

HYDRO VISIONS

Volume 13, No. 3

GROUNDWATER RESOURCES ASSOCIATION
OF CALIFORNIA

Fall 2004

ClO_4^- 2004 Symposium Profiles Latest Developments on Perchlorate in Groundwater

BY THOMAS K.G. MOHR, WITH CONTRIBUTIONS
BY JON ROHRER, ELIE HADDAD, AND TOM JOHNSON

Nearly 300 groundwater professionals from 16 states attended the August 4th Symposium, *ClO₄⁻ 2004: Perchlorate in California's Groundwater*, the 11th Symposium in GRA's *Series on Groundwater Contaminants*. The meeting was held at the Glendale Hilton Hotel, with experts from academia, consulting, regulatory and water utility agencies, and local governments presenting recent findings in a wide range of topics. The Southern California Branch held a dinner meeting the evening prior, featuring a comprehensive overview on perchlorate by Dr. Bill Motzer of D.K. Todd Engineers.

Due to space limitations, this article presents only a sampling of the many excellent presentations made. A longer article, summarizing the conference and including contributions from the session



Ralph Beck of Komex H₂O Science presents an overview of southern California perchlorate sites.

moderators, may be found online at http://www.grac.org/ClO4_2004_Article.pdf.

Perchlorate Forensics

Three talks by Richard Hurst (Hurst & Assoc.), Max Coleman (CalTech-JPL), and Neil Sturchio (UI Chicago), featured forensic techniques using naturally occurring stable isotopes of chloride, strontium, oxygen, and hydrogen. Shifts in the mass ratios of rare isotopes to abundant isotopes can be leveraged to distinguish source waters and different sources of perchlorate. An isotope of chloride, ³⁷Cl, becomes enriched by up to 50% during biodegradation of perchlorate, and different perchlorate production processes may produce different ³⁷Cl mass ratios due to isotope fractionation that occurs during crystallization.

The Atacama Desert in Chile is the source of sodium nitrate ("Bulldog Soda") fertilizer, exported to US growers for over

INSIDE

President's Message 2

Upcoming Events 3

Technical Corner 4

California Legislative Corner 5

California Regulatory Corner 6

Federal Legislative/Regulatory Corner 7

Education Corner 8

Alliance Corner 10

Organizational Corner 12

100 years. At several key perchlorate contamination sites, fertilizer has been suggested as a possible second source of perchlorate impacting groundwater. However, subtle shifts in the ratio of two strontium isotopes, ⁸⁷Sr/⁸⁶Sr, can be used to distinguish the naturally occurring perchlorate found in the Atacama from industrially generated perchlorate used in propellant formulations.

Dr. Sturchio presented data from Bao and Gu's publication (ES&T, 2004 – in press) showing that natural perchlorate has a pronounced ¹⁷O excess, suggesting that perchlorate occurrence in the Atacama desert may have an atmospheric origin due to upper atmosphere ozonation or other natural processes. Widespread occurrence of perchlorate in groundwater at concentrations as high as 50 ppb across the Texas panhandle and portions of New

Continued on page 14

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 TOM JOHNSON

"Paradigm Shift"

Traveling so much during the past 25 years, I have accumulated more than a million miles on at least one airline. Most of this travel has been in the U.S., much of it associated with teaching at various seminars for NGWA or visiting various company offices and clients in Boston, Los Angeles, Chicago, Honolulu, San Francisco, Nashville, Denver and countless other cities. One thing I usually have been able to count on in my travels it seems, regardless of the city, is an article in the local newspaper that day about some environmental issue.

For decades these articles commonly related to concerns about waste disposal and groundwater contamination, frequently reflecting the paradox of trying to address too many sites and issues with too little money, whether at the national or local level. However, during this past year I have noticed a change in reporting, in both local and national news. Groundwater supply problems and challenges are now front-page news, with an even more important challenge of providing clean, sustainable water resources to dramatically increasing populations.

Love Canal to Prozac

In the late 1970s, front pages carried stories about New York's Love Canal, the Valley of the Drums in Kentucky, or PCBs in Missouri; this was followed by a decade or more of stories chronicling the efforts of Congress and U.S. EPA to implement CERCLA, which was to provide funds to "clean up" these sites; and RCRA, to provide "cradle to grave" care for hazardous wastes. There were local stories about siting a new landfill in

Madison, expanding an existing landfill in San Diego, or "cleaning up" an old one in Portland. There have been articles by an investigative journalist on MTBE contamination at a gas station in Kansas City; TCE from a semiconductor facility in San Jose; or, most recently, Prozac from a pharmaceutical plant in Berlin. Certainly, there were also periodic articles about water shortages or drought, especially in certain parts of the country; and those stories were often front-page news in the areas that were most impacted. However, at that time, it seemed water contamination made better front-page news than water shortage.

Water Wars

Things have changed since then. For the past year or so I have been collecting news articles from various cities across the U.S. that have one common theme, an increased awareness of the challenges facing property owners, water purveyors and government at all levels in finding, providing, managing and controlling adequate supplies of clean, sustainable water. Recent headlines include: "Sweetheart Water Deals- New Studies Warn of Water Scarcity" (Sacramento Bee), "Water District Calls it Quits" (San Diego North County Times), "Grand Jury Urges New Ground Water Plan" (Santa Rosa Press Democrat), "Water Supply Critical Limit to Development" (Chicago Tribune), "Water Transfer Raises Flags" (Monterey County Herald), "Water, Water Everywhere and Not a Drop to Drink?," "Nevada's Plan to Develop the Desert" (Los Angeles Times), and, to top them all, "Scientists say Risk of Water Wars Rising" (Reuters-Stockholm). These articles all describe critical concerns

Continued on page 17

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HYDROVISIONS is the official publication of the Groundwater Resources Association of California (GRA). GRA's mailing address is 915 L Street, Suite 1000, Sacramento, CA 95814. Any questions or comments concerning this publication should be directed to the newsletter editor at editor@grac.org or faxed to (916) 442-0382.

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Arsenic in Groundwater: Impacts on a Critical Resource

October 18-19 in Fresno, CA

BY WILLIAM PIPES

Groundwater. A critical resource. Possibly the most critical local resource in the Western U.S. Here in California and the West, we are increasingly relying on groundwater for our domestic, industrial, and agricultural water supply as water demand increases and surface water supplies decrease. As more surface water is mandated for environmental purposes and as drought conditions strangle the West, groundwater and our alluvial aquifers become our insurance, as we bank it, store it, and pump it to augment surface water supplies. In California, 30% of our water supply is from groundwater, up to 40% in dry years. That number could be up to 60% within 20 years as the state's population is estimated to increase by two-thirds.

Enter arsenic. An odorless, tasteless, naturally occurring and ubiquitous element on earth. Arsenic is present in groundwater, in some cases, due to human activity, but primarily because there are many natural sources of arsenic, including over 100 rocks and minerals that contain it. We have long been aware that very high levels of arsenic are poisonous to humans, but recent studies are showing that chronic exposures to much lower levels of arsenic also can cause human health effects. The pertinent federal and state regulatory agencies have responded to this health threat by lowering the drinking water standard for arsenic.

Continued on page 17

Upcoming Events

GRA Proudly Presents:

The 13th Symposium in the Series on Groundwater Contaminants

Investigation and Remediation of Dry Cleaner Release Sites

NOVEMBER 10TH, 2004 – RADISSON HOTEL, NEWPORT BEACH, CALIFORNIA

Dry cleaner operations are as ubiquitous as gas stations, yet the well-documented potential for dry cleaners using perchloroethylene (PCE) to impact soil and groundwater has not been met with a commensurate regulatory response for water quality protection. Unlike your corner gas station leaking underground storage tank site, California currently has neither regulations nor funding mechanisms for the detection and clean up of dry cleaner release sites.

Typically, dry cleaner releases are only discovered in the course of Phase II investigations for property transactions, or when PCE shows up in nearby groundwater monitoring wells. Unfortunately, the first indication of a dry cleaner release has too often been the 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.

GRA will be hosting a one-day technical and policy seminar focusing upon dry cleaner impacts to groundwater and indoor air. The event will further examine issues profiled at another GRA Symposium by the same title held on April 7th, 2004 in Sacramento, where we had over 260 attendees from 18 states. This seminar

will feature new speakers focusing on technologies for rapid and effective screening and subsurface characterization of former and current 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 from Southern California and other dry cleaner release sites will be featured, representing the gamut of challenges posed by dry cleaner releases in both drinking water and air quality. Panel discussions will include regulators, consultants, research scientists, attorneys, water purveyors, and dry cleaning industry representatives.

The Symposium Planning Committee has issued a Call for Papers & Posters. For additional questions, please feel free to call the Committee co-chairs Alistaire Callender, 714-278-0992 x3015, or Jim Carter, 310-618-8889 x105. Information on exhibiting, sponsoring, or attending this event may be obtained at www.grac.org or by calling GRA at 916-446-3626. ♠

Fate and Transport of Pharmaceuticals and Endocrine Disrupting Compounds During Groundwater Recharge

BY ROBERT W. MASTERS,
INGRID M. VERSTRAETEN, AND
THOMAS HEBERER

One important emerging groundwater issue is the occurrence, fate, and transport of pharmaceuticals and endocrine disrupting compounds (EDCs) in the environment. Some pharmaceuticals are not completely metabolized after consumption by humans or animals and are excreted in their original form, while others are transformed into other compounds (conjugates). Many of the conjugates may be cleaved to release the parent compound during the physical and chemical treatment of sewage.

This National Ground Water Association (NGWA) article provides excerpts from the Forward written for a special issue of Ground Water Monitoring & Remediation (GWMR) (Spring 2004; Volume 24, No. 2). The special issue contains papers that evaluate the effect of groundwater recharge techniques, on the fate and transport of pharmaceuticals and EDCs, and was made possible by NGWA's Third International Conference on Pharmaceuticals and Endocrine Disrupting Compounds in Water held in Minneapolis, Minnesota, in March 2003. For the complete Forward, including numerous references on pharmaceuticals and EDC findings and issues, see

Technical Corner

<http://www.ngwa.org/publication/gwmr/2004-02/forward.shtml>.

