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GROUNDWATER RESOURCES ASSOCIATION
OF CALIFORNIA

Summer 2004

Dry Cleaner Symposium Focuses on Under-examined, Under-funded Threat to Groundwater Resources

BY SARAH RAKER, TOM MOHR, SCOTT DAVIS, JANET PETERS, AND JOHN MCHUGH

GRA celebrated its 10th Symposium in the Groundwater Contaminant Series on April 7th with over 260 attendees from 18 states at the “Investigation and Remediation of Dry Cleaner Release Sites.” The symposium was held in Sacramento and was co-sponsored by Arcadis G&M, Inc. and Daniel B. Stephens and Associates, Inc. Space constraints prevent acknowledgment of the full slate of excellent speakers and poster presenters by name in this issue; however, full presentations are included in the conference binder, available at <http://www.grac.org>, where abstracts may also be obtained.

Bill Linn, of Florida Department of Environmental Protection (DEP) and current chair of the State Coalition for Remediation of Drycleaners (SCRD), presented results of a survey designed to identify the sources of PCE releases at dry cleaner release sites. The survey of 348 facilities with reported releases identified

six main categories of release mechanisms, including equipment failures, spills during solvent transfer, dumping wastes to ground, and operational releases from frequent but small spills. Because the bulk of contaminant mass is generally located in close proximity to the discharge point, a better understanding of dry cleaning equipment, operations, and waste management practices helps identification of contaminant source areas, enabling investigators to focus sampling to provide accurate data in support of better remedial design. Mr. Linn has prepared a detailed paper on modes and points of release in dry cleaning plants, which is must-read material for anyone conducting dry cleaner investigations. The paper, “Reported Leaks, Spills and Discharges at Florida Drycleaning Sites”, is available for download at <http://www.drycleancoalition.org>.

Richard De Zeeuw of the Oregon Department of Environmental Quality presented a lunchtime keynote on the SCRDR, which he chaired in 2003 (Bill Linn of Florida DEP is the current chair). Mr. De Zeeuw profiled the SCRDR program, which was formed in 1998 by US EPA to facilitate exchange of technical information on dry cleaner remediation and funding mechanisms. Twelve member states, including California, actively participate in semi-annual technical exchange meetings. Mr. De Zeeuw drew from his background in economics to explain the challenges of funding dry cleaner remediation. The

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average resale value of dry cleaners is about \$130K, while the average cost to cleanup dry cleaner releases is \$200K. He estimates that there are about 2,800 active dry cleaners in the United States requiring remediation, and the number of inactive cleaners is four times as great. The benefits of Oregon’s Dry cleaner Fund were listed, including full immunity from liability, a continuous funding mechanism, and the opportunity to prioritize cases based on risk to drinking water supplies and occupants of overlying structures. Eleven states now have dry cleaner funds, and while available funding structures may not be sufficient to underwrite the total cost of cleanups needed, they’re seen as a significant improvement over litigating

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



President's Message

BY TOM JOHNSON

GRA Taken to the Cleaners

Where were you on April 7? If you attended the recent GRA Symposium "Investigation and Remediation of Dry Cleaner Release Sites" in Sacramento on April 7, you were in very good company. Some members had wondered whether there was sufficient interest in California for a conference related only to dry cleaners. Of course, newspapers have been chronicling recent events involving the City of Lodi and their approach to addressing PCE in groundwater, and the difficult legal battles fought over similar issues in Stockton and Modesto. However, there was still concern whether dry cleaner releases to groundwater were of statewide concern when planning for the conference began in late February.

The April 7 Dry Cleaner Symposium demonstrated that there is indeed widespread interest and concern, as well as serious disputes about dry cleaners and possible impacts on groundwater. The 270 attendees from 18 states and two Canadian provinces also showed that these issues are not limited to California. The conference addressed technical aspects of site investigation, remediation and human health risk, as well as the serious concerns of municipalities, water purveyors and the public regarding impacts to public water supplies. Important policy issues were also addressed in sometimes contentious panel discussions, including regulatory standards and cleanup levels, and allocation of responsibility. These are all very important and potentially very expensive issues, and, as a result, GRA will be hosting a second Dry Cleaner Symposium this year in Southern California on November 10. The announcement and call for papers for that symposium will soon be distributed and we look forward to an even more exciting conference.

However, there are many other groundwater issues facing California and GRA's almost 1,000 members, including groundwater sustainability, recharge and reuse, and the impacts of an increasing number of previously unregulated contaminants. Adding to this is the challenge of determining risks to human health or the environment, and setting (or revising) regulatory standards for drinking water or remedial goals that necessarily must consider practical aspects of cost and feasibility.

For many water purveyors and private well owners, the presence of arsenic or perchlorate, whether naturally occurring or introduced, has become a very critical issue, especially as changes in public health goals affect cleanup expense. To address these important issues, GRA is organizing two conferences. On August 4 in Glendale, GRA will host "CIO4 2004: Perchlorate in California's Groundwater," a comprehensive update on perchlorate in groundwater in California. Later, on October 18-19 in Fresno, GRA will hold a similar conference on "Arsenic in Groundwater." Look for the announcements for these conferences shortly at www.grac.com.

Perhaps no issues are more important or more contentious in California, however, than groundwater sustainability, aquifer protection, and water recharge or reuse. This is reflected by the increasing number of legal battles over water rights and disagreements over reuse policies. GRA's 13th Annual Meeting in Sonoma County on September 23-24, entitled "Managing Aquifers for Sustainability – Protection, Restoration, Replenishment and Water Reuse," will provide an important forum to address those issues. Also in time for the Annual Meeting, GRA expects to publish the exciting and completely revised Second Edition of the "California Groundwater Management" manual. Orders for this publication can be placed on the GRA web site (www.grac.org).

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Upcoming Events

More Symposia on the Way . . .

BY TOM MOHR, GRA VICE-PRESIDENT

GRA has several symposia planned for the remainder of 2004, each revisiting a topic that has attracted wide member interest on previous occasions.

Perchlorate 2004, the 11th Symposium in GRA's *Series on Groundwater Contaminants* will feature the latest developments on the toxicology, regulation, occurrence, and remediation of perchlorate. GRA's third symposium on this contaminant will feature new information on crop uptake, animal uptake, geogenic and atmospheric occurrence of perchlorate, in situ synthesis of perchlorate, policy and legal issues relating to large scale impacts to private and municipal well owners, forensic techniques to perchlorate, and new developments in remedial technologies for in situ and ex situ perchlorate treatment. GRA will stage this event on August 4th at the Hilton Hotel in Glendale, and will feature dual technical tracks.

Arsenic in Groundwater will be revisited on October 18th and 19th at the 12th Symposium in GRA's *Series on*

Groundwater Contaminants to be held at the Radisson Hotel in Fresno. This 2-day event will feature several new developments in the regulation and management of arsenic, and will include technical presentations on the mineralogy, geologic history, geochemistry, and origins of arsenic, the toxicology and regulation of arsenic, and the technology and economics for arsenic treatment. Case studies will be presented from arsenic-afflicted areas, and the rationale behind recent agency decisions reevaluating the disparity between the public health goal and the MCL will be discussed.

Investigation and Remediation of Dry Cleaner Release Sites (see article on Page 1) recently attracted a great deal of interest. GRA will hold a second symposium on this topic on November 10th in Southern California. This 13th Symposium in GRA's *Series on Groundwater Contaminants* will again feature presentations on the mechanisms and investigations of dry cleaner releases. Further discussion on the toxicology of tetrachloroethylene (PCE) will be held, including an analysis

of the adequacy of the physiologically based pharmacokinetic (PBPK) models used by OEHHA to establish California's 0.06 microgram per liter (ppb) Public Health Goal for PCE. The potential for impacts to groundwater from the several new dry cleaning agents will also be presented. A focus session on the in situ remediation of PCE source zones using chemical and bioremediation strategies will be held to contrast the benefits associated with each of a wide variety of approaches now in use.

2004 also marks the year of publication for the Second Edition of GRA's *Groundwater Management Handbook*. Subsequent to publication, GRA will host several training workshops and discussion forums on groundwater management strategies; locations and dates to be announced.

If you have ideas for seminars, workshops, or instructor led courses you would like to see staged by GRA, please contact Tom Mohr, Seminar Chair at tmohr@valleywater.org. GRA's all-volunteer Seminar Committee will evaluate submittals to gauge the applicability of the topic to GRA's mission and member interests. There are still opportunities for volunteers to assist the committees now organizing the events described above. Please contact me if you would like to volunteer. Sarah Raker is Seminar Co-Chair and can also be contacted regarding seminar planning and volunteering.

Tom Mohr is GRA's Vice President and a Hydrogeologist with the Santa Clara Valley Water District.

