  
Wilson, Penny  
Zdeb, Thomas

ENVIRON International  
ARCADIS  
Chevron Texaco  
England Geosystem, Inc.  
Tetra Tech  
Brighton Environmental Consulting  
Geomatrix Consultants, Inc.  
Shaw Environmental  
LBI Technologies, Inc.  
AllWest Environmental, Inc.  
PW Environmental  
Kern County Water Agency  
Craton Resources  
Technology, Engineering &  
Construction, Inc. dba Accutite  
Earth Tech  
Sanitation Districts of LA County  
Petra Geotechnical, Inc.  
Kleinfelder, Inc.  
LBI Technologies, Inc.  
GeoSyntec Consultants  
Tetra Tech EM Inc.  
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### Renew Your Membership Online - It's Quick and Easy

It's time to renew your GRA membership for 2004. You can renew online via GRA's Web site, [www.grac.org](http://www.grac.org), or you can request a hard copy dues renewal invoice from Kevin Blatt at [grac@inreach.com](mailto:grac@inreach.com). To save time and effort, GRA recommends that you renew online as the process is secure and seamless. It will also help GRA to keep related expenses to a minimum.

As GRA approaches 2004 with over 935 members, the goal of having 1,000 members by the end of 2004 is attainable. To make this happen, please renew your membership and recruit one new member to GRA. Recruiting a new member is a way to introduce your colleagues to a credible, innovative organization that provides many benefits for only \$75.

Thank you for your interest and continued participation in protecting and improving California's groundwater resources. 💧

# Groundwater Modeling is BIG in Texas

BY ROBERT E. MACE, TEXAS WATER DEVELOPMENT BOARD

Texas encompasses a large number and wide range of aquifers, from the humid swamps of the east to the dry and dusty deserts of the west. The state recognizes 9 major and 21 minor aquifers that range from karstic to clastic to volcanic. In addition to these major and minor aquifers, there are a number of smaller, but no less important, local aquifers in alluvial fill and other sediments. Together, all of these aquifers contributed about 10 million acre-ft of water in 1990, or 60 percent of the total amount of water used in Texas that year.

Based on regional and state water planning, Texas expects its population to almost double and its demand for water to increase to 20 million acre-feet per year by 2050. Many cities in Texas are looking for additional sources of water to meet near- and long-term needs, and several public and private groups are courting these cities with groundwater as a potential source to meet these needs. In response to concerns over current and potential future demand for groundwater, the number of groundwater conservation districts in Texas (the State's preferred method of groundwater management) has quadrupled since 1990 to 88.

Because of the importance of groundwater in Texas, the creation of regional water planning, the increased number of groundwater conservation districts, and the need to know how aquifers might respond to future stresses, Texas has embarked on an ambitious project to develop numerical groundwater flow models for all of the State's major and minor aquifers. This

## Student/Research Corner

program, called the Groundwater Availability Modeling (GAM) program, calls for the completion of models of the major aquifers by October of 2004, with work continuing on minor aquifers as time and money permit.

Since the advent of regional water planning in Texas in 1997, the Texas Water Development Board (TWDB) has infused stakeholder input into almost all of its activities. The implementation of the GAM program has also involved considerable stakeholder participation. Technical and policy experts helped assemble the list of elements required for the development of a GAM. Each GAM project is required to hold Stakeholder Advisory Forums at important points during the project so that policy makers and technical experts that may use the GAMs can see how the model is developed, offer data and technical advice, and voice concerns. Draft reports are available for public review, and the final report, supporting data, and models are available for anyone to use.

Needless to say, there is a tremendous amount of work required for developing regional groundwater flow models, necessitating widespread collaboration from many entities. Groundwater scientists at the TWDB, contractors to the TWDB, and, in two cases, individual political subdivisions have contributed to the effort. Universities, private companies, political subdivisions, and the U.S. Geological Survey have been and continue to be recipients of contracts to develop the models. Undergraduate and graduate students and interns have contributed to various aspects of the work, and noted scientists from outside of Texas, including Dr. Graham Fogg of the University of California, Davis, have also been involved.