Overview

Releases of pharmaceuticals to the environment are likely to continue as the human population increases and ages, new drugs are formulated and promoted, and more wastewater is generated. EDCs are of particular concern as these can interfere with metabolism and elimination of hormones in the body. Residues and metabolites of pharmaceuticals and EDCs have been detected in untreated and treated waste water at sewage treatment plants and in surface waters receiving sewage effluents. Residues of selected pharmaceuticals have also been detected at low concentrations in ground and drinking water.

Research Under Way

Research is under way in several countries to evaluate waste water treatment processes and their potential for removing pharmaceuticals and EDCs. Moreover, waste water reuse has become a focal point in managing water resources in order to provide sufficient drinking water supplies worldwide. In the past, waste water reuse was thought to be a water resources issue limited to the southwestern United States. Recently, however, reuse of gray water has become a focal point in the southeastern and even northeastern United States during periods of extreme drought. SAT, aquifer storage and recovery (ASR) projects, or direct injection of waste water are the most common processes employed for conditioning of waste water to create drinking water. Finally, urban growth has led to concerns pertaining to contamination of domestic drinking water due to releases of contaminants such as microorganisms and pharmaceuticals from septic systems.

These developments have brought the issues pertaining to fate and transport of these compounds to the attention of regulators and consumers. California has shown a strong interest in these issues and is considering adopting regulations that would require operators of groundwater recharge (reuse) programs to perform annual monitoring of EDCs. Florida also has shown interest in establishing regulations pertaining to injection of gray water for the purposes of reuse. Nevertheless, it may take anywhere from years to decades to establish new drinking water regulations as the sources, occurrence, and fate and transport of these compounds are better understood, and our understanding of the effects of exposure to these compounds on human health improves.

Contents of Special GWMR Issue

The special GWMR issue contains papers discussing persistence of pharmaceuticals and organic waste water compounds and pathogens during recharge; fate and transport of selected pharmaceuticals and estrogenic steroids during bank filtration or artificial groundwater recharge; estrogenic activity originating from waste water effluents in groundwater at recharge sites; the degradation of selected EDCs during SAT/ASR; the biological attenuation of selected EDCs, pharmaceuticals, and personal care products using biologically active sand and continuous flow simulated ASR experiments; and other related topics. Increased water demand and reuse of waste water for industrial and drinking water require that environmental and human health scientists, regulators, and consumers improve the understanding of the fate and transport of pharmaceuticals and EDCs in the near future, ultimately conveying this information to resource managers and

Continued on page 18

California Performance Review

GRA TO WEIGH IN ON CPR

BY TIM PARKER, LEGISLATIVE COMMITTEE CHAIR

GRA is attending and participating in the California Performance Review (CPR) hearings, providing comments on CPR, and is available to provide technical opinions and assistance on any implementation measures to ensure the protection and management of our State's groundwater resources.

Our Legislative Advocates, Hatch & Parent, have provided a Preliminary Overview of the CPR Report (a complete copy is available on the GRA webpage), and are attending the CPR hearings to collect more information as the public review process develops. The Legislative Committee will also hold a session on the CPR Report at the Annual Meeting in September. Chris Reynolds, CPR Team Leader for the Resource Conservation and Protection Team will provide an overview on the Report's recommendations and be available to answer questions. We will also have what promises to be a lively roundtable discussion with panel participants including Senator Denise Ducheny, a member of the CPR Commission; Gail Delihant, Legislative Director for Assemblymember Greg Aghazarian; Richard Katz, State Water Resources Control Board Member; David Spath, Ph.D., Chief, Division of Drinking Water and Environmental Management, Department of Health Services; Sujatha Jahagidar, Legislative Advocate, Clean Water Program, Environment California; and, Rob Saperstein, Water Practice Group Leader, Hatch & Parent.

We will also take your questions and welcome input from the membership as

California Legislative Corner

part of the roundtable discussion. We will draft initial comments on behalf of GRA based on the public hearings and Annual Meeting session, and post them on the website for your further comments before they are finalized and sent to the Commission.

Short Summary

The California Performance Review's recently released report recommendations, if fully implemented, are described as saving Californians over \$32 billion dollars in the next five years. These savings would be achieved by

consolidating state government into 11 departments and eliminating nearly 120 of the state's 300 boards and commissions. The report focuses on making California government more customer service focused and streamlining government to eliminate inefficiencies.

Three of the 11 departments will house all water and environmental programs. These departments include: Infrastructure, Environmental Protection, and Natural Resources. Through this consolidation the

Continued on page 18

Legislative Committee Update

In May, the Committee led the Annual GRA Legislative Symposium at the State Capitol. During our June meeting, the Committee debriefed the Legislative Symposium and concluded that it was a great success; we had a good turnout of members and a number of very successful meetings with our State legislators. The Committee also received an update on water and groundwater related legislation from our Legislative Advocates. The Committee began to plan for the legislative session of the Annual Meeting in September 2004 and selected the California Performance Review to be the focus of the session.

During our August meeting, the Committee discussed the preliminary analysis of the CPR Report provided by our Legislative Advocates. The preliminary analysis is posted on the GRA website, and summarized in a separate article in this issue of HV. The Committee discussed some of the many CPR Report's proposed government structural modifications that could occur in California, and how water and

groundwater policy and practices could be improved or harmed. Given the far-reaching impacts of CPR, the Committee asked our Legislative Advocates to attend the hearings; we plan to provide comments on the CPR Report on behalf of GRA (comments will include issues identified during our roundtable discussion on September 25 at the GRA Annual Meeting). The Committee also received an update on water and groundwater related legislation (see the GRA website for an end of the year report).

For information on the legislative issues GRA is monitoring, link to www.grac.org and click on Legislative and Regulatory Update. For the most recent changes to a bill or for other legislative information go to the Legislature's portal at <http://www.legislature.ca.gov/>.

Questions? Contact GRA's Legislative Advocates, Chris Frahm and Jennifer Carbuccia, at Hatch & Parent (assistant@hatchparent.com). 💧

CCGO Highlights

BY JANE H. GILL-SHALER

The recent document, “California Performance Review” (CPR Report) has triggered a number of concerned inquiries from CCGO members, GRA, and the Association of Engineering Geologists (AEG). GRA’s Legislative Advocates have done a preliminary analysis of this controversial report, and have posted it on the GRA website, www.grac.org, and written a short summary article in this issue of HV. The three California Sections of AEG (Southern California, San Francisco, and Sacramento Sections) have established a team to study the CPR to make recommendations to members for a course of action. CCGO has sent out an email to organizational, business, and individual members informing them of the general provisions of interest to all geoscientists, and of the provisions with respect to the licensure board. The email requests their level of interest in the issues surrounding the CPR, and for input on concerns from their membership.

A notice has also been sent out to California AEG members asking for input. AEG plans to have speakers at the September 17 meeting of the CPR Review Panel in Fresno to express its position. More information will be posted on the CCGO website www.ccggo.org, as it becomes available.

Jane H. Gill-Shaler, RG (CA and NC) is the Executive Director of CCGO. She can be reached at janehgill@aol.com.

California Regulatory Corner

California Water Plan Update

BY KAMYAR GUIVETCHI, P.E.

To continue to be relevant to California water policy, the process for developing the Water Plan Update and the information it contains must change — and is changing. The Water Plan is becoming a strategic planning document that better reflects the roles of the State and the growing role of regionally-based integrated resource planning in California water management.

In Jan 2001, Department of Water Resources (DWR) significantly expanded the public forum for preparing the California Water Plan, including an Advisory Committee (AC) (65), Extended Review Forum (350), and other interested members of the public (2000). The AC and DWR have developed a new planning framework for preparing this and future Water Plans, which includes comprehensive Water Portfolios, Regional Reports, multiple Future Scenarios, and 25 Resource Management Strategies.

Key themes emerging in the Water Plan include: (1) the central role of

California’s regions in water planning and project implementation; (2) the evolving role of State Government; (3) rehabilitating aging water infrastructure; (4) diversifying regional strategies for water management; and 5) improving data and analytical tools to reduce uncertainty and risk.

DWR plans to distribute the Public Review Draft in October 2004 and a Final California Water Plan in March 2005. Information on the Water Plan is available at www.waterplan.water.ca.gov/b160/indexb160.html.

Kamyar Guivetchi, P.E., is currently the Manager of Statewide Water Planning, Department of Water Resources. He was appointed Manager of DWR’s Statewide Water Planning Branch in November 2000, and during his 26 years with DWR, he has worked on projects with the Office of State Water Project Planning, and most recently the Division of Environmental Services as Program Manager of DWR’s Suisun Marsh Program.

DWR Awards AB303 Grants

The California Department of Water Resources (DWR) recently announced the award of the Fiscal Year 2003-2004 grants under the Local Groundwater Assistance Program (AB303). A total of \$6.2 million was awarded in amounts up to a maximum of \$250,000 each to a total of 28 water agencies. The money can be used for groundwater data collection, modeling, monitoring and management studies; monitoring programs and installation of equipment; basin management; and development of information management systems. The FY 2004-2005 funding cycle will begin in Fall 2004. For more information, go to www.grantsloans.water.ca.gov/grants/assistance.cfm.

Current Happenings at the Federal Government

BY JOHN UNGVARSKY, US E.P.A.

12 Federal Agencies Collaborate to Create Science Portal

Science.gov, made possible through the collaboration of 12 major science agencies, is the gateway to reliable information about science and technology from across federal government organizations. While retaining the content and advances originally unveiled in December 2002, now Version 2.0 will search 47 million pages of government R&D results, rapidly returning focused and relevant information for users. For more information, go to <http://www.science.gov>.