President's Message – Continued

Certainly these issues are not simple or easily resolved. However, as they say: "The answers are out there" and we need to keep looking for them. 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. ♠

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Legal Implications of the New Perchlorate Action Level

BY STEVEN HOCH

The setting of the Perchlorate Action Level at 6 ppb by the DHS raises interesting issues in the areas of environmental compliance and litigation. For water purveyors/providers, there is of course the issue of compliance. Under California law, a water provider is not required to treat for a substance (in this case, perchlorate), which exceeds an Action Level. However, the water provider is required to provide certain notices to governmental entities in the area where the water is served. The DHS recommends the water source containing perchlorate be terminated if the measured contaminant exceeds ten times the Action Level, or 60 ppb. Note that this is only a recommendation, which DHS has no statutory authority to enforce.

While the purpose of Action Levels is to provide advisory levels for contaminants, there has been a trend by certain regulatory agencies in California to expand the reach of these Action Levels. For example, in Southern California, certain agencies have attempted to incorporate DHS Action Levels for certain contaminants into permits. The question then becomes whether this inclusion of an Action Level in a permit affords the Action Level some greater regulatory weight above and beyond its intended purpose. Further, is it good practice for the regulatory community to include Action Levels in any type of permit, when these are contaminants whose effects have not been fully explored through the scientific review process?

Additionally, there has been a delay in setting the legislatively ordered MCL for perchlorate, and it is now likely that an MCL will be set within the next year. Thus, the larger compliance issue becomes anticipating whether or not an MCL at or around 6 ppb for perchlorate will be set. For water supplies currently at or above 6 ppb of perchlorate, there is a potential need to evaluate treatment options.

The problem, of course, is that perchlorate treatment can be expensive, and there are questions of responsibility. As an example, levels of the industrial contaminant perchlorate in the Colorado River have historically been measured in the range of approximately 4-8 ppb. Colorado River water is distributed by various water agencies for redistribution throughout Southern California. Some of that water is used to recharge basic groundwater supplies depleted by years of use and lack of recharge. Once in the groundwater, this perchlorate can find its way into public and private groundwater wells or is otherwise distributed to the public for a variety of uses, including agricultural.

In recent years, the number of lawsuits related to groundwater contamination has risen dramatically. To date, there have been suits brought by water consumers against water providers and industrial entities for personal injury. There have also been suits by water providers against industrial entities to recover water supply cleanup costs.

No matter what form the litigation or the parties, the issue is ultimately who is responsible. Certainly entities who use or used perchlorate industrially or commercially and have allowed perchlorate to get into the groundwater are liable. However, the \$64,000-question now being asked is who else is “responsible” – water providers, water agencies that recharge groundwater basins with Colorado River water, water suppliers who provide Colorado River water for direct delivery to consumers, or agencies who allow such water to recharge areas where the water would have

been headed naturally? Issues of legal responsibility that the courts have yet to substantively address and the outcome of such litigation will most likely shape the future of environmental litigation for years to come.

Steven Hoch, J.D. is managing partner for the Los Angeles office and practice group leader for the Environmental Quality Group of Hatch and Parent. ♪

No matter what form the litigation or the parties, the issue is ultimately who is responsible

California Regulatory Corner

CCGO Highlights

BY JANE H. GILL, EXECUTIVE DIRECTOR

CCGO 2004 Legislative Day

We certainly had a full slate of appointments at the 5th Annual Legislation Day in Sacramento on March 30, 2004. The delegation consisted of Rick Blake, representing American Association of Petroleum Geologists, Pacific Section, who is our CCGO President; Jason Preese, representing Association of Engineering Geologists, San Francisco Section, and our VP; and Lou Gilpin of Gilpin Geosciences, CCGO Business Member. They had a lot of walking and talking to do! The delegation met with the State Mining and Geology Board members and George Dunfield of the BGG; Michael Reichle of the California Geological Survey, and after a quick lunch, ran down to the offices of Assembly Members Guy Houston, Joe Nation and Manny Diaz, Senators Jeff Denham, Byron Sher, Debra Bowen, and Liz Figueroa. The delegation discussed CCGO's long-term objectives, and subjects as broad-based as seismic safety, geologist registration, ground-water resources, mining issues, science education and other issues that interest our members. They also talked with Deputy Cabinet Secretary Dan Skopec, of Governor Arnold Schwarzenegger's Office, for recommendations of geologists to fill state board seats required to be filled with geoscientists.



Tanya Atwater

Annual Fundraisers

The AEG-CCGO Northern and Southern California Annual Meetings featured Dr. Tanya Atwater this month. CCGO is very grateful to Dr. Atwater for both presentations, and to AEG Southern California Section and AEG San Francisco Section for organizing these events. CCGO obtains the funding for our operations for the entire year by memberships and donations, most of which are a result of these annual meetings. A Certificate of Appreciation was given to Tanya Atwater for her presentation, Plate Tectonics of Western North America. The Gold Award, for showing extraordinary dedication towards advancing the mission of CCGO, was presented to former CCGO President Jim Jacobs. Jim is one of the original founders of CCGO, and has been active since the beginning. Senator Liz Figueroa was presented the Legislator's Award, which is awarded to California legislators who have consistently advocated for sound geologic concepts in legislation on behalf of the geosciences professions. Inducted into the California Geologists Hall of Fame were Jim Davis, former State Geologist of California, and Doris Sloan, Adjunct Professor of Earth and Planetary Science at UC Berkeley, a beloved and extraordinary teacher to generations of

geologists. This honor is awarded to California geologists who have done extraordinary lifetime work towards improving the profession of geology. Previous inductees have been Tanya Atwater and Thomas Dibblee, Jr.

Big Pumice Cut

CCGO received several emails from our supporters warning of a proposed road realignment on the site of an important geologic teaching site at Big Pumice Cut on Highway 395 in Mono County near Bishop, California (<http://geology.csupomona.edu/docs/sierrap3.htm>). Our membership was concerned that this site could be made inaccessible for future generations of students. Mr. Bill Owen, of the Geophysics and Geology Branch of the Department of Transportation, responded to our barrage of emails and letters, writing to CCGO that he supported the preservation of the Big Pumice Cut. "I believe I speak for all Caltrans geologists in wanting to maintain the visibility of this important stratigraphic contact for future earth science researchers and students," he wrote. Thank you Mr. Owen! 💧

Legislative Committee Update

CHAIR: TIM PARKER

LEGISLATIVE ADVOCATES: CHRIS
FRAHM AND JENNIFER
CARBUCCIA, HATCH & PARENT

COMMITTEE MEMBERS: BOB
BOWCOCK, BOB VAN VALER,
CAROL WILLIAMS, JIM JACOBS,
AND TERRY FOREMAN.

During our **February Telecom**, the Committee discussed the pros and cons of supporting or opposing the proposed move to delay the issuance of the perchlorate public health goal. The committee decided on a membership survey, which was conducted in February. A total of 185 GRA members (or nearly 1/5 of the membership) responded; the responses were pretty well divided, and consequently GRA did not take a position on this contentious issue.

During our **March telecom**, the committee discussed all proposed legislation relating to GRA's mission and Legislative Guidelines (summary on-line). The Committee discussed taking a position on one bill: AB 2528 Lowenthal (Public Water Systems), which would modify current law to extend notification requirements when source water exceeds action levels or maximum contaminant levels to all sources of water and treat surface water and groundwater alike. The logic of AB 2528 is compelling: Contaminants should be treated the same under the law whether they are found in surface water or groundwater. The second part of the bill seeks to clarify the term "action level" by modifying terminology to clarify what requires notification and what requires response. The GRA Legislative Committee

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California Legislative Corner

California Groundwater Awareness Month is May! Be Aware of Your Groundwater!

Although often forgotten or misunderstood because of its invisibility, groundwater is one of California's most precious natural resources. Statewide, there is uncertainty on the effects of groundwater contamination, which basins are overdrafted and by how much, and sustainability of groundwater resources. Yet not all Californians are aware that groundwater is vital for a growing population, public health, the environment, agriculture and a healthy economy.

Prior to California's European occupation, groundwater was interconnected with our streams, sustaining streamflows and maintaining the health of riparian, aquatic, and wetland ecosystems. Since the 1900's many of California's streams have become perennial, and are now disconnected from groundwater at many locations, with a great loss in wetlands, diminished riparian habitat, and degradation of aquatic environment. Current information on California's groundwater includes:

- ◆ California uses roughly 17 million acre-feet per year or nearly 20 percent of the groundwater extracted in the nation;
- ◆ Nearly half of California's population depends upon groundwater for its drinking water supply;
- ◆ Nearly 1.3 million Californians obtain their water from privately owned groundwater wells;
- ◆ Groundwater is renewable, but generally not in a quick timeframe, with some aquifers taking hundreds to thousands of years to replenish naturally; and,

- ◆ Groundwater is being depleted an average of 1 to 2 million acre feet per year, causing declining groundwater levels and degrading groundwater quality.