Because of the size and breadth of some of the State's aquifers, 16 separate

GAMs will be required to model the nine major aquifers. To date, 11 of the 16 models are completed or nearly completed and 5 are in the middle of development. Six of the 21 minor aquifers have been modeled or are in the process of being modeled.

As with any modeling project, the GAM program has been a useful tool to indicate where additional hydrologic research is needed. Individual models show where additional data is required to increase the accuracy of the model. This process has prompted regional water planning groups and groundwater conservation districts to pro-actively collect this data for future model updates. On a broader level, the GAM program has shown the need for better information on recharge rates at a regional scale. Related to this is the need for better information and conceptual models on the amount and influence of groundwater evapotranspiration at a regional scale. Cross-formational flow and the hydraulic properties of confining layers and interbedded clays and shales have also proven to be important, especially when large well fields are employed.

Completed models have been used to investigate the possible effects of large well fields on water levels and springs and to investigate water budgets for groundwater conservation districts and regional water planning groups to help assess groundwater availability. With greater demands for water, GAMs are proving to be useful scientific tools for assisting policymakers in managing their groundwater resources. 💧

## "Subsurface Vapor Intrusion to Indoor Air: When is Soil and Groundwater Contamination an Indoor Air Issue?" – Continued from Page 1

Concerns at Sites With Contaminated Soil and Groundwater" (July 2003, [www.swrcb.ca.gov/rwqcb2/esl.htm](http://www.swrcb.ca.gov/rwqcb2/esl.htm)). Screening levels are based on a target excess cancer risk of one-in-a-million and a target hazard quotient of 0.2 for noncancer effects.

Dr. Berry provided an overview of DTSC's rationale for developing guidance that differs from both the USEPA and the San Francisco Bay RWQCB. DTSC is developing guidance for the evaluation of the vapor intrusion pathway with an expected release in January 2004. Both DTSC and the RWQCB will follow the new guidance. DTSC's approach differs from USEPA and the RWQCB in several areas. For example, DTSC will not include screening values for soil gas, soil and groundwater in the guidance. Rather, DTSC provides for generic conservative modeling for sites with limited data. If such modeling fails, additional site data, including soil gas sampling and site-specific modeling, would be required. Indoor air monitoring would be the last step in the evaluation process.

The next presentation, given by John Moody, USEPA, Region 9, provided a case study of the former GTE Government Systems site in Mountain View, California, where TCE has impacted a residential community. Due to the sensitive nature of the situation, Mr. Moody did not disclose street locations. The former GTE site was re-developed for residential use in 1996 – 1998 following soil and groundwater remedial activities. Indoor air samples were initially collected in 2000. Samples collected throughout the homes yielded consistent results. Certain homes have been retrofitted with active ventilation systems with positive results. Additional soil gas and groundwater investigations are planned as well as additional indoor air monitoring.



Paul Johnson, left, and Robbie Ettinger re-unite for GRA's Indoor Air Symposium

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*DTSC's approach to the of the vapor intrusion pathway differs from USEPA and the RWQCB in several areas.*

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Next, Paul Johnson, Ph.D., Professor and Associate Dean of the Ira A. Fulton School of Engineering, Arizona State University, presented a talk entitled, "Confusion? Delusion? What Do We Really Know About Vapor Intrusion?" Dr. Johnson, one of the authors of the original JEM, discussed the debate concerning current regulatory guidance and the practical implications associated with such guidance. His talk focused on reviewing basic technical concepts, empirical evidence and lessons-learned from empirical analyses, the current understanding and conceptualization of the pathway, and the translation of that understanding to mathematical algorithms. Lastly, he presented recent results from three-dimensional numerical visualization studies and offered recommendations for the future.