Source Water Protection and Underground Storage Tanks: Program Integration and Partnership Opportunity

EPA's Offices of Ground Water and Drinking Water and Underground Storage Tanks are working together to reduce the risks of underground storage tanks to drinking water sources. A July 2004 joint memo outlined recommended actions to determine whether USTs are one of the risks to drinking water sources in their Region, and to coordinate work to make the best use of resources and increase public health protection. For more information, see: http://www.epa.gov/safewater/protect/pdfs/memo_swp_usts_wppartnership.pdf.

Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action

The Handbook of Groundwater Protection...contains EPA's latest interpretation of policies on such topics

Continued on page 18

Federal Legislative/Regulatory

USGS and the Private Sector

BY GLENN G. PATTERSON, U.S. GEOLOGICAL SURVEY

Throughout the 125-year history of the U.S. Geological Survey (USGS), collaboration with State and local government agencies has been fundamental to our mission of providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. The collaborative relationship related to water resources was officially recognized by Congress in 1895 with the establishment of the Federal-State Cooperative Program (now known as the Cooperative Water Program or CWP). Central to the CWP is: (1) recognition that governments at all levels share a common interest in obtaining reliable data to better understand water resources that are critical to human and ecological needs, and (2) recognition that water-resources information developed jointly by the USGS and non-Federal cooperators is of great value to the public at large, and must be made publicly accessible. This common interest is reflected in the CWP by jointly funding data collection and interpretive studies conducted by the USGS. For much of the history of the CWP, the cost-share ratio was 50:50. During the last decade, however, the proportion of Federal funding has declined in comparison to the non-Federal share, resulting in a current cost-share ratio of 33:67. In 2003, the CWP involved about 1,400 State, local, and Tribal cooperators, and funded about 4,200 streamgaging stations and 750 interpretive projects. These projects focus on hydrologic issues with broad regional or national public interest,

including water supplies available from rivers and aquifers, patterns of water use, quality of water in relation to human health, hazards from floods and droughts, and quantity and quality of water to meet ecological needs.

Historically, the CWP has worked closely with water-resource agencies at all levels of government to set priorities for work and funding activities. In collaborating with our many stakeholders, the USGS often addresses issues that have private sector involvement as well. As a result, we continually assess what activities are appropriate in fulfilling our mission and which are more appropriate for commercial consulting firms. First and foremost, the USGS undertakes projects that support our role as the principal Federal provider of hydrologic data, scientific theory, research, and new technology for the Nation. In order to avoid competition with the private sector, projects undertaken with funding partners must align with the broader mission goals of the CWP, which include:

- expanding knowledge of the regional hydrologic system;
- advancing field or analytical methodology;
- increasing scientific understanding of hydrologic processes;
- providing data or results useful to multiple parties in potentially litigious inter-jurisdictional conflicts over water resources;
- delivering hydrologic data required for interstate and international

Continued on page 19

Awesome Aquifers for Science Olympiad

BY SHARON LIEN, THE GROUNDWATER FOUNDATION

Students throughout the country will be learning about groundwater by building model aquifers as part of The Groundwater Foundation's new Science Olympiad event "Awesome Aquifers." Science Olympiad is an international program that encourages middle and high school students to learn an area of science and then compete as individuals and teams at local, state and national tournaments. During the last school year, approximately two million students at 14,000 schools from all 50 states and Canada participated in Science Olympiad. Events cover all science disciplines, and include both paper tests and events that require students to build models or demonstrate their abilities to use scientific tools. Science Olympiad, which is typically a school club, also offers students opportunities to meet and work with working scientists, who often serve as program mentors or event judges.

Because an event on groundwater didn't exist in the Science Olympiad program, The Groundwater Foundation created Awesome Aquifers. This event is designed to increase students' understanding of groundwater concepts by providing hands-on, experience-based groundwater education to students that participate in Science Olympiad tournaments. Prior to the tournament, students conduct groundwater research, then design and build a groundwater flow model, according to standardized Science Olympiad rules. During

competition, students use their models to demonstrate an understanding of the hydrologic cycle, the physical makeup of an aquifer and changes to the groundwater system. Students can earn bonus points for demonstrating possible

the complexity of an aquifer, and that it is an important water source. In fact, more than 85 percent of the students indicated that the event influenced them to conserve or protect groundwater.



Two enthusiastic middle school students experiment with an aquifer model.

contamination remediation techniques, such as using an intervening well to intercept a contaminant plume, chemical or physical treatment, or pump and aeration treatment. While students are required to demonstrate certain concepts, there are almost no restrictions on how they build their models, so the event encourages student creativity.

During the 2003-2004 school year Awesome Aquifers was a trial event at the Missouri and Nebraska State Science Olympiad Tournaments, and at the National Science Olympiad Tournament. Students that have participated in these events overwhelmingly indicated on the evaluation forms that they learned about the importance of groundwater,

Because of the success and enthusiasm of the students at this past year's events, Awesome Aquifers has been accepted as an official Science Olympiad middle school event for the next three school years. This is a particularly important development because it is an opportunity to teach some of the nation's brightest young scientists about a resource that is critical to human and environmental health at a time when earth science programs are being reduced in many schools.

During the next year, The Groundwater Foundation will be calling on groundwater enthusiasts throughout the country to support the Awesome Aquifers movement. There will be a need for people to help promote the event to Science Olympiad teams in each state and assist at local and state tournaments as event supervisors and judges. For more information on how you can be involved with Awesome Aquifers for Science Olympiad, please call The Groundwater Foundation at 1-800-858-1844, email Sharon@groundwater.org or visit our website at www.groundwater.org.

Sharon Lien is the Education Development Director of The Groundwater Foundation. 💧

Education Corner

Susan Garcia, Teacher and GRA Director, Honored for Groundwater Science

Susan Garcia, seventh grade science teacher at Powell Academy and former professional hydrogeologist, was recently honored for her outstanding efforts to bring alive the science of groundwater for young students. Garcia was presented the Distinguished Service Award from the Water Replenishment District of Southern California. She involved students in essay and poster contests about the water cycle, brought in water experts for school presentations and organized a field trip to a water treatment plant, a desalination facility and a spreading ground for replenishing groundwater.

For 14 years Garcia worked as a hydrogeologist, making contaminant assessments of property and proposing remediation efforts for businesses and organizations such as UPS and NASA. After being laid off following a downturn in business, she assessed her corporate skills in educating and training clients and put them to use in a north Long Beach classroom. With five years experience at Powell, she remains active in hydrogeology. She is a state registered geologist and certified hydrogeologist and serves as a board member of GRA.

She believes teaching middle school students gives her maximum opportunity to affect their lives for the better. "Whatever happens on the surface impacts what happens to the groundwater, now and in the future," she said. "Students can realize that everything is interrelated and that small changes can have big consequences. With groundwater—and with life—I want them to be able to make a benefit/cost analysis, in order to understand consequences and be equipped to make informed decisions."



Susan Garcia, center, is presented the Distinguished Service Award from WRD.

This article was edited and reprinted from a press release by the Long Beach Unified School District. Contact

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International Association of Hydrogeologists Notes

BY LENNY KONIKOW, IAH

The 33rd Congress of the International Association of Hydrogeologists (IAH) will be held in Zacatecas City, Mexico, during October 11-15, 2004. The overall theme of the meeting is "Groundwater Flow Understanding: From Local to Regional Scales." The Congress will also include symposia on transboundary aquifers, arsenic in groundwater, and groundwater and metal mining. To find out more details about the meeting, go to the Congress Web site at: <http://www.igeograf.unam.mx/aih/>.

An international conference and field seminar on "Water Resources & Environmental Problems in Karst" will be held in Belgrade and Kotor, Sept. 14-19, 2005. It is being organized by the IAH National Committee of Serbia & Montenegro. More information is available from the conference web site at: <http://www.cvijic-karst2005.org.yu>.

A new IAH book on "Nitrates in Groundwater" was recently announced. It includes 27 chapters and provides an extensive overview of studies of nitrates in groundwater, including chemical and physical processes affecting the fate of nitrate, and detailed case studies from Europe. The book is available from Balkema Publishers (<http://balkema.ima.nl>).

Another new book is also available now, published by the Netherlands IAH Committee, on "Management of Aquifer Recharge and Sustainable Storage." It provides a summary of recent developments in managed recharge. Copies are available from the Netherlands IAH (email: j.heederik@nitg.tno). ♠

Alliance Corner

California Groundwater Association Notes

BY MIKE MORTENSSON, CGA EXECUTIVE DIRECTOR

Concern on Proposed DHS Regulations

CGA and GRA have been working together to make recommendations to DHS on their proposed Waterworks Standard that includes a section regarding aquifer capacity testing in hard rock well areas for public water systems. A task force with contractors and technical members of both CGA and GRA proposed an alternative be added to the DHS draft that allows public water systems to utilize the services of a California registered geologist or a California licensed engineer with groundwater hydrology experience to manage and evaluate aquifer and well tests to ascertain well capacity. Although DHS appeared supportive of such an alternative, they have not included it as of this writing. What is in place are basic formula approaches of 3 day and 10 day tests with subsequent reduction of capacities by 50-75% for the final approved capacity. CGA has expressed concern that these approaches are not in the best interest of the general public. Further actions on this matter are underway. Contact CGA or David Abbott of GRA if this issue is of concern to you.

CGA Well Project Coming to TV this Fall

It started with a phone call about an existing water treatment system and ended with the construction of a new well, storage tank, booster pumps and filtration system...IN 2 DAYS!!!

CGA members recently completed a critical portion of an ABC-TV Extreme Makeover Home Edition project in Sonoma County. Ty Pennington, star of the show got drenched with well development water (intentionally) while filming a key segment of the show, which

is to be aired this fall. The TV show's producers selected the home after hearing from the family's teenage daughter who had not had a normal life for six years since she became allergic to sunlight.