In order to intelligently manage California's groundwater resources, substantial challenges need to be considered, including population growth, climate change, aquifer variability, droughts, and groundwater contamination; California must act through water conservation and reuse, public education, artificial recharge, conjunctive management, improved source water protection, and other means.

In June 2003, the Legislature of the State of California recognized and declared the month of May as Groundwater Awareness Month, and the Legislature is committed to supporting efforts to protect and improve the management of this precious and limited resource, while preserving existing water rights. This action was taken under the leadership of Assembly Member Carol Liu (Flintridge) with the assistance of GRA, with the proclamation of Assembly Concurrent Resolution 99 (Liu) Groundwater Awareness Month. Groundwater Awareness Month is an important statewide tool for raising awareness among governmental officials and the public about the nature and scope of the challenges ahead.

Be aware that even though your groundwater resources are out of sight and out of mind, there are actions all members of the community can take to conserve, protect and preserve this resource for future generations. ◆

AB599 Groundwater Quality Monitoring Act of 2001 – Sampling about to Commence

BY SARAH RAKER AND TIM PARKER

In these tough budget times, with large federal and state budget deficits, California is indeed fortunate to have a program commencing with the premiere national earth science organization in the country at the helm. As reported in the last edition of *HydroVisions*, funding through Proposition 50 was put on hold unless an exemption was granted. The AB599 Groundwater Monitoring Act of 2001 was granted an exemption and will be in full swing this summer. The people of California can look forward to a much better understanding of the state's groundwater quality in the years to come with this exciting effort underway.

In response to the Groundwater Quality Monitoring Act of 2001 (AB 599), the State Water Resources Control Board (SWRCB) is building upon their existing Groundwater Ambient Monitoring and Assessment Program (GAMA) to implement a statewide comprehensive groundwater quality monitoring program. As part of the SWRCB's Report to the Governor and Legislature, the U.S Geological Survey prepared a technical plan to conduct the statewide comprehensive groundwater monitoring program: *Framework for a Ground-Water Quality Monitoring and Assessment Program for California, Water-Resources Investigations Report 03-4166* (see *HydroVisions* Spring 2004). One of the primary goals of the program is to produce groundwater basin assessments that 1) describe constituents affecting groundwater quality, 2) identify

California Legislative Corner

trends in groundwater quality, 3) identify emerging constituents of concern, 4) relate groundwater quality to human and natural factors, and 5) identify data gaps. The program prioritizes 116 of the 525 groundwater basins for assessment based on groundwater use. For more details, The SWRCB Report to the Governor and Legislature and the USGS technical plan are available online at <http://www.swrcb.ca.gov/gama/ab599hom.htm>.


The SWRCB has committed nearly \$12 million (including FY 200304 allocations from Propositions 50 and 40) to the assessment of 44 (38%) of the priority groundwater basins. Groundwater basin assessments are planned across the state and represent areas in all 10 Hydrogeologic Provinces. Prior to implementing the program in specific basins, the SWRCB and USGS will coordinate with stakeholders including state and local agencies and local water purveyors. Under contract with the SWRCB, the USGS is preparing to start field work in June 2004, to commence the groundwater sampling effort as laid out in WRIR 03-4166. The overall statewide program is roughly a \$50 million, 10-year effort, excluding the future decadal and triennial trend monitoring.

The program will focus primarily on public-supply wells that are located in basins where groundwater is an important source of drinking supply and will utilize water-quality data assembled for the purposes of regulatory compliance (DHS database), with the collection of additional water samples from public-supply wells and other types of wells as needed (domestic supply, irrigation and monitoring). An estimated 3,000 to 3,200 wells will be sampled to provide complete spatial coverage of the priority basins. The proposed network of wells will be used for assessing the status of the groundwater resource and assessing trends in water quality, and will provide

a basis for understanding the factors that affect water quality.

Approximately half of the wells will be sampled for a basic schedule of constituents, including environmental tracers and low-level concentrations of volatile organic compounds; these constituents are the same as those included in the SWRCB California Aquifer Susceptibility studies. The remaining wells will be sampled for field parameters, major ions, trace elements, pesticides, and emerging contaminants, as well as the constituents on the basic analytical schedule. The expanded schedule of constituents is similar to that used by the USGS NAWQA program.

The primary criterion used for identifying priority basins (Category 1 to 4) was the number of public supply wells in a DWR-mapped groundwater basin. Secondary criteria included municipal groundwater use, agricultural pumping, number of leaking underground fuel tanks (LUFTs), and pesticide applications. For the purposes of efficiency, some of the basins can be grouped with neighboring basins. A fifth category, wells outside mapped groundwater basins, are important because they contain a significant percentage of wells with secondary selection criteria. A subset of selected areas of Category 5 basins will be included in the program to monitor and assess.

The SWRCB GAMA Program Manager is Angela Schroeter and the USGS Program Chief for National Water-Quality Assessment is Kenneth Belitz out of the San Diego office. The program goals are to have on-line data reports available on a basin-basis within four months of completion of sampling, and interpretive reports on a basin-basis nine months following the data reports. For more information on the GAMA Program or AB 599, visit the SWRCB GAMA website at <http://www.swrcb.ca.gov/gama/>. 

Federal Legislative Corner

Current Happenings at the Federal Government

BY JOHN UNGVARSKY

Annotated Bibliography of Source Water Materials

EPA has developed a bibliography of materials on Source Water Protection (SWP). This extensive list of available materials covers a variety of topics of interest to SWP planners, including source water assessment and protection, best management practices, wellhead protection, underground injection control, Clean Water Act/Safe Drinking Water Act integration, security, and funding. The bibliography includes technical materials, outreach materials, and guidances dating from 1984 to 2003, and may be copied and distributed. EPA plans to expand the bibliography to include additional resource materials from Federal, state, and not-for-profit organizations. If you have materials to be considered, contact Marjorie Copeland at copeland.jori@epa.gov. To access it, go to <http://www.epa.gov/safewater/protect/bibliography.html>.

Groundwater Depletion Across the Nation

U.S. Geological Survey (USGS) new Fact Sheet on Ground Water Depletion Across the Nation discusses what depletion is, why is it occurring, and where. Groundwater is the source of drinking water for about half the nation and nearly all of the rural population, and it provides over 50 billion gallons per day in support of the Nation's agricultural economy. Groundwater depletion, a term often defined as long-term water-level declines caused by sustained groundwater pumping, is a key issue experienced in many areas of the United States. For more information, go to <http://water.usgs.gov/pubs/fs/fs10303/>.

Southwestern Groundwater Resources Project

The Southwestern Ground Water Resources Project is a USGS 5-year study of groundwater and surface water interactions and their effects on the availability and sustainability of groundwater supplies in the Southwest. The study area includes aquifer systems in the arid to semiarid basins in southwestern states of California, Nevada, Utah, Arizona, and New Mexico. The main focus topics of the project are: 1) Regional synthesis of information on the interaction of groundwater and surface water; 2) Development of improved methods of quantifying inflow to groundwater systems from streams and application of these recharge methods in the Southwest; 3) Assessments of the effects of groundwater development on riparian systems; 4) Assessments of the effects of climate variations on recharge to and discharge from groundwater systems; 5) Development of improved methods of simulating interaction of surface water and groundwater. For more information contact Stanley Leake at saleake@usgs.gov or go to <http://az.water.usgs.gov/swgwrp/Pages/Overview.html>.

EPA's National Water Program Strategic Plan

EPA's new National Water Program Strategic Plan and National Program Guidance are available for review. The Plan addresses SWP, including a strategic target for community water systems to minimize risk to public health by implementing SWP actions. To view the entire Plan, go to <http://www.epa.gov/water/waterplan/>. To view language specific to SWP, go to

Core Area 4: Protection of Sources of Drinking Water from Contamination at http://www.epa.gov/water/waterplan/documents/drinking_sip.pdf. EPA is coordinating with the Association of State Drinking Water Administrators, Ground Water Protection Council, and representatives from state agencies to develop guidance for implementation of the Plan.

Drinking Water and Groundwater Statistics

Did you know there are approximately 146,000 public water systems that rely on groundwater as the water source? EPA recently released Factoids: Drinking Water and Ground Water Statistics for 2003, which contains basic statistics on U.S. public water systems, population served, water source, violations, and other interesting information. To review Factoids, go to http://www.epa.gov/safewater/data/pdfs/factoids_2003.pdf.