Following a lunch break, Dan Gallagher, DTSC, provided the audience with a more in-depth overview of DTSC's forthcoming guidance for the evaluation of the vapor intrusion to indoor air exposure pathway for sites in California. DTSC's guidance will emphasize the importance of collecting high quality contaminant data

when characterizing subsurface plumes. Mr. Gallagher discussed the approaches for collecting high quality soil gas, soil matrix, groundwater, and flux chamber data. However, the DTSC guidance document will specify that soil gas samples are the preferred contaminant data for evaluating vapor intrusion to indoor air. Additionally, Mr. Gallagher provided the conceptual approach for the use of the JEM within California. DTSC is proposing a two-step approach, generic evaluations and site-specific evaluations.

Generic evaluations would use minimal site information. Sites would be evaluated using the maximum soil gas concentration, along with the depth to the contamination. Soil type would be selected from lithologies encountered during site characterization. For sites that are coarse-grained, the characteristics of sand, as determined by the United States Soil Conservation Service (USSCS) classification, would be used in the model. For sites that are fine-grained, the characteristics of USSCS loam would be used. A default of 5 liters per minute for the soil gas advection rate would also be used for generic evaluations. The other input parameters for the model would be default values characteristic of California. For site-specific evaluations, input parameters into the model would be determined through laboratory and field measurements. Dry bulk density, grain density (total porosity determination), moisture content (water-filled porosity determination), and fraction organic carbon would be determined from laboratory measurements. Soil air permeability would be determined from field measurements. Other parameters would be default values, such as the building indoor-outdoor pressure differential (4 pascals), the residential indoor air exchange rate (0.5 exchanges per hour), and the foundation crack-to-total area ratio (0.005).



Todd McAlary, GeoSyntec Consultants, Inc. presented “Empirical Experience Gathering Data to Assess Vapor Intrusion.” Mr. McAlary noted that the conservative nature of generic screening criteria and risk evaluations would necessitate the collection of site-specific soil gas samples. Based on an evaluation of empirical experience, vapor transport can be evaluated with confidence, providing rigorous protocols are followed. Mr. McAlary discussed sampling protocol, and noted that high purge volume sampling provides an integrated average approach that may provide additional valuable insights. He also indicated that groundwater data do not correlate well with soil gas data, and to use groundwater data to predict indoor air quality is very difficult without supporting lines of evidence. Mr. McAlary noted that mathematical modeling of vapor diffusion is relatively simple whereas advective gas flow into buildings is much more challenging and requires further research.

Next, Robbie Ettinger, Shell Global Solutions (US) Inc., presented “Background Contamination and its Impact on the Assessment of Vapor Intrusion.” Mr. Ettinger, also one of the authors of the original JEM, highlighted the difficulties associated with the use of indoor air sampling results in evaluating risk due to intrusion of subsurface soil gas. Interfering background sources can include household activities, consumer products, building materials and ambient air. Mr. Ettinger provided information on a number of common environmental contaminants that are present in common household products as well as ambient air, as monitored by the California Air Resources Board. He noted, however, that other researchers have not found 1,1-Dichloroethene (1,1-DCE) associated with non-subsurface sources in studies performed to date, suggesting that its presence in indoor air is indicative of subsurface soil gas intrusion. Mr. Ettinger

highlighted a number of factors that should be considered to assess the impact of background on vapor intrusion pathway evaluations, with emphasis on indoor air sampling considerations.

In a presentation entitled, “Engineering Controls for Reducing the Levels of Volatile Contaminants in the Indoor Air that Originated in the Soil Gas,” Ron Mosely, USEPA Office of Research and Development, shared his radon experience with the audience. He stressed that entry of contaminants into buildings from soil requires a source, an entry pathway and



*Members of the Panel Discussion at the end of the day, featuring all of the speakers at the Symposium.*

driving forces. The exposure pathway would be rendered incomplete if one of these three entities is successfully removed. Experience with radon and VOCs has shown that it is usually simpler and more cost-effective to prevent the entry of soil gas contaminants, usually with sub-slab ventilation or depressurization (i.e., engineering controls). Mr. Mosely’s presentation also identified intrusion pathways, driving forces, and diagnostic criteria for selecting and designing an appropriate control system.