High nitrate levels in the water supply required the construction of a new well and water system. The task involved five CGA contractors working in concert and 20 manufacturer/supplier members who provided the needed system components. The entire makeover project was done in a week. The family came home on July 14th to a new 2000 sq. ft. home, well system, covered outdoor pool and spa, entertainment center building, landscaping and a new septic system. The well is a first for the show and they said it would be a key element in the storyline. The show is tentatively set to air on Sunday, October 10th on ABC-TV.

CGA Seminars Scheduled

CGA will again offer a number of seminars at its 56th Annual Convention and Trade Show on November 4-6 at the Silver Legacy Resort Casino in Reno. More details are available at the CGA website www.groundh2o.org. The McEllhiney Lecture by Hank Baski on the subject of "Groundwater: Fallacies and Facts" will also be held on Saturday morning.

CGA will conduct Water Well Destruction workshops for regulatory personnel in both northern and southern California on Sept 22 and 29 under a US EPA contract. These workshops follow upon the highly successful Basic Water Well Construction workshops for regulatory agency personnel held in 2003. ♠

2004 and 2005 GSA Birdsall-Dreiss Distinguished Lecturers

BY VICKI KRETSINGER, GRA DIRECTOR

The Birdsall-Dreiss Distinguished Lectureship, sponsored by the Geological Society of America (GSA) Hydrogeology Division and funded by the GSA Foundation and now in its 27th year, brings eminent hydrogeologists to higher education and research institutes on a mission to educate others on the latest hydrogeologic research, promote the study of hydrogeology and scientific exchange, and act as an ambassador of goodwill on behalf of GSA. On May 12, 2004, the San Francisco Branch had the pleasure of hosting the 2004 Birdsall-Dreiss Distinguished Lecturer. This year's esteemed recipient was Dr. Barbara Bekins, from the U.S. Geological Survey in Menlo Park, California. Dr. Bekins provided the Branch with her presentation on The Influence of Hydrogeology on 25 years of Natural Attenuation at a Crude Oil Spill Site. See the San Francisco Branch Highlights for the abstract of Dr. Bekins presentation.

For 2005, the prestigious GSA Birdsall-Dreiss lectureship has been



GSA Birdsall-Dreiss lecturer William W. Woessner.

awarded to William W. Woessner, a geology professor of the University of Montana since 1981. He teaches classes in applied hydrogeology, advanced hydrogeology, groundwater modeling, applied groundwater modeling, surface water-groundwater interaction, and groundwater remediation. His research includes quantifying flow systems in intermountain valleys; water resources systems analyses, including ground water-surface water interactions at lakes, wetlands and streams; contaminant transport (including virus transport); and the development and application of groundwater flow and contaminant models. He and Mary P. Anderson co-authored the popular reference text Applied

Groundwater Modeling, Simulation of Flow and Advective Transport (1992) that is distributed worldwide. Dr. Woessner is the co-founder and Acting Director of the University of Montana Center for Riverine Science and Stream Renaturalization. The Center, created in 2002, is an interdisciplinary research group whose mission is to advance the knowledge of natural stream function and develop methods and procedures to mitigate impacted stream systems.

To request a visit, contact William Woessner, The University of Montana, 32 Campus Dr. #1296, Missoula, MT 59812-2341, (406) 243-5698, e-mail: woessner@umontana.edu. Dr. Woessner is offering the following lectures:

- Examining the Exchange of Groundwater with the Stream/Floodplain System: Physical, Thermal and Geochemical Approaches with Ties to Stream Renaturalization
- Occurrence, Transport and Fate of Viruses and Pharmaceuticals in Groundwater Impacted by Septic System Effluent: The Hydrogeologists and Human Health

Watch for announcements where Dr. Woessner may be providing a lecture near you and plan to attend! •



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Call for Nominations for GRA Director Seats Open in 2005

The Association is now soliciting nominations for GRA Board of Director candidates to run for seats that commence service January 1, 2005. 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 Member 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 appointment.
- ◆ Nominations must be submitted in writing to GRA 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

Organizational Corner



The GRA Directors relax after the August 21, 2004 Board Meeting in Pt. Richmond.

the material to Kathy Snelson, GRA Executive Director, via email (executive_director@grac.org), fax (916-442-0382) or mail (915 L Street, Suite 1000, Sacramento, CA 95814) no later than October 8, 2004.

Should you have any questions or need additional information about

the GRA Director Call for Nominations, please contact Kathy Snelson at (916) 446-3626. ◆

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 upon 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 above and forward

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An Annual Celebration

BY KATHY SNELSON, GRA
EXECUTIVE DIRECTOR

GRA's 13th Annual Meeting will have concluded by the time this edition of *HydroVisions* is circulated. Nevertheless, it seemed like an appropriate time to write about the collaborative development and collective work that goes into executing an annual meeting.

An annual meeting is much like an abbreviated version of an organization. It is a two-to-three day snapshot of what an organization is like throughout the year – many things to many members with a variety of needs. It is a forum in which an organization's entire leadership and most of the active volunteers are often present, readily available and looking forward to exchanging ideas and sincere pleasantries with as many members and stakeholders as possible. It is an established time to honor exceptional achievements by special individuals and organizations. And, very importantly, it is a once-a-year opportunity for members to directly experience the organization they belong to and believe in, to evaluate its performance, and to assess if it still has what it takes to envision and pursue the vast possibilities that can achieve the organization's mission.

While an annual meeting might not always be the highest revenue-generating program, or include all of the "hottest" industry topics, it is an excellent example of significant, relevant work accomplished by a collective, dedicated group of volunteers. The result is most often a comprehensive program that addresses several facets and issues involved with an organization's principal purpose and related industry – a sincere effort to

Organizational Corner

address the majority of members' needs (current and prospective). In addition, an annual meeting is often structured to offer social events that encourage face-to-face contact (a refreshing balance to the usual, fast paced electronic-based communications we have become accustomed to) and participatory educational activities that highlight local industry issues and operations. As Jim Collins writes in his book *Good to Great*, "It is not any one variable in isolation that makes a company great; it is the combination of all of the pieces working together in an integrated package consistently and over time." An annual meeting is a microcosm of the organization it symbolizes and the members it represents.

If you weren't able to participate in GRA's 13th Annual Meeting, I hope you will participate in GRA's 14th Annual Meeting. This perpetual GRA event encapsulates what Jim Collins states about enduring companies, "Enduring great companies preserve their core values and purpose while their business strategies and operating practices endlessly adapt to a changing world. This is the magical combination of preserve the core and stimulate progress." At the least, GRA's Annual Meeting is a celebration of continuous "dedication to protecting and improving groundwater in California." Not so "small", when you think about it. It is reason enough to join GRA's annual celebration each and every year! 💧

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Mexico, spanning an area as large as California's Sacramento Valley, is also believed to have a natural origin, possibly due to deposition with precipitation.

Dr. Andrew Eaton of MHW Laboratories profiled three new analytical methods for perchlorate testing. EPA

Method 314.1 is an ion chromatography technique much like 314.0, but with an online preconcentration system to permit analysis of large sample volumes for low

reporting limits (0.2 ppb). A second technique, Method 330.0, will use ion-chromatography with mass spectrometry using an electrospray interface to obtain low reporting limits even in samples with high salt concentrations. Method 331.0, commercially available today, uses liquid chromatography-mass spectrometry-mass spectrometry to achieve a method reporting limit of 0.02 ppb. Using a double-blind study, labs had generally good performance for quantifying perchlorate below 1 ppb in deionized water, but accuracy and precision degraded considerably in samples with higher total dissolved solids.

Toxicology of Perchlorate

The Environmental Working Group's (EWG) Renee Sharp presented data and policy implications of perchlorate detections in edible food crops, cattle feed, and milk. Perchlorate has now been identified through grab-sample spot surveys in at least a dozen food products and two feed crops, with plant tissue perchlorate bioconcentration factors as high as 1200-fold over irrigation water concentrations. Perchlorate test data in 34 commercial milk samples from milk suppliers across the state analyzed by the California Department of Food and Agriculture had detectable perchlorate, and 31 of 32 milk samples analyzed for EWG showed presence of perchlorate levels at concentrations lower than those tested by the California Department of Food and Agriculture (CDFA). EWG concludes that half the children from ages 1 to 5 years

would be getting more perchlorate per day than EPA's draft toxicity threshold of 1 ppb in drinking water from milk consumption alone. Cal-EPA assumed in its Public Health Goal (PHG) document that perchlorate exposure from food sources comprises 40% of total exposure. EWG

questions whether that level may underestimate total exposure, and whether the Uncertainty Factor applied in establishing the PHG may be too low.

“Perchlorate has now been identified...in at least a dozen food products and two feed crops”

Dr. Philip Smith of Texas Tech University profiled his research on perchlorate movement from plants, soil and water into mammals, noting that soil may be a greater source of perchlorate exposure in rodents living in perchlorate affected areas than vegetative matter. Analysis of tissue residue in exposed prairie voles and deer mice suggested perchlorate in food may be less available for adsorption than perchlorate in water.

In another presentation, Dr. Richard Pleus of Inertox and U. Nebraska Medical Center classifies the iodide uptake

effects at levels higher than about 250,000 ppb. Pleus notes that the common dietary ingredients nitrate and thiocyanate, which are found in most vegetables, meats, and dairy products, also inhibit iodide uptake. He emphasizes that IUI is several steps removed from an adverse irreversible effect, and that the contribution of the levels of perchlorate found in most perchlorate-contaminated drinking water sources to IUI is negligible when compared to the dietary contribution to IUI.

Dr. Richard Bull, lead author of UC Irvine's Urban Water Resource Center report on perchlorate, presented his views on the development of an MCL for perchlorate. Based on available data, he proposes 100 µg/L as the level below which IUI will not occur in normal, healthy adults. He compared the IUI effects of perchlorate to other anions, such as nitrate, commonly found in drinking water. The regulatory threshold equivalence of nitrate to the California perchlorate PHG of 6 µg/L based on potential IUI would be 11 mg/L rather than the current MCL of 45 mg/L. Since nitrate is a much more abundant contaminant in groundwater than perchlorate, the economic considerations for a consistent regulatory framework seeking to protect drinking water consumers from IUIs warrants detailed examination before establishing an MCL.