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

PFOA and PFOS

BY BART SIMMONS

Perfluoroalkyl compounds have been produced since the 1950s. Their uses include stain-resistant coatings for paper, fabric, and carpets; fire retardants; refrigerants; and insecticides. Perfluorooctane sulfonate (PFOS), a major perfluoroalkyl product, is widely distributed in the environment, including remote locations in the Arctic and the mid-Pacific Ocean. PFOA (Perfluorooctanoic Acid) has also been found widely, although at lower concentrations than PFOS. The precise source of environmental PFOA is unknown. Both PFOA and PFOS have properties unlike the traditional chlorinated compounds; they have both a hydrophobic end and a hydrophilic end, which makes it difficult to predict their environmental fate.

Mary F. Dominiak of the US EPA Office of Pollution Prevention and Toxic Substances presented an update on PFOA at the March 22 meeting of the Forum on State and Territorial Toxics Action (FOSTTA) in Washington, DC. US EPA began investigating perfluorinated compounds in late 1999, based on new data for PFOS, which was found in human blood and the environment worldwide. It is persistent, and it has shown developmental and systemic toxicity in animal testing. EPA expanded its investigation into PFOA and telomers (short chain length polymers): it was also found in human blood in the US, although at lower concentrations than PFOS. PFOA is also persistent, and caused developmental effects in a 2-generation rat study.

In April, 2003, EPA released a Preliminary Draft Risk Assessment on developmental concerns, and solicited Enforceable Consent Agreements (ECAs). The EPA focus in the ECAs is to understand the sources of PFOA in

the environment, and pathways leading to human and environmental exposure. Industry Letters of Intent promise to provide data on market and use information, physical and chemical data, product and article contamination analysis, plus monitoring/modeling for releases, and mass balance. The ECAs seek to fill data gaps for incineration, degradation, article aging, plus environmental sampling and monitoring. EPA held its first ECA meeting in June, 2003. Technical subgroups were formed to pursue the issues of: fluoropolymer and telomer incineration, telomer biodegradation, fluoropolymer aged article analysis, and environmental sampling and monitoring. Current information on this continuing process may be found in the online docket: www.epa.gov/edocket/ search for OPPT-2003-0012.

EPA has proposed that the Centers for Disease Control (CDC) include PFOA, PFOS, and other perfluorinated chemicals in the next NHANES study. EPA is also nominating to the National Toxicology Program a "class" study on perfluorochemicals.

PFOA and PFOS, like the polybrominated diphenyl ethers (PBDEs), originate in consumer and

business products, rather than point source pollutants. They also raised concerns because they were measured in humans and wildlife before the route of exposure was understood. These are examples of how human and wildlife monitoring can serve as indicators of actual chemical exposure.

For further information on the status of EPA's progress with PFOA, see www.epa.gov/opptintr/pfoa.

Bart Simmons is Chief of the Hazardous Materials laboratory in the Department of Toxic Substances Control (DTSC). The opinions in this article are those of the author and not necessarily those of the DTSC or the California EPA.

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Chemist's Corner

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

Recent Actions Impact Science Instruction in California

BY SUSAN GARCIA

The California Department of Education (CDE) recently approved two items that will impact Earth science education within the State: science testing required by No Child Left Behind Act (NCLB) and science textbook adoption criteria. As groundwater professionals we need to be aware of these items to prevent possible adverse impacts to the science education of our youth.

Science Testing Required by NCLB

NCLB, a federal K-12 education reform law, requires by 2008 that all states administer science assessments to students at least once in grades 3rd-5th; 6th-9th and 10th-12th, requiring 95% of the students in all subgroups (ethnicity, poverty and learning disability) within a single grade take this exam, or the school will be considered as "failing" for not meeting this requirement. In January 2004, the CDE approved testing of general science in 5th grade, physical science in 8th grade and middle school life science and biology in 10th grade. Middle school science currently teaches Earth Science in 6th grade, Life Science/Health in 7th grade and Physical Science in 8th grade. The CDE looked at the best way to meet the requirements for NCLB and elected to test 8th graders in physical science because it was just covered. Earth science instruction in high school does not reach 95% of the students, as contrasted with the more popular biological sciences. The only Earth science instruction some students may have would be that received in 6th

Continued on page 20

Educational Corner

Ask a Scientist – California Aquifer Protection Question

Dear GRA:

I am a graduate student doing research on innovative local [California] laws that protect aquifer resources (for human and/or wildlife benefit). I am hoping to identify innovative ordinances and will then contact the enacting communities to find out how and why the ordinances were adopted and to see how successful they have been so far. If you know of any other resources that might be useful to me, such as local organizations that are active in promoting aquifer protection, that information would be useful as well. Thanks in advance for any help you can give me!

Bruce Ho
*Master of Environmental
Management Candidate, 2005*
Yale School of Forestry and
Environmental Studies
bruce.ho@yale.edu

Dear Mr. Ho:

In California, multiple entities are responsible for groundwater management, which is defined as the planned and coordinated monitoring, operation, and administration of a groundwater basin. Unlike the system of appropriate rights for surface water administered by the State Water Resources Control Board (SWRCB), groundwater has never been regulated by the State (except in special cases where groundwater is found to be connected to a stream and the SWRCB does have jurisdiction). Local groundwater management needs may be directly resolved at the local agency level, additional actions such as enactment of local government ordinances, passage of laws by the state legislature, or decisions by the courts. The State's role is primarily to provide technical and financial assistance to local agencies for their groundwater management efforts (DWR, 2003).

Three basic groundwater management methods have been employed in California. The first is management by local water agencies under the authority of the California Water Code and other applicable state statutes. A second method is by court adjudication, with subsequent management by a court-appointed watermaster, and a third is by local groundwater management ordinances, which have been adopted in 27 counties. All three groundwater management methods are described in the Department of Water Resources Bulletin 118- Update 2003: California's Groundwater (www.groundwater.water.ca.gov/bulletin118/), which includes a listing of counties with ordinances. There is also a description of groundwater management through basin management objectives (Box D), an example of which is Glenn County, winner of GRA's 2002 Kevin J. Neese Award (www.grac.org/awards2002.html). You can view their approach at www.countyofglenn.net/Water_Advisory_Committee/home_page.asp. Bulletin 118's example of managing groundwater through a Joint Powers Authority is the American River Basin Cooperating Agencies and Sacramento Groundwater Authority (SGA) Partnership, which was selected for GRA's 2001 Kevin J. Neese Award (www.grac.org/awards.html) and has adopted a Groundwater Management Plan (www.sgah2o.org/sga/programs/groundwater/).

We hope this information is useful in your research. Please don't hesitate to contact GRA if we may be of further assistance.

Martin G. Steinpress, R.G., C. Hg.
GRA Director
Chief Hydrogeologist,
Brown and Caldwell

Application of a New Model for Groundwater Age Distributions: Modeling and Isotopic Analysis of Artificial Recharge in the Rialto-Colton Basin, California

BY PROFESSOR TIMOTHY R. GINN
UC DAVIS, DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Project Summary

The “banking” of water in aquifers has drawn much interest lately as a strategy for controlling scarce California water reserves. Banking is being considered at the Rialto-Colton basin aquifer in Southern California. Age, or groundwater residence time, serves as a useful indicator of groundwater renewability and the feasibility of using aquifers for water storage, and equally importantly, age is approximately measurable. The carbon-14 (C^{14}) isotope is one natural tracer commonly used to infer groundwater ages. To determine age at a point in space and time in an aquifer, one measures the C^{14} activity there and with known activity in influent, calculates age as the time required for the radioactive decay to reduce the activity to that measured, with corrections for geochemical reactions. The objectives of this project were to characterize these reactions in the Rialto-Colton basin aquifer using one-dimensional geochemical modeling along four flow paths, and to quantify their effect on C^{14} data by simulating reactive transport in the aquifer over several thousand years.

A first step to modeling reactive transport is to determine equilibrium and kinetic reaction rates. Equilibrium constants are well established for all the mineral phases used in the model. The kinetic reaction rates were obtained through model calibration by adjusting



selected kinetic rates so that simulated concentrations of dissolved constituents matched measured constituents. After calibration, the model was run to simulate concentrations of the dissolved constituents considered. Breakthrough curves for the constituents considered indicated that the concentrations initially increased or decreased then, within about four years, reached a relatively constant concentration for all wells. Breakthrough curves for the mineral phases increase for some constituents and decrease for others

over the ten-year simulation period; however, the changes from year to year are very small.

Therefore, treatment of the C^{14} tracer as nonreactive aside from radioactive decay is a potentially useful assumption that allows C^{14} -inferred ages to be treated as representative data. These data can be used in model validation studies by comparison with simulated ground-water age obtained by solving the governing equation for groundwater age derived by Ginn (1999).