In an effort to pull together the information presented thus far in the Symposium, Eric Nichols, LFR Levine-Fricke, Inc., presented a “Hypothetical Case Study: A Site Road Map for Vapor Intrusion,” demonstrating many of the concepts previously discussed, to illustrate and guide decisions at a hypothetical site from initial concern through ultimate resolution. The hypothetical site was

impacted with chlorinated solvents and petroleum hydrocarbons, resulting in the following chemicals of potential concern: TCE, 1,1-DCE, vinyl chloride and benzene. Site soils were previously excavated; a groundwater pump-and-treat system is in operation. The site was sold with plans for residential development. The presentation followed a four-step road map to evaluate soil gas concerns and potential indoor air risks, ending with the need for site-specific decisions.

The day was concluded with a Panel Discussion featuring all of the speakers. Members of the audience raised a number of issues, including questions raised by a non-technical member of a community directly impacted by indoor air issues related to a former industrial/commercial property. Other issues discussed were DTSC’s stated preference for JEM input based on data collected pursuant to the following hierarchy: soil gas, groundwater, soil, and flux chamber measurements; and the degree to which modeling should be relied upon for decision making. Three-dimensional models have been routinely used for indoor air assessments for radon but indoor air samples are always collected prior to decision-making.

The indoor air symposium was co-sponsored by CH2M HILL, Envirogroup Limited, GeoSyntec Consultants, Inc., LFR Levine-Fricke, and Malcolm Pirnie. Additional information on the symposium, including binders with speaker contact information, slides, abstracts, and supplemental information, can be purchased from GRA at (916) 446-3626 or [www.grac.org](http://www.grac.org).

## Legislative Update and Year in Review – Continued from Page 6

his brother-in-law, Robert Kennedy Jr., a well-known conservationist, and by others in the Kennedy Clan, as “the best environmental Governor California could have.” Schwarzenegger has named at least two people to his transition team with apparently diverse environmental credentials: (1) Bonnie Reiss, dubbed by some conservative columnists as a “Hollywood green activist,” founded the Earth Communications Office, a Los Angeles-based group that helped place environmental messages in television shows in the early 1990s; and (2) Bill Reilly, former Administrator of the U.S. Environmental Protection Agency during the Bush Administration from 1989-93.

The Governor-elect’s initial policy statements, environmental platform and agenda focus on issues including air pollution, solving the energy crisis, extending parks and open space, improving urban environments, protection of California’s rivers, bays and coastline and enforcement of existing environmental laws. His policy statements related to protecting California’s watersheds include,

“Cal/EPA and the Resources Agency to completely overhaul their recent “California Watershed Management MOU” to transform it from a “bureaucratic do-nothing document” to an action plan that will clean up California’s most endangered

watersheds now. Emphasis will be placed by the new Administration on practical strategies to finance these initiatives using state or private revolving loan funds, by seeking California’s fair share of federal funding, and by making sure that existing permitting fees are applied to resource management so that they benefit the environment...not bureaucrats.”

Most promising for water quality concerns is the section of the Governor-elect’s platform on enforcement of current environmental laws:

“Strict law enforcement is vital to assure environmental protection, prevent polluters from achieving unfair competitive advantage against complying competitors, send a message of public values, and establish conditions conducive to creativity and participation in voluntary initiatives. [This] Administration will focus on keeping underlying statutes and regulations simple; simple rules are easiest to follow and comply with; unnecessarily complex rules are hard to comply with, hard to enforce, and encourage evasion. Particular attention will be given to better use of information technologies with strict, clear and rapid penalties for intentional or negligent misstatements or

omissions. Government should be held accountable for environmental protection to the same extent as private parties and should be held to the same enforcement standards. To the greatest possible extent, environmental enforcement settlements should be used to provide direct environmental improvement through supervised projects, rather than having all penalties go to government treasuries.”