Keynote Speaker

Following the morning discussions on the toxicology of perchlorate, Dr. Gina Solomon of UCSF and the Natural Resources Defense Council presented the Keynote speech, in which effects of IUI in the developing fetus were emphasized. Perchlorate may interfere with fetal IUI in three ways: decreased transfer of

iodide across the placenta, prevention of iodide uptake in the developing thyroid, and decreased maternal thyroid production on which the fetus depends. In the first trimester, a mother's thyroid hormone production must increase 30 to 50%, as



Symposium sponsors and attendees enjoy a conversation in the exhibit hall.

inhibition (IUI) effects of perchlorate exposure as reversible or 'pre-adaptive' from drinking water concentrations up to 17,000 ppb, adaptive and producing thyroid hormone level changes to >100,000 ppb, and presumed neurodevelopmental

the fetus does not yet have a functioning thyroid. Numerous neuro-developmental affects may result in the developing fetus with insufficient thyroid hormone availability. Dr. Solomon notes that infants are much more susceptible to IUI than adults, and the baby's thyroid stores only a 24-hour reserve of iodide. In adults, iodide stored in the thyroid lasts several months. An infant consumes 6-times the amount of liquid an adult does on a bodyweight-adjusted basis, and Dr. Solomon advises that a great deal more caution is needed for neurotoxicants like perchlorate, asserting that the inter-individual uncertainty factor used by Cal-EPA to set the Public Health Goal, 3 to 10, is not sufficiently protective of all of California's drinking water consumers. US EPA and the State of Massachusetts set their uncertainty factors ranging from 30 to 300 to account for inter-individual variations and database uncertainties, and set their advisory exposure levels at 1 µg/L, which Dr. Solomon believes is more appropriate.

Innovative Remediation Methods

Dr. Baohua Gu of Oak Ridge National Laboratory, and Dr. Sam Bryan of Pacific Northwest National Laboratory presented their research in a platform talk and a poster, respectively, on highly efficient perchlorate selective resins coupled with point of use determination of resin bed loading using Raman spectroscopy. The perchlorate selective resins were originally developed to remove the radioisotope pertechnate at the ppt level in Paducah, Kentucky. Pertechnate, TeO_4^- is an analog to perchlorate. At 50 ppb influent perchlorate, ORNL's perchlorate selective resin can treat 100,000 bed volumes to below 1 ppb, compared with 500 bed volumes for carbon and Type II acrylic resins, or 3,000 bed volumes for styrenic gel resins. Regeneration of resin beds is accomplished using a solution of FeCl_3 in HCl, which rapidly desorbs perchlorate in less than 2 bed volumes of regenerant solution. The regenerant solution chemically reduces perchlorate, thereby eliminating it, and the spent regenerant solution can be reused with no secondary waste production. This approach can lead to greater than 60% cost reduction over conventional ion

exchange resins, and may also allow smaller footprints for resin equipment.

Kleinfelder's David Jenkins presented an innovative in situ treatment technology that includes delivery of an electron donor in vapor phase using acetic acid (vinegar) in vapor form. Electron donor sparging using vapor addition avoids biofouling, is effective in low permeability and heterogeneous soils, and capitalizes on buoyancy forces to assist with distribution of the donor. The stoichiometrics of acetic acid addition predict that one gallon of household vinegar at 5% solution can treat up to 860,000 gallons of groundwater contaminated with 100 µg/L perchlorate.

Jess Brown presented the Carollo team's work on evaluating pilot-scale fixed bed reactors to design full-scale design criteria and operating parameters, and the potential for system upsets. Microorganisms indigenous to the Saugus Aquifer, which supplies water to the Castaic Lake Water Agency's municipal supply wells, were used in the pilot-scale bioreactor. The bioreactor successfully removed perchlorate to below detection, and was not impacted by episodic loading of perchlorate. The bioreactor also proved to be immune to short-duration (one day) interruptions of electron donor feed, as well as extended system shutdown. Biologic treatment provides the advantage of avoiding costly brine disposal.

Various other innovative remediation methods were discussed and detailed, including treatment by ion exchange resins (Carollo Engineer's Lina Boulos); tailored carbon (Dr. James Graham of US Filter Weststates); and electron-donor sparging (David Cook of Kleinfelder). A detailed description may be found on the GRA website.

Recent Legislation, Regulations, and Legal Issues

This very interesting and often controversial panel discussion featured four noted California attorneys who

typically represent a variety of clients, including water utilities, industry or land owners. The panelist presentations and occasional sidebars accurately reflected the very divergent views of opposing parties in complex litigation cases involving perchlorate in groundwater, public drinking water supplies, and extremely large monetary sums at stake.

Andrew Yamamoto, of Nossaman Guthner Knox & Elliott, who represents water purveyors, portrayed litigation over groundwater contamination as a "high-stakes game of poker." He described the litigation "bluffing" strategy used by alleged "polluters" to claim that

Litigation over groundwater contamination [is] a "high-stakes game of poker"

plaintiff water companies are liable for perchlorate contamination from pumping or water-spreading activities, and that the "bluff" had been "called" recently when a court rejected that argument in southern California, and the Regional Water Quality Control Board issued a CAO requiring replacement water in northern California. "Wild cards" in this "game" include possible bankruptcy of defendants and insurance options for cost recovery.

Lawrence Hilton, of Hewitt & O'Neil, represents a landowner of a site with historical perchlorate contamination, and understandably took issue with the use of the term "polluter," when many such defendants in lawsuits may have acquired a property with historical contamination. He raised many important issues in such lawsuits filed by water purveyors, including the actual extent of damages vs. the water utility "wish list," and the possible responsibility and potential liability of plaintiffs and other possible parties in such cases.

Steven Hoch, of Hatch & Parent, represents water purveyors and stressed the importance of thorough investigation and documentation when evaluating whether Chilean nitrate fertilizer or other alternative sources of perchlorate could have impacted groundwater at any

Continued on page 16

particular site, particularly in the vicinity of a larger known source of perchlorate, such as an aerospace manufacturer. This should include historical fertilizer use in the area, including Chilean nitrate fertilizer, and evaluation whether any other sources of perchlorate could have impacted groundwater.

Earl Hagstrom, of Sedgwick Detert Moran & Arnold, represents an industrial defendant in a perchlorate litigation in northern California. He raised the important question of whether there is any “damage” if regulatory criteria have not been exceeded, and suggested that it is premature to pursue litigation to determine liability and allocate monetary damages before scientific studies are completed and regulatory criteria, such as health-based standards, are established.

Continuing Problems for Water Utilities

Although the Symposium touched on numerous notable perchlorate plumes, one perchlorate impacted area in the Inland Empire involves many of the technologies, challenges and new developments related to perchlorate discussed during the day. Perchlorate detected in water wells for the City of Colton, Fontana Water Company, City of Rialto and West Valley Water District covers over one-half century of time, more than 20 potentially responsible parties, three regulatory agencies and at least 20 impacted wells.

Four distinguished panelists representing the Santa Ana Regional Water Quality Control Board and each of the water purveyors noted above discussed the challenges associated with providing drinking water within this impacted region. The common theme in many discussions was that cooperation between regulators, impacted purveyors and potentially responsible parties is necessary in order to restore the aquifer and meet water supply challenges. In addition, all panelists agreed that there is not enough funding currently

available to satisfy long-term water treatment or source-specific remedies. However, the panelists shared differing opinions on the benefits and detriments of potential listing on the National Priorities List and Superfund designation.

Case Studies

A number of detailed case studies, covering remediation technologies and general investigative techniques, were presented throughout the conference. These case studies, two of which are described below, presented the actual results of field work, and detailed the problems and solutions associated with some

“Cooperation between regulators, impacted purveyors and potentially responsible parties is necessary in order to restore the aquifer and meet water supply challenges”

interesting and complex cases. Presentations included an overview of various field applications of soil treatment remedial technologies, including in situ and ex situ (GeoSyntec’s Evan Cox); and the regulatory aspects of adopting a new Order for a solid rocket motor plant in San Jose (Keith Roberson of The San Francisco Bay RWQCB).

Carollo Engineer’s Joon Min presented the Carollo team’s work to assist the City of Ontario with managing the dual challenges of perchlorate and nitrate contamination. A detailed strategy using distribution system modeling and optimization analysis provided an acceptable solution emphasizing blending of water from different sources to achieve drinking water standards. This approach required a complete understanding of the system’s supply and demand parameters under the full range of operating conditions. Logistics for treatment technology installation, including brine storage and disposal, siting and space requirements, and routing water to achieve both blending and treatment, were evaluated using the model Carollo developed to solve Ontario’s perchlorate problem.

Dan Davis of D.B. Stephens & Associates presented his analysis of the reinjection of partially treated groundwater

at the Rancho Cordova perchlorate sites. VOCs were removed under regulatory order but perchlorate, while previously identified in the area in 1959 and 1979, was not considered a contaminant of concern. The reinjection of treated groundwater from which perchlorate had not been removed, at locations downgradient of the treatment systems, led to further spreading of perchlorate and ultimate shutdown of numerous municipal supply wells. Davis demonstrated through groundwater modeling that using a different hydraulic capture approach, in which off-site discharge of treated water is prevented, will avoid unforeseen future problems from new emerging contaminants or lower cleanup standards.

The remaining case studies are detailed on our website.

Thanks to our Committee Members

GRA thanks the Committee members who volunteered their time to plan and ensure the success of this symposium: Bill Motzer, Co-Chair (Todd Engineers), Jon Rohrer (Komex), Mark Fenner and Barry Molnaa (Arcadis), Tom Johnson and Scott Seyfried (LFR Levine Fricke), Elie Haddad (Locus Technologies), Peter Murphy (Kennedy Jenks), and George Cook (Santa Clara Valley Water District). This event was co-sponsored by Arcadis G&M Inc., Daniel B. Stephens Inc., GeoSyntec Consultants, Kleinfelder Inc., and the Santa Clara Valley Water District.