Continued on page 20

The Groundwater Community Expands

BY VICKI KRETSINGER

One part of National Ground Water Association's (NGWA) vision statement for 2008 is that it "will be a community of groundwater professionals." The AGWSE Board heartily supports this vision, and we are actively promoting the long-term value of being a groundwater community. As I wrote in the article "NGWA and GSA — Communication, Cooperation and Collaboration in Action" (*The Hydrogeologist*, GSA Hydrogeology Division newsletter, October 2003), the value of geoscience organizations working together means "more effectively promoting the geosciences and geoscience education, collaborating to expand programs for the exchange and dissemination of scientific

information and new developments, providing science-based review and input on policy and regulatory issues pertaining to the geosciences, and promoting goodwill between scientists worldwide." This year's co-sponsorship by NGWA/AGWSE for two sessions at the 2004 GSA Annual Meeting provides an illustration of one of the many instances of collaborative endeavors being implemented with other organizations.

Through the recent implementation of the new Associated State Society program, NGWA is now also engaging in outreach to expand the groundwater community at the state level. I am pleased to announce that the NGWA Membership Committee approved GRA's application for becoming an Associated State Society. This recommendation went to the full NGWA Board of Directors on February 11, and following approval by the

Board, GRA is the first Associated State Society. The Affiliate States Subcommittee, which emphasizes the Affiliate member activities, has a great tagline to communicate its goals; the phrase, "together we're better," is an excellent reflection of the activities of the subcommittee to have nearly all-encompassing partnering by state Affiliate organizations with NGWA. It is my hope that the new program will set a new bar so that "together we're better as a groundwater community." If you are a member of a state groundwater professional organization, and are not familiar with this new program, the benefits of becoming an Associated State Society are posted on NGWA's web site.

Vicki Kretsinger is a Principal Hydrologist of Luhdorff & Scalomini, GRA Director, and Chair of the AGWSE Board. ♣

Alliance Corner

GSA CALL FOR ABSTRACTS: The Future of Hydrogeology — 2004 GSA Session Co-Sponsored by IAH and NGWA

BY CLIFF VOSS

What is the future for hydrogeology and geoscientists? Established world-class scientists and emerging geoscientists are encouraged to reflect on this question and bring their views to the session, *The Future of Hydrogeology*, occurring at this year's GSA Annual Meeting & Exposition, *Geoscience in a Changing World*, in Denver, Colorado, November 7-10, 2004. Many thought-provoking questions serve as the concept for a 2005 special theme journal, including: How will hydrogeology evolve in the future? What fundamental research is still needed? What scientific knowledge and methods will move into practice?

What approaches will end in their usefulness? Will the science of hydrogeology become largely an applied field? Will multi-disciplined research efforts lead to new research approaches and methods? Thus, a key objective is for presenters to highlight areas of anticipated or necessary growth in hydrogeology and related sciences. Presenters are encouraged to review past milestones only insofar as they offer clues to future developments. The session focus is not to review geoscience history and the state of the science in a particular discipline; rather, presenters are asked to give their opinion on future developments. This session creates an excellent opportunity

for attendees to hear the perspectives of invited and volunteered session presenters. The session also provides a forum for attendees to offer comments and engage in an exciting dialog about the future of hydrogeology.

Abstracts for this session (Topical Session T1) must be submitted electronically on GSA's web site at www.geosociety.org (instructions are posted at the site) by July 13, 2004. Electronic abstracts will be archived and remain searchable on the site for at least two years. For further information about the session, please contact Cliff Voss at cvoss@usgs.gov or call (703)-648-5885. ♣

California Groundwater Association Update

BY MIKE MORTENSSON, CGA EXECUTIVE DIRECTOR

CGA & GRA Participate in NGWA Fly-In

CGA and GRA members participated in the 2004 NGWA Fly-In in mid-March in Washington DC. It was a chance for California groundwater professionals to present a united front on four key issues: MTBE, Mobile Machinery Exemption Groundwater Sustainability, and Household Water Well Financing. Presentations were given to staff in the offices of Senator Dianne Feinstein and Senator Barbara Boxer as well as to a number of Representatives. Additional meetings were held with certain Committee staff members on technical issues. As a result of this joint effort, CGA & GRA are cooperating on a groundwater survey and legislative efforts at the state level. Watch for further details on how this new cooperative effort is supporting the groundwater professional community in California.

Cooperative Effort on New Regulations

CGA and GRA have also been working together to make recommendations to DHS on their proposed Waterworks Standard. This future standard in the initial phase of development 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 has met on a number of occasions. The task force proposed that 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. DHS has agreed to include such an alternative but has asked the task force for more information about other alternative basic formula approaches.

CGA Seminars Planned

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. Sessions planned include Corrosion Control, Air Rotary Drilling, Job Costing for Profit, Well Rehabilitation, Human Resources Asset Management, and other topics. The McEllhiney Lecture by Hank Baski on the subject of "Groundwater: Fallacies and Facts" will also be held on Saturday morning. If you'd like more info, visit the CGA website at www.groundh2o.org for the schedule and an early registration form.

CGA is also planning a Water Well Destruction workshop for regulatory personnel in both northern and southern California later this fall. USEPA funding is being sought for the workshop which will follow upon the highly successful Basic Water Well Construction workshops for regulatory agency personnel held in 2003. 💧

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Nominations Requested for the 2004 GRA Lifetime Achievement and Kevin J. Neese Memorial Awards

The GRA Awards Committee is accepting nominations for GRA's 2004 Lifetime Achievement and Kevin J. Neese Memorial Awards. Nominations for either award should

indicate the reason you are making the nomination, a brief statement of qualifications of the nominee and your full contact information. Email nominations to Brian Lewis, Awards Committee Chair, at admin@grac.org by July 23, 2004. Nominations will be reviewed at GRA's August 21, 2004 Board meeting, and the awards will be presented at GRA's Annual Meeting on September 23-24, 2004. Should you have any questions about the nomination process, please contact Brian Lewis.

The purpose of the GRA Awards Program is to recognize noteworthy projects and unique individual

contributions related to the protection and management of groundwater in California.

Lifetime Achievement Awards are presented to individuals for their exemplary contributions to the groundwater industry, 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. Previous Lifetime Achievement Award winners include Rita Schmidt Sudman (2003), Thomas W. Dibblee, Jr. (2002), Carl Hauge (2001), Joseph H. Birman (2000), David Keith Todd (1999), and Eugene E. Luhdorff, Jr. (1998).

The **Kevin J. Neese Award** recognizes significant accomplishments by a person or entity within the most recent 12-month period that fosters the understanding, development, protection and management of groundwater. Previous Kevin J. Neese Award winners include:

- ◆ 2002 - Glenn County Water Advisory Committee for formulating a significant groundwater management ordinance that was adopted by the Glenn County Board of Supervisors.
- ◆ 2001 - American River Basin Cooperating Agencies and Sacramento Groundwater Authority Partnership for fostering the understanding and development of a cooperative approach to regional planning, protection and management of groundwater.
- ◆ 2000 - Board of Directors of the Chino Basin Watermaster for delivering a remarkable OBMP that created a consensus-based approach for making water supplies in the Chino Basin more reliable and cost effective.
- ◆ 1999 - Governor Gray Davis for his work and leadership in addressing MTBE. ◆

Organizational Corner

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Organizational Corner

American Fulbright Senior Specialist Grant in Jamaica

GRA Extends Sincere Appreciation to its Symposium Co-Chairs and Sponsors for its 2004 *Series on Groundwater Contaminants Symposium, "Investigation and Remediation of Dry Cleaner Release Sites"*

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GRA Director Jim Jacobs, an American Fulbright Senior Specialist, taught an intense 4-week graduate class in Jamaica this spring. Mr. Jacobs was awarded a four-week Fulbright grant, from February 22 to March 20, 2004. The participants were all graduate students from government agencies, consulting firms, and academia working on their Masters Degree in Water Resources Management at the University of the West Indies (UWI). The course, entitled Environmental Engineering: Sampling, Assessment and Remediation, included lectures, homework, readings, problems, and a required report and presentation on a selected environmental contaminant. GRA generously donated a library of GRA short-course books to the UWI program.

About four hours of teaching and problems were presented per day, including material on risk-based corrective action, in-situ remediation, and natural attenuation processes. Two additional American lecturers were invited to teach during a special 3-day workshop, Dr. Ravi Arulanantham of Geomatrix Consultants in Oakland, California and Dr. Roger Brewer with the California Water Quality Control Board, San Francisco Bay Region. It is hoped that the regulatory approach taught in the workshop will be considered by the Jamaican regulatory authorities.

Mr. Jacobs also met with a variety of environmental regulatory officials to discuss groundwater, which is used extensively by this island nation. Jamaica is projected to have a large population growth over the next 25 years, and in some locations, is threatened by contaminated groundwater. Saltwater intrusion is common along the coastal cities, where most of the population lives. Solutions suggested are desalinization, which is now thought to be cost effective, and large private sector water exploration programs. Either way, Jamaica must plan for new water supplies as population and water needs increase.