How these statements translate into the development of policy, law and the appointments calculated to best implement such a policy will remain to be seen. Obviously, the task at hand is even more daunting for the Governor-elect given the continued budget deficit, now further exacerbated by a spate of fires that have raged throughout Southern California. Our GRA Legislative Committee and Advocates stand ready to assist the new Administration in any way possible and will continue to work closely with the Legislature on issues of concern to our membership. The current summary and status of Bills considered significant to groundwater issues are posted on the GRA website. 💧

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## CCGO Highlights – Continued from Page 7

geology. Stops at various points would be about 5 minutes maximum. Dates and identification of the fossils are needed. Contact Allen Sauté, Sequoia Middle School (805) 498-3617 x1101 or asaute@conejo.k12.ca

### Progress in 2003

As we head into the last quarter of our legislative year, we can look back at some great progress we have made towards forging CCGO into a leader of recognized integrity in advancing programs and legislation that take into consideration California’s diverse geologic conditions, advocating knowledgeable use of resources, and working to reduce the

impact of geologic hazards. In addition to posting the latest AEG analyses of relevant upcoming legislation, we have posted the annual reviews of the CGS and BGG, and sent out a number of email alerts to our mailing list requesting prompt action in sending letters of support. If you would like to have your name, phone number, or email address put on our alert list, please go to [www.ccco.org](http://www.ccco.org) and click on the Contact button.

### Elections and plans for 2004

CCGO Board of Directors meeting and annual elections are scheduled for November 15. We extend our warmest thanks to Sue Jagoda, our President for 2003, and Vice

President and Secretary for the previous two years; to David Abbott, our Secretary and a Director for several years, too. Special thanks are due to Anne Cavazos, of the Shaw Group, who has been the CCGO Treasurer since 1998. Our heartiest welcome to incoming President Rick Blake, who has been on the CCGO Board of Directors for several years, and an officer for two. We are already making plans for the March Legislative Drive-In, May General meeting and Fundraisers, and several Educational events during the year. We also wish to thank our 2003 Organization and Business Members, some of whom have been involved with CCGO from the beginning. Thank you for your support! 💧

# California Colloquium on Water at UC Berkeley

The Water Resources Center Archives has been presenting a series of lectures about water. The lectures, which are preceded by an afternoon reception, are open to the public, and are held at the Water Resources Center Archives, 410 O'Brien Hall, UC Berkeley. One more lecture in the series is scheduled.

December 9

## *"The Geysers: The Nature, Development & Preservation of a Unique Resource"*

W. T. (Tom) Box, Jr., Vice President, Geothermal Resource Management, Calpine Corporation

For more information, contact the Water Resources Center Archives at (510) 642-2666 or [waterarc@library.berkeley.edu](mailto:waterarc@library.berkeley.edu), or check out the web site: <http://lib.berkeley.edu/WRCA/ccow.html> GRA is considering a financial co-sponsorship (nominal) at the Nov. 8 Board meeting. ♡

# California's Groundwater Bulletin 118 – Update 2003 is Online

The final document "California's Groundwater, Bulletin 118 –Update 2003", recently posted at the California Department of Water Resources (DWR) website, is a publication by the DWR for the purpose of enhancing the management and understanding of California's groundwater basins, encouraging partnerships between the state and local agencies, and coordinating and expanding data collection and monitoring activities that will provide necessary information for more effective groundwater management. The Bulletin also includes a web-based, dynamic supplement that is an inventory of essential information on the state's groundwater resources to help guide local water planning and decisions for the protection and sustainable use of groundwater. The publication may be found online at [http://www.waterplan.water.ca.gov/groundwater/pdf/Bulletin118/Bulletin118\\_Entire.pdf](http://www.waterplan.water.ca.gov/groundwater/pdf/Bulletin118/Bulletin118_Entire.pdf). ♡

## President's Message – Continued from Page 2

course of the last three years, GRA has been able to amass financial reserves that will allow us to make strategic decisions on how to best invest in the association for the future. At the November Board of Directors meeting and the Strategic Planning Meeting in January, the Board will be discussing ways to position GRA to build on the success we have had. The Board is focusing more than ever on defining the strategic goals to help us achieve our Mission and Vision statements, and to make GRA the finest groundwater association in the country.