Thomas Mohr is GRA’s Vice President, Seminar Committee Co-Chair, and Perchlorate Symposium Chair. Jon Rohrer, of Komex H2O Science; Elie Haddad, Vice President of Locus Technologies, Inc.; and Tom Johnson, Vice President of LFR Levine-Fricke, also contributed to this article. ♠

over how to provide, manage, sustain or control our most important resource.

Groundwater resource sustainability is becoming one of the most important issues facing California. This is reflected by recent Grand Jury hearings on water planning issues in Sonoma County, increased litigation over water rights in the Santa Maria area, and disputes over the increased export of water to the Los Angeles area. GRA and its members must play an important role in helping to find, provide, protect and maintain supplies of clean water for California's ever increasing population. I encourage you to get involved at the state or local level; attend water-planning meetings, follow and support state legislation and local ordinances that protect groundwater, and get more involved in GRA. Your participation in GRA professional meetings, committee activities, and outreach activities will help keep the subject in the news. Accordingly, GRA's 13th Annual Meeting in Sonoma County on September 23-24, entitled "Aquifer protection, Replenishment and Treated Water Reuse," will provide an important forum to address those issues. GRA also expects to publish the completely revised Second Edition of the "California Groundwater Management" manual this fall (orders for this publication can be placed at www.grac.org).

I welcome your feedback, and look forward to seeing you at GRA events. I also welcome you to contact me by email at tom.johnson@lfr.com or by phone at (510) 596-9511. ♪

Unfortunately, the drinking water standard is below arsenic concentrations naturally found in groundwater in many locales in California and the West. Critics of the new arsenic in drinking water standard say that our reliance on groundwater may come with a very stiff price as water suppliers throughout the nation will have to consider some hard choices; either construct very expensive treatment facilities, attempt to obtain new supplies, or turn off the spigots.

The Symposium

This fall, GRA will be holding a symposium on this important topic. "Arsenic in Groundwater: Impacts on a Critical Resource" is the 12th in GRA's important and very popular Contaminants in Groundwater Series, and a follow-up to the successful arsenic symposium held by GRA in 2001. The symposium will be held October 18-19 in Fresno, California, and will focus on the continuing and escalating problems associated with this problem. Experts and researchers from academia, consulting, regulatory agencies, water purveyors, and the legal arenas will present papers, poster sessions, and provide panel discussions. The symposium begins at noon on the first day and concludes at 3 pm on the second day.

Sessions on the first day include Overview: Regulatory Framework, Occurrence, and Chemistry, where the federal and state PHG level for arsenic and development of drinking water standards will be discussed, followed by presentations on arsenic chemistry, arsenic sampling and analytical methods, and the distribution of

arsenic in ground water in the San Joaquin Valley and in Kern Fan sediments. The second session on the first day will be Impacts on Beneficial Use and Public Health. In this session, experts will discuss risk communication of the arsenic issue with

water consumers, the impacts that new regulations will have on private well owners, and the impacts the new arsenic standard is expected to have on groundwater management and conjunctive use.

Day two will open with a keynote presentation by Steve Hall, Executive Director of the Association of California Water Agencies. The morning will then focus on the Remediation of Arsenic in Groundwater. Presentations will be delivered on aquifer chemistry and pumping well remediation, POU/POE treatment methods, co-occurrence of other contaminants in groundwater, waste disposal following treatment, and the results of pilot projects currently being conducted by agencies throughout the west.

The keynote speaker for the luncheon on the second day will be Jeffrey Wright, Dean of Engineering at the new University of California campus in Merced. Following lunch, the symposium will close with a panel discussion on the Consequences of Arsenic Cleanup in Groundwater where panel members will discuss the intended, and unintended, consequences of the new arsenic regulations, including the impact to the groundwater supply, the costs for the water suppliers, the expected benefits to the consumer, and other issues, such as disposal of the hazardous waste likely to result from some of the treatment options.

GRA's last arsenic conference attracted more than 160 attendees from throughout California and the Western U.S., and the 2004 event is expected to once again be California's leading arsenic event, presenting the latest technical information and dynamic policy discussions. The cost of the two-day symposium is \$295 for GRA members and \$345 for nonmembers. For more information and registration, please go to www.grac.org, or call GRA's main offices in Sacramento @ (916) 446-3626.

William Pipes is Vice President and Principal Geologist of Geomatrix Consultants, Inc. and is based in Fresno, California. He serves on the GRA Board of Directors and is the founding President of the San Joaquin Valley Branch of GRA. ♪

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SWRCB, Regional Boards, Colorado River Board, Reclamation Board, California Water Commission, Department of Toxic Substance Control and others will cease to exist.

Hearings began in Riverside on August 13th, covering the infrastructure and resource recommendations. Following a series of scheduled hearings, including a hearing on resource conservation and environmental protection scheduled for September 17th in Fresno, the Little Hoover Commission will make recommendations on the package presented to the Governor. The Governor will then present his package at the beginning of next session as part of his State of the State address. The real battle will occur in the Legislature, where this 2,500 page report has already been pronounced “dead on arrival” by Senate President Pro Tempore John Burton and where certain provisions have been sharply criticized by the Democratic majority in the Assembly.

The report is in four volumes, including a summary of findings, outline for government streamlining, keeping the

books, and issues and recommendations. The streamlined government would include the following departments:

- ▲ Commerce and Consumer Protection
- ▲ Correctional Services
- ▲ Education and Workforce Preparation
- ▲ Environmental Protection
- ▲ Food and Agriculture
- ▲ Health and Human Services
- ▲ Infrastructure
- ▲ Labor and Economic Development
- ▲ Public Safety and Homeland Security
- ▲ Natural Resources
- ▲ Veterans Affairs

The fourth volume of the report contains 279 government issues with over 1,200 recommendations that have the potential to save the state \$32 billion over the next five years. ▲

Current Happenings at the Federal Government – Continued from Page 7

as cleanup goals, the role of groundwater use, point of compliance, source control, and monitored natural attenuation. This Handbook ties 15 different topics together with an overall Groundwater Protection and Cleanup Strategy that emphasizes a phased, results-based approach to cleaning up contaminated groundwater. For more information, go to <http://www.epa.gov/correctiveaction/resource/guidance/gw/gwhandbk/gwhndbk.htm>

National Study of Impacts from Hydraulic Fracturing of Coalbed Methane Reservoirs

EPA published in June a final report evaluating the potential threat to underground sources of drinking water (USDWs) from injection of hydraulic fracturing fluids into coalbed methane production wells. The report concluded that the practice poses minimal threat to USDWs. For more information, see <http://www.epa.gov/safewater/uic/cbmstudy.html>.

Guidelines for Evaluating Ground-Water Flow Models

Ground-water flow modeling is an important tool frequently used in studies of ground-water systems. A new USGS report provides guidelines and discussion on how to evaluate complex ground-water flow models used in the investigation of ground-water systems. For more information, see <http://water.usgs.gov/pubs/sir/2004/5038/>.

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. ▲

Fate and Transport of Pharmaceuticals and Endocrine Disrupting Compounds During Groundwater Recharge –

Continued from Page 4

consumers to ensure proper management of resources and improved confidence in our water supply.

October 13-15, 2004 Conference

On October 13-15, 2004, the Fourth Annual Conference on Pharmaceuticals and Endocrine Disrupting Chemicals will be held in Minneapolis, MN. This NGWA conference is being co-sponsored by the U.S. EPA National Risk Management Research Laboratory, U.S. Geological Survey Toxic Substances Hydrology Program, German Federal Institute for Risk Assessment, Minnesota Department of Health, the KWB-Berlin Centre of Competence for Water, and the Technical University of Berlin. For program details, see the NGWA web site at <http://www.ngwa.org/e/conf/0410125013.shtml>.

Robert Masters is the Conference Manager for the National Ground Water Association.

Ingrid Verstraeten is a Supervisory Hydrologist, Water-Resources Discipline, at the U.S. Geological Survey Maryland District.

Thomas Heberer is on the faculty of the Technical University of Berlin. ▲

compacts, Federal law, court decrees, and congressionally mandated studies;

- ▲ furnishing hydrologic data or information that contribute to protection of life and property; and
- ▲ providing standardized, quality-assured data in national databases available to the public and in published reports.

Other measures that the USGS has taken to help ensure that we remain sensitive to the issue of competition include: (1) disseminating a policy memorandum on avoiding competition with the private sector; (2) requiring that all new project proposals contain statements describing the Federal interest in the proposed work; and (3) requesting external review of the CWP. The external review was requested in 1999 through the Advisory Committee for Water Information (ACWI). The ACWI convened a task force of associations representing varied interests in the water-resources community, including several representatives from the private sector. A total of 59 recommendations were made for improving the CWP, including some suggestions related to the issue of competition. We have again asked ACWI to convene an external review task force to work with the USGS to evaluate our progress in implementing those recommendations. The task force, which again includes several members from the private sector, will be presenting its findings to the ACWI later this year.

For additional information on the Cooperative Water Program, including the USGS memorandum on competition, please visit the CWP web site: <http://water.usgs.gov/coop/>.

Glenn G. Patterson is the Coordinator of the Cooperative Water Program with the U.S. Geological Survey, 409 National Center, Reston, VA. He can be reached at gpatter@usgs.gov, or 703-648-6876.

Editors Note: This article is a follow-up to the workshop on this subject at GRA's Artificial Recharge Conference in San Jose in April 2003. ▲

The California Colloquium on Water is a lecture series sponsored by the Water Resources Center Archives, a system-wide unit of the University of California Division of Agriculture & Natural Resources. Scholars of distinction in the fields of natural sciences, engineering, social sciences, humanities, law, and environmental design offer monthly lectures. The goal of the Colloquium is to increase the understanding and appreciation of water resources and to contribute to informed decisions about water in California.