The Fulbright programs (www.CIES.org) are a terrific way for American professionals to work within an established international exchange program. The perspectives obtained during exchanges like this one help promote mutual understanding and respect between United States and other nations. Mr. Jacobs can be reached at augerpro@sbcglobal.net. For a more complete description of this teaching assignment, plus some great photos, go to the GRA website, www.grac.org. 

Correction:

The article, "San Francisco Branch Scholarship Program," in the Spring 2004 issue of *HydroVisions*, page 10, was incorrectly credited. The authors were J.C. Isham and Gary Foote. We regret any inconvenience this omission may have caused.
– The Editor

Lodi Dry Cleaner Case Study – Lessons Learned?

LETTER TO THE EDITOR

BY JOHN M. FARR, PH.D., P.E.

When the pending Lodi Case was “discussed” at GRA’s Symposium on Drycleaner Release Sites, GRA was used and manipulated by special interests, which stacked the panel (and much of the rest of the Symposium) to promote their agenda. The unanswered question is this: Who should pay for site investigations and cleanup: the general public through taxes and utility fees, or those who use and support the drycleaning industry and their insurance carriers? This question is worthy of discussion, but the GRA-convened panel would not allow it.

The biased panel fixated on leaky sewers as a source of PCE contamination,

and said that POTW owners should be held liable for the contamination. I was cut off while trying to raise a question. Why did the panel silence me when I tried to speak? The panel included representatives who had lost a previous dry cleaners case at Lincoln Center, Stockton. Lincoln Center is being cleaned up at the expense of a consortium of insurance companies. The same players are involved in Lodi, and they will go to extreme lengths (including using GRA forums for their aggressive public relations campaign) to prevent another loss.

With the HydroVisions’ space limitation here, I will say only that the panel presentation was seriously misleading. The fact is that Lodi’s groundwater supply was impacted by PCE,

and the City wanted to force cleanup work without impacting local businesses. The City filed the lawsuit to make insurance funds available for site investigation and cleanup. There was much propaganda at the Symposium from the dry cleaning, insurance, and solvents industries.

GRA should be more careful when inviting lobbyists and attorneys to participate in symposia, especially if discussion and questions are suppressed. I hope that “Lessons Learned” from the Symposium will prevent such a reoccurrence. ♠

The statements and opinions expressed herein are those of the author, and are not necessarily those of the GRA, its Board of Directors, or its members.
– Editor

GRA Statement Regarding Panel Discussions and Symposia

Legal Aspects of Emerging Contaminants and Moving Targets: Responsible Party Perspective

The December 10, 2003 GRA Symposium on 1,4-Dioxane and Other Solvent Stabilizers in the Environment featured a presentation by Brian Haughton, an attorney with Barg Coffin Lewis and Trapp, on legal issues surrounding contaminants for which legal standards have not yet been adopted. His full article can be found on GRA’s web site under publications, http://www.grac.org/Legal_Aspects.pdf, or at BCLT’s web site.
– Editor

GRA seeks to invite presenters and panelists representing a wide spectrum of viewpoints, particularly on controversial matters such as the recent Dry Cleaner Symposium. Panel members are invited because of the differing perspectives they may bring, and because they may represent key stakeholders. As such, panel members and presenters do not represent any position taken by GRA. GRA is an organization with a large and very diverse membership, many of which often find themselves on the opposing sides on contentious issues. It is the goal of GRA to provide forums such as the Dry Cleaner Symposium

for such diverse issues to be presented and discussed. However, considering that most presentations at the Dry Cleaner Symposium and other such conferences are volunteered, we attempt but cannot ensure that all views or stakeholders are represented. Based on the overwhelmingly positive feedback we receive regarding GRA Symposia, we plan to continue our tradition of focusing on current and often controversial groundwater issues, with diverse presentations and panel discussions. ♠

Tom Mohr, Vice President
GRA Seminar Chair

Editors Note: Letters to the editor 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.

insurance settlements. Mr. De Zeeuw encouraged attendees to make full use of the many resources available at SCRCD's website, <http://www.drycleancoalition.org>.

Additional source identification techniques presented included a talk by Peter Krasnoff on the estimated contribution of pure phase cleaning solvent that is discharged from dry cleaning water separators, and thus, may be discharged to the sanitary sewer. A case study was presented by Stephen Carlton that used passive soil gas sampling to help identify potential impacts to groundwater from dry cleaning operations. The study concluded that passive soil gas results could be a reliable and cost-effective indicator of PCE in groundwater. John Karachewski presented a

detailed case study conducted at Lawrence Livermore National Laboratory (LLNL); the study demonstrated the importance of characterizing the hydrogeology at solvent release sites and integrating multiple data sets, including geologic, geophysical, and soil vapor, soil, and groundwater chemical data.

Dr. Robert Howd of the California Office of Environmental Health Hazard Assessment (OEHHA) presented background on the risk assessment conducted by OEHHA in 2001 to establish the public health goal (PHG) for PCE. The PHG of 0.06 ug/L is based on carcinogenic effects in rodents, including liver cancer in mice by inhalation or ingestion, and leukemia in rats by inhalation. New data, available since the MCL was established at 5 ug/L in 1989 as the lowest achievable level, may lead to review and possibly lowering of the MCL. Dr. Howd also presented new toxicology information on alternative dry cleaning agents such as 1-propyl bromide, HFE-7100, propylene glycol t-butyl ether, and D5/D4, each of which has some unfavorable toxic and environmental properties.

Remedial Strategies for Dry Cleaning Sites

The call for papers produced a large number of excellent abstracts, enough to

hold an entire conference on remediation technologies for dry cleaning sites. An abbreviated account is presented here; a more detailed summary of the remediation sessions may be downloaded from GRA's website.

Daniel Leigh of Shaw Environmental presented the results of a pilot scale demonstration using in-situ anaerobic bioremediation (ISAB) to remediate PCE and associated degradation products in groundwater at Naval Air Station Treasure Island. Sampling at the site prior to the pilot test confirmed that the dechlorinating microorganism, Dehalococcoides (DHC), was present within the aquifer. Three separate ISAB techniques were tested including 1)

biostimulation by lactate (fermentable food source) addition alone, 2) lactate supplemented with gaseous hydrogen and 3) lactate addition and bioaugmentation with SDC-9. SDC-9 is a DHC containing culture that more rapidly degrades PCE to ethene compared to indigenous cultures during a bench scale test. The three techniques were evaluated simultaneously in three hydrologically separate, adjacent groundwater recirculation loops established in the source area. All three techniques completely reduced PCE. Addition of hydrogen gas significantly increased the degradation rates and reduced the amount of lactate substrate required. The study concluded that ISAB could be enhanced using the SDC-9 culture and hydrogen amendment.

Scott Andrews of ARCADIS G&M presented work incorporating in-situ biostimulation techniques with Brownfield redevelopment and guaranteed fixed price contracting to facilitate remediation and redevelopment of two former dry cleaning solvent sites. The focus of the talk was redevelopment of a commercial property that was the cornerstone of a downtown revitalization master plan. Two dry cleaning facilities formerly operated at the site in two separate locations. The dissolved

contaminant plumes were commingled. Inability to determine the potentially responsible party (PRP) allocation for these commingled plumes was preventing the property transaction and securing construction loans/grants in excess of \$300M from moving forward. A soil vapor survey using Gore-Sorbers® was implemented in a grid pattern covering the suspected contaminant source areas was successful in identifying the two distinct source area locations where the use of the existing groundwater monitoring well network had failed. To obtain funding for cleanup, a guaranteed remediation program contract was used to obtain commitment to attain regulatory closure for a fixed price. Remediation entailed excavation of impacted soil and biostimulation using enhanced reductive dechlorination to address the dissolved chlorinated solvent plume. Hydraulic fracturing was used to enhance the carbon substrate (dilute molasses) delivery within the low permeability aquifer matrix. The site is being transformed into a vibrant, mixed-use, pedestrian-oriented downtown district.

Barry Molnaa of ARCADIS G&M, Inc. presented a practical approach to choosing between biostimulation and bioaugmentation to enhance reductive dechlorination of chlorinated solvents. Reactive zone technology was described as establishing a fully-dechlorinating reactive barrier using a line of injection wells transecting the contaminant plume, and injecting a degradable food source (carbohydrate or lactate) to modify biogeochemical conditions for anaerobic degradation. Case studies showed biostimulation can be used for sorbed-phase source area mass removal. Proper design of the electron donor loading and effective delivery is critical in achieving the proper biogeochemical aquifer conditions to obtain this result. Two competing approaches for Enhanced Reductive Dechlorination (ERD), biostimulation (addition of electron donor) and bioaugmentation (addition of dechlorinating bacteria, primarily Dehalococcoides ethenogenes (DHE) were contrasted. A consortium of bacteria abundant in most aquifer settings rather than a specific dechlorinating bacterium

Continued on page 18

was proposed as responsible degradation of halocarbons. Adding DHE may be effective at sites where attempts at biostimulation did not induce dechlorination, or in deeper aquifers where microbial activity may be limited. Mr. Molnaa recommends a 6 to 9 month biostimulation evaluation period prior to proceeding to the more costly bioaugmentation step.