I am very excited about the future of GRA and I am confident that we will continue to grow and succeed. I urge you to join a Committee, become an Officer in your local Branch and to become involved in GRA, because you will be rewarded many times over. I feel blessed to have served the Groundwater Resources Association, and it has been my honor to serve as your President. Thanks for your support. ♡

Jim Carter,  
GRA President

## MARK YOUR CALENDAR



### GRA's 13th Annual Meeting

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## Movement and Longevity of Viruses in the Subsurface

Since 1989, EPA's Ground Water and Ecosystems Restoration Division in Oklahoma has developed a series of over 30 Ground Water Issue Papers, with the most recent addressing Movement and Longevity of Viruses in the Subsurface. Approximately half of the drinking water supplies in this country are taken from underground sources, and roughly half of the waterborne diseases have been attributed to contaminated groundwater, with viruses being the principal pathogens. This issue paper discusses conditions affecting the transport and survival of viruses in the subsurface, identifies their sources and indicators of viral contamination, outlines the effects of hydrogeologic settings on their movement, and presents the current state of transport modeling along with an example of a screening model. The transport, as well as survival, of pathogens in the subsurface is strongly virus dependent and subject to their retention to soil and aquifer materials. For further information contact Dr. Ann Azadpour-Keeley at (580) 436-8890 or keeley.ann@epa.gov. To see this and other issue papers, go to: <http://www.epa.gov/ada/publications.html>.

## Environmental Technology Verification Program

Established in 2002, EPA's Environmental Technology Verification (ETV) Water Quality Protection Center addresses technologies for protection of groundwater and surface water from contamination. The program includes two components, source water and wet weather flow. "Source Water Protection Technologies" verifies the performance of commercially available technologies that prevent the contamination and maintain the quality of drinking water supplies from both groundwater and surface water sources. "Wet Weather Flow

Technologies" verifies the performance of commercially available technologies that control and treat the increased volumes of water as runoff, in sewers, and in wastewater treatment plants during periods of wet weather events. For more information, see: <http://www.epa.gov/etv/centers/center4.html>.

*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 groundwater 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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## 1, 4-DIOXANE & OTHER SOLVENT STABILIZER COMPOUNDS IN THE ENVIRONMENT

**December 10, 2003 – DoubleTree Hotel, San Jose**



## Sacramento Branch Highlights

BY STEVE PHILLIPS

A special meeting of the Sacramento Branch was held on July 30, 2003 and featured Thomas Mohr who presented "The San Martin Perchlorate Problem: Leveraging Local Government Resources for Rapid Response." 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 GRA Director and a past president of the Sacramento Branch.

Tom discussed technical and social aspects of a highly publicized case of groundwater contamination. Perchlorate was first discovered in San Martin in 2000, and ensuing investigations delineated a large plume 9 miles in length. The plume has impacted at least 400 domestic and agricultural wells, which has caused a high level of public concern and triggered a great deal of media attention. The Santa Clara Valley Water District has played a large role in this case, ranging from providing technical support for the RWQCB to purchasing bottled water, at great expense, for the citizens of San Martin in affected areas. Tom stated, "The San Martin perchlorate problem illustrates the integral role groundwater plays in the daily lives of citizens and how a single impact can affect every corner of a community."

This meeting was organized by GRA and hosted by the Sacramento Branch. Attendance exceeded 120 people. 💧