The Groundwater Resources Association (GRA), one of the financial supporters of the Colloquium, is pleased to provide you with information about the fall series. Receptions for each of the lectures are from 4:45-5:30pm at the Water Resources Center Archives, 410 O'Brien Hall. The lectures are from 5:30-7pm in 10 Evans Hall.

October 12 – “Fluids and Faulting: Water and Earthquakes in California:” Mark Zoback, Professor of Geophysics, Stanford University

November 9 – “When Myth Trumps History: The Reclamation Bureau and the Family Farm, 1902-1935;” Donald Pisani, Merrick Professor of History, University of Oklahoma

December 7 – “Water Follies: The Environmental Consequences of Groundwater Pumping;” Robert Glennon, Morris K. Udall Professor of Law & Public Policy, University of Arizona

For more information, contact the Water Resources Center Archives at (510) 642-2666 or waterarc@library.berkeley.edu, or check out the Colloquium web site: <http://lib.berkeley.edu/WRCA/ccow.html>. ▲





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Increased Interest in Banked Water in Texas

BY JANE GILL-SHALER, CCGO

American PureTex Water Corporation (PureTex), based in Houston, Texas, recently announced its acquisition of 24 trillion gallons of water currently stored in aquifers in Austin, Colorado, and Wharton counties in Texas. The group of private investors at PureTex is headed by George Abbey, who formerly directed the Johnson Space Center.

In two related articles in the Houston Business Journal (HBJ) and San Antonio Express News this summer, Abbey said "Water will be a critical and limiting factor for growth in these areas." Officials at the City of Houston did not agree, however, according to the HBJ, and indicated that available water supply and pending rights permits would serve Houston through the middle of the 21st century. "We have no immediate need to develop such a groundwater supply project," spokesman Wes Johnson of Houston Public Works is quoted in HBJ, which also indicated that Houston Public Works and Engineering Water Production representatives had not met with PureTex. However, in the same article, Abbey is quoted as saying that PureTex has met with members of communities in west Harris County, north Harris County, Fort Bend County, and San Antonio regarding future water supply issues.

As the population of Texas is projected to increase by 100% by 2050, other speculators are also attracted to the

increasing value of water in this area. Oilman and speculator T. Boone Pickens has updated an old plan to transport groundwater from the Panhandle to San Antonio through a pipeline, then into the Brazos River, and back through a pipeline to San Antonio, a distance of nearly 700 miles. Pickens has projected a cost for this proposal of \$650 per acre-foot, less than other proposals.

However, according to the San Antonio Express-News, San Antonio Water System (SAWS) Board Chairman James Mayor indicated that they had new proposals nearly every week. "There are a lot of people out there wanting to sell water right now. But we have a policy that they have to prove the science—that it's sustainable, that it doesn't affect the neighbors where they're drawing it from." According to Mayor, the price has to be favorable for the ratepayers. Susan Butler, SAWS water resources director, is reported to say that the Texas Legislature's 7-year-old restrictions on selling water from one river basin to another have limited the types of offers. In addition, she indicated concerns

regarding cost and availability of water in the projected source area, according to the San Antonio Express-News.

Other projects are in the works to ensure long-term water supply to the area, according to the SAWS website (<http://www.saws.org/>). Among these are: bringing in water from other aquifers; exploring the use of surface water in conjunction with southwestern area River Authorities; investigating the feasibility of Edwards Aquifer Recharge; and desalination as potential new water sources.

Information for this article was gathered from the San Antonio Water System website and articles in the San Antonio Express-News and the Houston Business Journal. Links of interest are at <http://houston.bizjournals.com/houston/stories/2004/07/19/story2.html>, <http://www.waterwebster.com/BusinessNews.htm> and <http://www.saws.org/>.

Jane Gill-Shaler is the Executive Director of the California Council of Geoscience Organizations. ♠

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Earth Science Week October 10-16, 2004

BY ANN BENBOW, AGI

Earth Science Week, October 10-16, 2004, is a time when geoscientists around the world will be sharing their knowledge and love of earth science with their communities. Earth Science Week was established by the American Geological Institute (AGI) in 1998 to raise awareness of earth and environmental sciences and their importance to society. During this week, geoscientists work with students and the general public to help them discover the earth sciences and become engaged in scientific exploration.

The theme for Earth Science Week 2004 is "Living on a Restless Earth." The global community is affected by the restless nature of our planet every day. Natural hazards such as earthquakes, storms, volcanoes and landslides threaten our homes and businesses, but they also provide evidence of the incredible power and beauty of our planet. Earth scientists study dramatic phenomena such as these to understand their causes and minimize their impacts on society. You can share your knowledge and enthusiasm about our dynamic Earth with others by getting involved in Earth Science Week.

There are many ways to celebrate. Teachers and students explore earth science with activities and experiments or by having scientists visit their classrooms. Museums and science centers host earth science exhibits, and field stations and university departments hold open houses for the public. In 2003, earth scientists and educators organized more than 200 events in all 50 states and in nine additional countries.

Your participation can be as simple as sending an Earth Science Week kit to a science teacher you know. The kits contain classroom activities, a teacher's guide, posters, bookmarks, and other materials that help teachers celebrate the week in classrooms. For more information about Earth Science Week, and to find out how you can get involved, visit www.earthsciweek.org.

Ann Benbow is the Director of Outreach and Education, American Geological Institute. This article was reprinted from GSA Today, September 2004. ♠

GRA Names Recipients of 2004 Annual Awards

The purpose of the GRA Annual Awards Program is to recognize noteworthy projects and unique individual contributions related to the protection and management of groundwater in California.

The 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 recipient of the 2004 Lifetime Achievement Award is John Bredehoeft.

The Kevin J. Neese Award recognizes significant accomplishment by a person or entity within the most recent 12-month period that fosters the understanding, development, protection and management of groundwater. The recipient of the 2004 Kevin J. Neese Award is the California Department of Water Resources for publication of Bulletin 118 and related actions to further effective groundwater management.

Details about the recipients and pictures of the 2004 awards ceremony at GRA's 13th Annual Conference will follow in the winter edition of *HydroVisions*. ♠

Editors Note: Letters to the editor are welcomed and should be submitted to Floyd Flood at editor@grac.org. Please include your name, address and daytime phone number. Letters are typically limited to 200 words. Letters may not be published or may be edited and republished in any format at the sole discretion of the GRA. All letters submitted become the property of GRA.

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For additional information, visit GRA's Web site at www.grac.org or contact Kathy Snelson, GRA Executive Director, at executive_director@grac.org or 916-446-3626.

GRA Welcomes the Following New Members

JANUARY 24, 2004 – AUGUST 27, 2004

Abadie, Victor	Santa Clara Valley Water District	Fox, Keary	Weiss Associates
Abuye, Chanie	Environ International Corporation	Francis, Tom	East Bay MUD
Achour, Farid	Roscoe Moss Company	Fricke, Rodney	Aerojet
Aispuro, Cristina	Kleinfelder, Inc.	Fudacz, Fred	Nossaman Guthner Knox & Elliott LLP
Aldern, Joseph	Geomatrix Consultants, Inc.	Galleni, Andrew	ENV America Incorporated
Amini, Hassan	Tetra Tech, Inc.	Giuntoli, Chris	GeoTrans, Inc.
Anderson, Stephen	Valley County Water District	Greger, Joel	Piers Environmental
Armendariz, Joseph	GeoSyntec Consultants	Hamer, Greg	Geomatrix Consultants, Inc.
Arteaga, Karen	Camp Dresser and McKee	Haroun, Lynne	Environ International
Ayres, John	Sedgwick, Detert, Moran & Arnold	Harrington, Robert	Inyo County Water Department
Bailey, Brett	Vironex Inc.	Harris, Victor	MWH Americas, Inc.
Baker, Jeff	Errol L. Montgomery & Assoc.	Heald, Scott	West Yost & Associates
Barry, Denis	Beveridge & Diamond, P.C.	Hekimian, Kenneth	HVN Environmental
Barter, Hale	USGS	Heningburg, Ben	ENSR International
Beer, Alex	ERM	Hickling, Katie	ENSR International
Bekins, Barbara	WRIME, Inc.	Holguin, Dolores	Valley County Water District
Besemer, Marjorie	GeoSyntec Consultants	Holmes, Tara	SCS Engineers
Bjorklund, Brian	Adverus, Inc.	Holt, Matthew	Treadwell & Rollo
Blanke, Jim	Camp Dresser & McKee	Hoose, Seena	Santa Clara Valley Water District
Bradford, Alan	ENV America	Hosangadi, Vitthal	Tetra Tech FW
Brathwaite, Sam	Schlumberger Water Services	Houser, Chuck	Petra Geotechnical, Inc.
Brewer, Steven	Gallet & Associates, Inc.	Howell, Richard	Tetra Tech EM, Inc.
Briones, Raul	Swenson & Associates	Hurst, Richard	Hurst & Associates, Inc.
Brode, Elizabeth	SJSU / SCVWD	Iovenitti, Joe	Weiss Associates
Bullock, Douglas	ENSR	Jamison, Dennis	Komex H2O Science
Burrell, Frank	GeoTrans, Inc.	Jasperse, Jay	Sonoma County Water Agency
Burrows, Malia	Tetra Tech, Inc.	Jenkins, Dave	Kleinfelder, Inc.
Cannon, Melissa	Cascade Drilling Inc.	Joffe, Lawrence	Shaw Environmental
Carlton, Stephen	Valley County Water District	Johnson, Peter	Johnson Wright, Inc.
Choi, Jongsok	W.A. Craig	Kalve, Erica	LFR Levine-Fricke
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Cook, Tim	Jacobson Helgoth Consultants	Kelson, Vic	WHPA, Inc.
Cook, David	Shaw Environmental	Kibel, Paul	Fitzgerald, Abbott & Beardsley, LLP
Cox, Randy	Applied Research Associates, Inc.	Kimura, Laurence	Provost & Pritchard Engineering Group
Crenshaw, Steve	Wildermuth Environmental	Klein, Josh	Geomatrix Consultants, Inc.
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BOOK REVIEW — Two Related Books on Sediment and Erosion Control

BY JAMES A. JACOBS, ENVIRONMENTAL BIO-SYSTEMS, INC.