Cindy Schreier of PRIMA Environmental presented a discussion of the crucial role of bench-scale treatability testing in properly evaluating chemical oxidation and other technologies for dry cleaner site remediation. Bench-scale testing allows quick identification of an adverse outcome, and allows exploration of other remediation technologies without the expense of a full-scale test of a technology that might have eventually failed.

Dwight Hoenig of Clayton Group Services presented Electric Resistive Heating (ERH) for source area remediation at dry cleaner sites. ERH involves passing an electrical current through soil causing subsurface heating using standard three-phase power. Soil is heated to the boiling point of water, causing rapid volatilization of PCE and other VOCs from the vadose and saturated zones. The electrode well casings can be retrofitted for vapor recovery using standard soil vapor extraction techniques, and wells can be installed within active facilities. Heating also increases permeability in tight soils. ERH had been applied successfully even at smaller scale dry cleaning sites. Cleanup costs for typical commercial sites range from \$57 to \$120 per cubic yard of soil treated, depending on the scale of the project.

Lodi Case Panel Discussion

A panel discussion on the Lodi Case featured attorney Lori Gualco, consultant Don Bradshaw, RWQCB project manager Duncan Austin, and Lodi Mayor Larry Hansen. In 1989, two city supply wells showed contamination from PCE, used in dry cleaning, printing, and other businesses. The City entered into an agreement with DTSC to allow city pursuit of RPs for cleanup under a city ordinance (Comprehensive Municipal Environmental Response and Liability Ordinance –

MERLO). Substantial effort and funds were expended with little accomplished towards cleanup. Lodi's outside counsel was released after the judge in the case questioned Lodi's legal strategy, and particularly the financing of the legal effort through a high interest loan from a major investment firm, repayment of which is predicated on successful recovery of cleanup and litigation costs from insurance companies. In 2001, the RWQCB, who had not assented to MERLO, returned to the case due to lack of progress toward cleanup and concerns for potential vapor intrusion into buildings. RWQCB included the City among named RPs due to leakage from City's sewer lines.

Mayor Hansen, who was elected in 2002, well after key decisions on the case were rendered by the City Council and former City Attorney, reported that the citizens of Lodi are very concerned over the enormous expenditures on litigation. While PCE was discharged to leaky sewer lines more than a decade ago, residual DNAPL present below joints in the sewer lines continues to dissolve PCE to underlying groundwater as additional water is released through leaking sewers. The City of Lodi has completed first steps toward the

formidable task of sewer line rehabilitation to prevent additional mobilization of PCE and other contaminants. A questioner from the floor called for a publicly available cumulative database compiling results from the efforts of 19 consulting teams working on the case. There was some agreement among panelists that the considerable sums expended on attorney fees could have been more productively used toward remediating contamination.

Inability to determine the PRP allocation for these commingled plumes was preventing the property transaction

Policy Elements of Dry Cleaner Remediation

A second panel discussion, focused on the policy elements of dry cleaner remediation, featured Wendy Cohen of Central Valley RWQCB, Jan Greben, an environmental attorney representing insurance industry interests, Dwayne Siler, an attorney representing dry cleaning and halogenated solvents industry interests, Richard De Zeeuw, representing the State Coalition for Remediation of Drycleaners, Sandra Giardi, Executive Director of the California Cleaners Association, and Jim Crowley of the Santa Clara Valley Water District. Ms. Cohen listed naming RPs as the most important issue plaguing successful enforcement for

Continued on the facing page

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Dry Cleaner Symposium Focuses on Under-examined, Under-funded Threat to Groundwater Resources – Continued from Page 18

remediation of dry cleaners. She differentiated availability of insurance funding by when the policy was issued and whether the release was gradual or catastrophic, and noted many insurance policies only come into play when lawsuits are filed. Jan Greben noted that ‘excess’ insurance policies (e.g. umbrella policies) must pay for RWQCB ordered cleanups, and may be invoked without lawsuits. Dwayne Siler noted that the previously acceptable practice of discharge to sewer lines is a primary cause of the contamination we’re facing today. He noted that the solvent industry has taken several steps to reduce impacts from dry cleaner use of PCE, including using smaller containers to reduce the severity of accidental spills, producing educational literature recommending secondary containment, and best management practices. Mr. Siler also suggested that establishing a dry cleaner cleanup fund that provides liability protection will reprogram dollars from litigation to cleanup. Mr. De

Zeeuw reiterated the benefits of cleanup funds, and noted that indoor air is now a driving force in motivating remediation of dry cleaners in cases that might be considered low threat from a water quality perspective.

Jim Crowley pointed out that while there are 220 operating cleaners in Santa Clara County today, the total number of unique sites occupied by cleaners in the last 70 years is well over 900, greatly increasing the cumulative impact of the dry cleaning industry on urban/suburban groundwater basins. A possible future lowering of the MCL from the current 10-4 risk level may require a great deal more cleanup to achieve the MCL. Overall, the regulatory process is not protecting groundwater basins from dry cleaner impacts since investigations of past and current cleaners are not required unless an impact is discovered by other means, such as a Phase II property transfer investigation done at the behest of lenders, or PCE detection in a supply well. Using SCVWD

water rates, 1 gallon of PCE can degrade and prevent the use of a quantity of water valued at \$300K. Crowley advocates sewer maintenance, implementing a cleanup fund such as AB 698, increasing the incentive to investigate potential releases, and revisiting the questions of how we value our water, and how much we’re willing to pay per article of clothing cleaned to solve the problem.

The overwhelming response on the Dry Cleaners issue has led GRA to begin planning a second symposium on dry cleaner remediation, which will be held November 10th in Orange County. Visit GRA’s website in mid-June for a call for papers and conference announcement

Sarah Raker is with the San Francisco Bay RWQCB and is a GRA Director. Tom Mohr is the Vice President of GRA, and along with John McHugh, is with the Santa Clara Valley Water District. Scott Davis and Janet Peters are with Arcadis G&M Inc. ♠

Legislative Committee Update – Continued from Page 6

believes that much more must be done to cure the public’s confusion about water quality that is created under current legal criteria. GRA Legislative Committee also believes it is imperative that public water systems be advised clearly what the legal standards are so that they can take reasonable steps to assure that the standards are met and protect themselves. However, the Committee is willing to support the proposed change in terminology in the hope that it will provide a very small step in the right direction. The committee felt this is not a controversial bill and fits in tightly with GRA’s Legislative Guidelines. GRA has submitted a letter of support for the bill.

During our **April Telecom**, the Committee focused on the annual Legislative Symposium. Lester Snow, DWR’s new Director, will give the morning keynote, and Senator Machado, Senate Agriculture and Water Resources Chair, will give the Lunch keynote. The focus of this year’s activities will be AB 2528 and the issue of water quality standards, reliability and consumer confidence. During our visits, our message will be to support AB 2528, underscoring the connection between surface water and groundwater, and that GRA is a valuable technical resource for our Legislators.

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 (jcarbuccia@hatchparent.com). ♠

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Recent Actions Impact Science Instruction in California – Continued from Page 10

grade. Although we understand the constraints the CDE was under to meet NCLB requirements, the focus on biological sciences is perpetuating the current practice of relegating Earth Science to second-class status.

Science Textbook Criteria Adoption

The California Curriculum Development and Supplemental Materials Commission recommended the CDE Board adopt science textbook criteria that limits the amount of science instruction to “no more than 20-to-25% of hands-on material,” although research indicates that this is the best way for student to learn science. The education community feared that this limitation would make State funding difficult for hands-on science materials, as well as setting a national model because of the size of California’s market. The California Science Teachers Association

(CSTA) along with the National Science Teachers Association (NSTA) and the National Academy of Sciences (NAS), and others protested the adoption criteria, which was then changed to read “hands on activities composing at least 20 to 25 percent of the science instruction program.” This is an example of where an attack on good science instruction, whether through intent or ignorance, was ameliorated through the action of a group of organizations.

Things to Consider

We need to consider a coalition of professional organizations that can be readily mobilized to affect change towards promoting a balanced science education, namely more Earth Science. The preference of one science at the expense of another is unacceptable. We need to educate our youth in an Earth system science approach—one that provides them with the necessary tools to make informed decisions in the future, and let our educators know that we support their efforts in science instruction.