## San Francisco Bay Branch Highlights

BY GARY FOOTE,  
BRANCH PRESIDENT

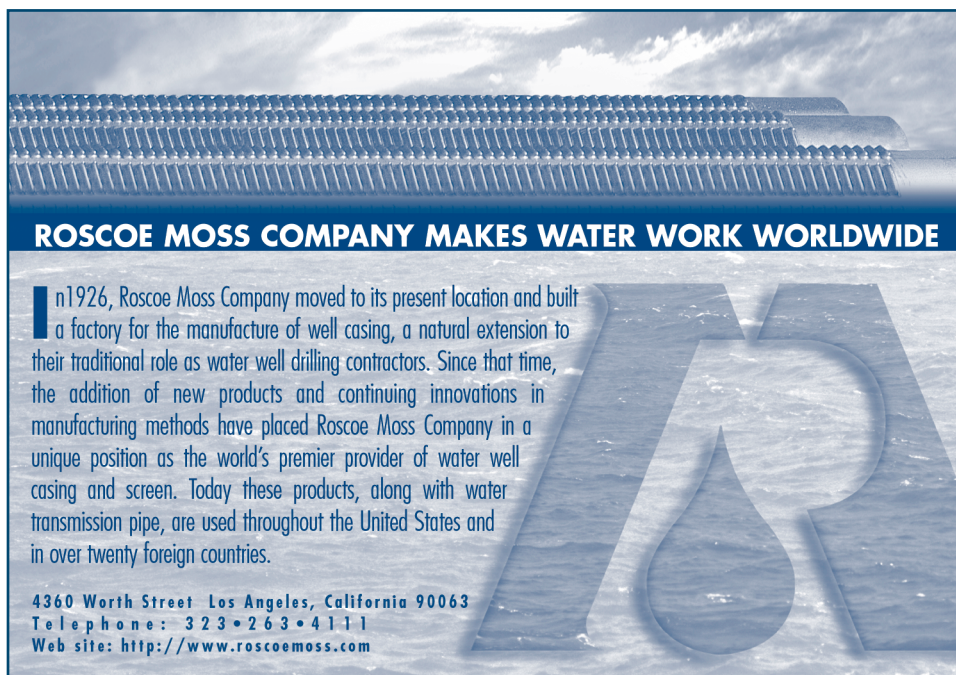
The San Francisco Bay Branch held two South Bay events in Santa Clara this Fall. Many thanks to Mark Wheeler, our South Bay coordinator, for organizing the events.

The September Branch meeting was held September 29, 2003, the evening before GRA's Symposium on Subsurface Vapor Intrusion to Indoor Air. The speaker was Roger Brewer, Ph.D., San Francisco Regional Water Quality Control Board (RWQCB). Dr. Brewer is the principal author of the RWQCB's July 2003 Technical Document on Environmental Screening Levels (ESLs). He presented an overview of the scope and intent of the ESLs and specifically discussed the ESLs for indoor air and shallow soil gas that were developed to address potential vapor intrusion.

Alec Naugle, RWQCB, was the speaker at the October 28, 2003 meeting. Alec presented an overview of findings and

recommendations contained in a recently released 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 RWQCB'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.

The Branch's student scholarship program is underway. The Branch will award a total of five \$300 "book scholarships", one each to a student from each of five Bay Area universities. Scholarships have been awarded to Sean Gehlke from San Jose State University and Christy Swindling from Stanford University. Scholarships will also be awarded to a student from the University of California, Berkeley; San Francisco State University; and California State University, Hayward. Many thanks to J.C. Isham, Branch Vice President, for organizing and implementing the Branch's scholarship program. 💧



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e-mail: sf.branch@grac.org

*President: Gary Foote*  
Geomatrix Consultants, Inc.  
(510) 663-4260  
gfoote@geomatrix.com

*Vice President: J.C. Isham*  
The Shaw Group  
(925) 288-2381  
julian.isham@theshawgroup.com

*Secretary: Mary Morkin*  
Malcolm Pirnie  
(510) 596-3060  
mmorkin@pirnie.com

*Treasurer: David Abbott*  
David Keith Todd Consulting Engineers  
(510) 595-2120  
jorysue@msn.com

*Membership Chair: Bill Motzer*  
Todd Engineers  
(510) 595-2120  
bmotzer@toddengineers.com

*Technical Chair: Jim Ulrick*  
Ulrick & Associates  
(510) 848-3721  
julrick@ulrick.com

*South Bay Coordinator: Mark Wheeler*  
Crawford Consulting  
(408) 287-9934  
mark@crawfordconsulting.com

*Past President: Linda Spencer*  
lindageo@earthlink.net

### Central Coast Branch

e-mail: cc.branch@grac.org

*President: Terry L. Foreman*  
CH2MHill  
(805) 371-7817, x27  
tforeman@ch2m.com