Designing for Effective Sediment and Erosion Control on Construction Sites; and the related Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors; both by Jerald S. Fifield, Ph.D., CPESC, Forester Communications Inc., Santa Barbara, California, www.foresterpress.com.

These books are a worthy and practical addition to the libraries of those involved with erosion control and construction projects. Surface water and groundwater impact from non-point pollution sources is

a major regulatory challenge, in that construction sites, including environmental remediation activities, may contain a variety of natural and man-made contaminants that could exceed regulatory levels. These sites are locations where special erosion control measures may be needed to prevent storm-water runoff and sediment buildup in nearby waterways and groundwater recharge areas.

The history of erosion control is one written not only by engineers and scientists, but also by contractors who are out in the field, testing out the ideas of the

former. As many contractors know, great erosion control designs on paper do not always translate into terrific sediment and erosion control systems in the field. The cooperation of the innovative erosion control professional with the practical contractor has the greatest chance for success, and it is from this sensible perspective that these two books on sediment and erosion control were written.

James Jacobs, R.G., C.H.G., is Chief Hydrogeologist with Environmental Bio-Systems, Inc. and can be reached at augerpro@sbcglobal.net. ♠

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Sacramento Branch Highlights

BY STEVE PHILLIPS
BRANCH SECRETARY

For our April meeting, Rob Swartz discussed the state of the groundwater basin underlying northern Sacramento County. Rob is a Senior Project Manager overseeing the Groundwater Management Program for the Sacramento Groundwater Authority, prior to which he worked for the California Department of Water Resources for more than ten years. The Sacramento Groundwater Authority has adopted a new groundwater management plan, developed a recent state of the basin report, and facilitated the construction of facilities by local water purveyors. A key goal behind these activities is the sustainable expansion of the overall water supply by better management of surface water and groundwater supplies.

In May, Thomas Harter discussed results from intensive studies on nitrogen fate and transport underneath dairies, which in California produce 20% of US milk. Thomas is an Associate Cooperative Extension Groundwater Hydrology Specialist at UC Davis, who focuses on applying advanced modeling techniques to address groundwater quality and resource issues in rural and agricultural areas. Extensive monitoring of nitrogen in soil and crops grown on a dairy field, coupled with monitoring of shallow groundwater on 5 dairies in the northeastern San Joaquin Valley, provided a rich dataset for analysis using statistical and innovative modeling tools at multiple scales.

Salmon was the topic of our June meeting, where Jan Fleckenstein discussed the declining population of the endangered Chinook salmon in the Cosumnes River. Jan is finishing his Ph.D. with Prof. Graham Fogg in Hydrologic Sciences at UC Davis, and has worked on groundwater- surface water interactions along the lower Cosumnes River for the

last 5 years. The decline in salmon population has been linked to a decrease in river flows during the fall migration season caused by overdraft of the regional aquifer. To develop a better understanding of the critical relationship between the river and aquifer system, a 3D heterogeneous model of the river-aquifer system was constructed based on detailed geostatistical realizations of the alluvial stratigraphy. ♠

San Francisco Bay Branch Highlights

BY MARY MORKIN
BRANCH PRESIDENT

As a change from its usual Oakland location, the San Francisco Bay Branch held two talks this past quarter in the heart of Silicon Valley in San Jose. Many thanks to Mark Wheeler for selecting the speakers, organizing these meetings and helping us to reach more South Bay members. The following is a brief summary.

On May 12, 2004, the Branch hosted the 2004 Birdsall-Dreiss Distinguished Lecturer, sponsored by the GSA Hydrogeology Division and funded by the GSA Foundation. This year's recipient was Dr. Barbara Bekins, from the U.S. Geological Survey in Menlo Park, California. Dr. Bekins presented on "The influence of hydrogeology on 25 years of natural attenuation at a crude oil spill site." Below is the abstract for Dr. Bekin's talk.

The Bemidji results show that groundwater flow plays a central role in regulating subsurface microbial activity during natural attenuation. Microbial populations and reaction rates are inextricably linked to recharge, permeability, and hydraulic gradient. At the Bemidji site, degradation rates for constituents of non-aqueous crude oil vary strongly with recharge rates. In addition, the temporal evolution of microbial

populations and associated benzene degradation capabilities vary with permeability. The Bemidji results show that thorough characterization of the hydrogeology of a site is essential for understanding the subsurface microbial populations, their activities, and the associated effects on water quality.

On June 16, 2004, Dr. Jean Moran from the Lawrence Livermore National Laboratory presented "Comparing contamination vulnerability using isotopic and trace analytical techniques in two urban groundwater basins." Dr. Moran reviewed the work being done for the Ambient Groundwater Monitoring and Assessment (GAMA) program, sponsored by the California State Water Resources Control Board (SWRCB). This program aims to assess water quality and to predict relative susceptibility of groundwater resources to contamination based on analyses that are not routinely carried out at public water supply wells: ultra low-level measurement of volatile organic compounds (VOCs), and groundwater age dating. These analyses help define the flow field of a groundwater basin, and indicate the degree of vertical connection between near-surface sources of contamination and deeper groundwater pumped at high capacity production wells.

Upcoming talks for the San Francisco Bay Branch include: October 20, 2004 "Nitrate in California Groundwater: Sources, Sinks and Transport" by Brad Esser, Lawrence Livermore National Laboratory; and November 17, 2004 – "Aquitards and Contamination" by John Cherry. Watch for the announcements and on-line registration at www.grac.org. ♠

San Joaquin Valley Branch Highlights

BY BILL PIPES
BRANCH PRESIDENT

We meet for dinner every 3rd Thursday of the month, usually in Fresno, but we are starting to also meet in other San Joaquin Valley cities. One of those other locations is Bakersfield, where we always seem to have our best turnout. One of the fastest growing cities in California, Bakersfield has a significant population of geologists, engineers, and environmental scientists supporting Kern County's petroleum, agriculture, and aerospace industries. Groundwater plays a significant role in the Southern San Joaquin Valley as it makes up a substantial portion of the municipal, agriculture, and industrial supply. CSU Bakersfield has excellent geology and hydrogeology programs, and just a few miles northwest of Bakersfield sits one of the largest water banking projects in the world – the Kern Water Bank.

Our May meeting was held in Bakersfield at the Woolgrowers (Basque) Restaurant. Dr. Dirk Baron, Associate Professor of Geology at CSUB, presented "Distribution and Sources of Arsenic in Sediments from the Southern San Joaquin Valley, California." Dr. Baron's research is focused on the behavior of trace elements in natural and contaminated subsurface environments.

In June we returned to Fresno where we had a presentation given by Gary Corbell, Owner and President of Welenco, and one of the founders of the GRA San Joaquin Valley Branch. Gary's presentation was on "Recent Advances in Geophysical Logging for the Groundwater Industry." Gary recently has developed the software for a highly acclaimed drift and alignment calculation package which now includes Flo-Pac, a spinner flowmeter interpretation module. Supplementing this software package are special viewer modules for uses by the industry.

We took July and August for vacation. On September 16 in Fresno we will be welcoming this year's NGWA McElhiney Distinguished Lecturer, Hank Baski, President of Baski Inc., a Denver-based company that designs and manufactures equipment for the ground water industry. He will be discussing "Ground Water: Fallacies and Forecasts" that hinder optimal development of water wells, as well as new technologies and innovations that are expected to impact the water well industry over the next decade.

We will be hosting the next GRA Contaminants Series in Fresno on October 18-19, 2004, "Arsenic in Groundwater: Impacts on a Critical Resource." The symposium will look at arsenic in groundwater issues, impacts the new standards will have on this critical Western U.S. resource, and possible solutions to mitigate these impacts. Please check out the GRA web site for meeting announcements and other updates from the San Joaquin Valley Branch. ♠

Southern California Branch Highlights

BY DARRYL THOMPSON
BRANCH PRESIDENT

On August 3, 2004, the Southern California Branch of GRA held its chapter meeting at the Glendale Hilton on the eve of the August 4th Symposium, CIO4-•2004:Perchlorate in California's Groundwater. The keynote speaker was William E. Motzer, Ph.D., RG, Senior Geochemist at Todd Engineers. Mr. Motzer presented a talk entitled "Perchlorate in the Environment: What We Know in 2004 and Where Do We Go From Here?" Attendance at the chapter meeting was terrific, exceeding 70 people. We would like to extend a big thank you to our speaker and to Mary Megary and Kathy Snelson for assisting us in arranging the chapter meeting as part of the Symposium. We are looking forward to hosting another chapter meeting immediately prior to the November Dry Cleaner Symposium in Newport Beach, CA. Stay tuned for more information. ♠

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Dates & Details

GRA MEETINGS AND KEY DATES

(Please visit www.grac.org for detailed information, updates, and registration unless noted)

GRA Workshop <i>Model Calibration & Predictive Uncertainty Analysis Using PEST</i>	September 27-29, 2004 San Francisco, CA	GRA Symposium <i>Investigation and Remediation of Dry Cleaner Release Sites</i>	November 10, 2004 Newport Beach, CA
GRA Symposium <i>Arsenic in Groundwater: Impacts on a Critical Resource</i>	October 18-19, 2004 Fresno, CA	GRA Board of Directors Strategic Planning Meeting	January 15-16, 2005 Santa Barbara, CA
GRA Board of Directors Meeting	November 6, 2004 Irvine, CA	EIMS - Environmental Information Management Systems	January 26, 2005 Northern California



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