Susan Garcia is a 7th Grade Science Teacher and Past GRA Education Chairperson. Due to space constraints, this article has been shortened; the complete article is on the GRA Education Corner at www.grac.org.

Application of a New Model for Groundwater Age Distributions –

Continued from Page 11

The reactive-transport model included a simplified four-layer velocity field. Because transport is controlled by aquifer heterogeneity, significant effort has been devoted to developing a texture model to incorporate into the groundwater flow model, and thus, produce a more complex velocity field. Input for the texture model was derived from borehole geophysical and lithologic logs from 18 wells. Two textures were used in the simulations, and different aquifer parameters were assigned to each texture. The velocity fields generated including the texture model will be used with future groundwater age modeling in the Rialto-Colton Basin.

Project Team

Linda Woolfenden is employed by the United States Geological Survey (USGS) at the Sacramento Office and is a Ph.D. candidate at UC Davis, and her dissertation is about this project. The project P.I. is Tim Ginn, Professor of Civil and Environmental Engineering at UC Davis. Dr. Uma Seeboonruang, a doctoral student with Professor Ginn, now at King Mongkut’s Institute of Technology in Thailand, contributed to the reactive transport simulation work in the project, and she was assisted by Esther Chung, a master’s student with Professor Ginn, now at the California State Water Resources Control Board.

John Izbicki of the USGS served as an advisor to the project and collaborated on the interpretation of equilibrium chemistry signatures of water samples from the aquifer. The full article, with figure and references, may be found on the GRA website, www.grac.org.



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Sacramento Branch Highlights

BY STEVE PHILLIPS

For our January meeting, Bill Black and Bill Heinrich of NorCal Geophysical discussed advances in surface and borehole geophysical techniques for groundwater exploration and resource evaluation. Recent technological advances in instrumentation and computer processing have significantly improved the capabilities of these techniques with regard to accuracy, resolution, and data acquisition rates. The surface geophysical techniques discussed included high resolution seismic reflection, seismic refraction, time domain electromagnetics, streaming potential, and electrical resistivity profiling. These techniques can be used to determine depth to bedrock, delineate permeable zones, detect aquacludes, map groundwater movement, and delineate water-bearing fracture zones. Borehole techniques discussed included standard well logs; downhole mapping of bedding structures and fractures using high resolution acoustic and optical televiwer surveys; evaluation of ground water movement using heat-pulse flow meter, temperature, and fluid conductivity logs; and three dimensional analysis of aquifers and well fields utilizing geophysical log response, data base creation, and geo-statistical interpolations. New borehole techniques include a UV hydrocarbon detect log, a colloidal borescope (horizontal flow velocity and direction), time-sequential fluid conductivity after DI replacement (hydrophysics) , and ultrasonic void detection behind casing walls.

In February, David Kaminski presented the benefits of low-flow purging and sampling in terms of improved data quality (repeatability, control of false positive results) and operational efficiency (less time, reduced purge water quantities). David is Senior Vice President at QED Environmental Systems, a manufacturer of ground-water sampling equipment,

remediation pumping and treatment systems and landfill leachate removal systems. The benefits of low-flow purging and sampling have been documented, but questions have been raised regarding the appropriateness of this technique for detection monitoring programs. These questions are due to a perception that a sample collected from a monitoring well at a low flow rate only samples a very narrow vertical interval near the pump intake, and contaminants above or below the pump could therefore be missed, especially with typical monitoring wells screens of 10 - 20 feet in length. Detailed three-dimensional numerical simulation of groundwater flow in the vicinity of a monitoring well during low-flow purging and sampling was developed to provide a means to investigate the actual monitoring zone achieved during these sampling operations. Key results of these simulations suggest that pump placement has little effect on the zone monitored, and that screen penetration has a significant effect.

In March, Dr. Eric LaBolle discussed the effects of heterogeneity on monitoring natural attenuation. Natural attenuation is often declared to be effective when apparent plume concentrations and/or plume lengths are stable or decreasing with time. Heterogeneity, however, strongly influences subsurface contaminant transport, and therefore efficacy of plume monitoring. High-resolution transport experiments were used to explore the limitations of conventional plume monitoring schemes in the presence of heterogeneity. Results demonstrated that an inadequate sample density can produce observations that falsely indicate effective natural attenuation of plume migration. A comparison of simulated and observed MTBE transport in three-dimensional facies models of glacio-fluvial sediments in the South Lake Tahoe basin, California, further illustrated complexities of monitoring for natural attenuation. Simulated plumes, highly variable in space and time, compared well with observations at monitoring points. Nevertheless, simulations suggest the possibility of additional contamination that has gone undetected by the monitoring network. ♪

San Joaquin Valley Branch Highlights

BY BILL PIPES
BRANCH PRESIDENT

In its third year, the San Joaquin Valley Branch continues to attract a diverse and enthusiastic membership representing water purveyors, industry, academia, consulting, the legal community, and regulators. We meet for dinner every third Thursday of the month. Our February meeting featured Dr. Steve Bachman of the United Water Conservation District. He presented a talk on “The Definition of Groundwater in California: The Legal and Technical Issues.”

At our March meeting in Fresno, we enjoyed a presentation by Mr. David Kaminski, Senior Vice President at Severn Trent QED Environmental Systems, a leading manufacturer of ground-water sampling equipment. David’s presentation was “Using Low Flow Groundwater Sampling For Detection Monitoring Programs: Are We Missing Contaminants?” David has published several articles and technical papers on sampling practices and their implications in our industry.

Dr. David Purkey, Senior Hydrologist at the Natural Heritage Institute Berkeley, CA, was our April speaker. He presented “Hydrogeologic Suitability for Groundwater Banking in the Central Valley”. David has consulted with a variety of international organizations in the areas of irrigation management, conjunctive use of surface water, and soil and water management.

Please check out the GRA web site for future meeting announcements and other updates from the San Joaquin Valley Branch. ♪

San Francisco Bay Branch Highlights

BY MARY MORKIN
BRANCH PRESIDENT

The San Francisco Bay Branch has continued to be very active this year. The following is a brief summary of talks that have taken place in 2004, with a planned agenda for the remainder of the year.

On January 21, 2004, the Branch held its annual regulatory update given by the California Regional Water Quality Control Board – San Francisco Bay Region. Our speakers were Stephen Hill and Alec Naugle, who addressed an audience of more than 100 members – easily one of our best attended talks! Issues discussed included environmental screening levels, indoor air/vapor exposure concerns, MTBE leaks at operating service stations,

emerging contaminants, electronic reporting and access, and brownfields actions. In addition, the recent report entitled “*Comprehensive Groundwater Protection Evaluation for South San Francisco Bay Basin*” was summarized, as was “*Groundwater Ambient Monitoring and Assessment Program*” and the legislation, “*Groundwater Monitoring Act of 2001*” (AB599).

On March 17, 2004, the Branch hosted the fourth annual McEllhiney Distinguished Lecture, sponsored by the National Ground Water Association. This year’s recipient was Hank Baski, who gave an entertaining presentation on several fallacies and forecasts within the ground water industry. Among the topics were horizontal wells, which may play a greater role in water recovery and injection, and potentially pricing larger wells based on well efficiency instead of footage.

On April 21, 2004, Scott Slater, Esq., Partner with Hatch and Parent gave an intriguing lecture on emerging issues on

California water litigation. Mr. Slater is well known for his innovative work in groundwater water law throughout the western United States. He spoke on multiple topics including overlying water rights – who owns what, safe yield vs. natural safe yield, prescriptive groundwater rights, future of groundwater adjudication, and storage rights within aquifers.

Upcoming talks include:

June 16, 2004 – “*Comparing Contamination Vulnerability Using Isotopic and Trace Analytical Techniques in Two Urban Groundwater Basins*” (Santa Clara and Sacramento) by Jean Moran, Lawrence Livermore National Laboratory (South Bay venue)

October 20, 2004 – “*Nitrate in California Groundwater: Sources, Sinks and Transport*” by Brad Esser, Lawrence Livermore National Laboratory

November 17, 2004 – “*Aquitards and Contamination*” by John Cherry



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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 Symposium <i>Perchlorate Update 2004</i>	August 4, 2004 Glendale, CA	GRA Symposium <i>Arsenic Update 2004</i>	October 18-19, 2004 Fresno, CA
GRA Board of Directors Meeting	August 21, 2004 Pt. Richmond, CA	GRA Board of Directors Meeting	November 6, 2004 Irvine, CA
GRA 13th Annual Meeting <i>Managing Aquifers for Sustainability—Protection, Restoration, Replenishment and Water Reuse</i>	September 23-24, 2004 Sonoma, CA	GRA Symposium <i>Investigation and Remediation of Dry Cleaner Release Sites</i>	November 10, 2004 Southern California



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