*Vice President: Stephanie Osler Hastings*  
Hatch and Parent  
(805) 963-7000, x415  
shastings@hatchparent.com

*Secretary: William (Bill) O'Brien, PE*  
Applications International Corp. (SAIC)  
(805) 966-0811 x3208  
obrienw@saic.com

*Treasurer: Ryan Harding*  
Tetra Tech, Inc.  
(805) 681-3100  
ryan.harding@tetratech.com

### Southern California Branch

*President: Tony Maggio*  
SCS Engineers  
(562) 426-9544  
email: amaggio@scseng.com

*Vice President: Darrel Thompson*  
Shaw Environmental & Infrastructure  
(949) 660-7532  
email: dthompson@theshawgroup.com

*Treasurer: Robert Ruscitto*  
ARCADIS  
(714) 278-0992  
e-mail: rruscitto@arcadis-us.com

*Secretary: Carmen Guzman*  
ARCADIS  
(714) 278-0992  
e-mail: cguzman@gmgw.com

*Member At Large: Steve Zigan*  
Environmental Resolutions  
(949) 457-8952  
email: szigan@eri-ug.com

*Past President: Paul Parmentier*

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EMAX Laboratories, Inc.  
(310) 618-8889  
email: jcarter@emaxlabs.com

*Past President: Louis R. Reimer*  
Tait & Associates  
(714) 560-8200  
email: loureimer@aol.com

### Sacramento Branch

e-mail: rshatz@geiconsultants.com

*President: Richard Shatz*  
Bookman-Edmonston  
(916) 631-4027  
rshatz@geiconsultants.com

*Vice President: Kelly Tilford*  
Golder Associates  
(916) 786-2424  
ktilford@golder.com

*Secretary: Dave Zuber*  
Brown & Caldwell  
(916) 854-5318  
dzuber@brwnclad.com

*Treasurer: David Von Aspern*  
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(916) 372-1434  
dvonaspern@wallace-kuhl.com

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Jacobson Helgoth Consultants  
(916) 985-3353  
pdunn@jhcinc.com

*Member At Large: Barbara Heinsch*  
Yolo County Div. of Integrated Wast Mgmt.  
(530) 666-8858  
bheinsch@jps.net

*Member At Large: Steven P. Phillips*  
US Geological Survey  
(916) 278-3002  
sphilip@usgs.gov

### San Joaquin Valley Branch

e-mail: wpipes@geomatrix.com

*President: Bill Pipes*  
Geomatrix Consultants, Inc.  
(559) 264-2535  
wpipes@geomatrix.com

*Secretary: Mary McClanahan*  
California Water Institute, CSU, Fresno  
(559) 278-8468  
mmclana@csurfresno.com

*Vice President: Tom Haslebach*  
Kern County Water Agency  
(661) 634-1450  
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# Dates & Details

## GRA MEETINGS AND KEY DATES

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

- |   |  |  |   |
|---|--|--|---|
| GRA Symposium<br><i>1, 4 Dioxane and Other<br/>Solvent Stabilizer<br/>Components in the<br/>Environment</i> | December 10, 2003<br>San Jose, CA                    | GRA Workshop<br><i>Low Yield Aquifer Testing</i>   | April or May, 2004<br>Northern & Southern<br>California |
| GRA Board of Directors<br>Strategic Planning and<br>Board Meetings  | January 17-18, 2004<br>Glendale, CA                  | GRA Symposium<br><i>Perchlorate 2004</i>   | June, 2004<br>Southern California                       |
| GRA Symposium<br><i>Investigation &amp;<br/>Remediation of Dry<br/>Cleaner Release Sites</i>                | Late March or<br>Early April, 2004<br>Sacramento, CA | GRA 13th Annual Meeting<br><i>Aquifer Protection,<br/>Restoration, Replenishment<br/>and Treated Water Reuse</i> | September 23-24, 2004<br>Sonoma, CA                     |



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