

HYDRO VISIONS

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Micropol & Ecohazard 2009

The 6th IWA/GRA Specialized Conference on Assessment and Control of Micropollutants/Hazardous Substances in Water

CONFERENCE HIGHLIGHTS AND SUMMARY

By Rula Deeb, Malcolm Pirnie, Inc., and David Sedlak, University of California at Berkeley

Micropollutants (also referred to as emerging contaminants, trace organic compounds, microconstituents, contaminants of emerging concern, etc.) include pharmaceuticals, ingredients of personal care products, biocides, fluorinated compounds, disinfection byproducts, nanomaterials and industrial additives. The presence of these compounds in wastewater, surface water, sediments, soils, groundwater and drinking water presents numerous technical and institutional challenges to society and environmental and public health professionals. In June 2007, the **Micropol & Ecohazard 2007** conference in Germany provided an international platform on the effects of micropollutants and their removal in natural and engineered water systems. Because of the tremendous success of the 2007 conference, the International Water Association (IWA) partnered with GRA to hold **Micropol & Ecohazard 2009** in San Francisco, California.

This three-day international event was the first comprehensive conference to profile the latest developments in the



From left, conference attendees Dr. Bill Cooper (University of California at Irvine), Dr. Juliane Hollender (Eawag, Switzerland), Dr. Susan Richardson (USEPA), conference co-chair Dr. David Sedlak (University of California at Berkeley) and Dr. Thomas Ternes (Federal Institute of Hydrology, Germany)

detection, risk assessment, treatment and regulation of micropollutants in all environmental media by the world's top experts. Despite a weakened global economy, **Micropol & Ecohazard 2009** attracted 260 attendees from five continents and over 27 countries. Conference attendees included university professors, researchers, practicing hydrogeologists, environmental chemists, drinking water and wastewater engineers, water and wastewater utility managers, ecotoxicologists, regulators, consultants, attorneys, policy makers and students.

In an overwhelming response to the Call for Abstracts, GRA received almost 300 abstracts. About 60 abstracts were selected for presentations by international experts (www.grac.org/micropol.asp); many of the remaining abstracts were presented at poster sessions held during conference breaks and evening receptions.

The conference was co-chaired by **Dr. Rula Deeb** of Malcolm Pirnie, Inc. and **Dr. David Sedlak** of the University of California at Berkeley. It was held

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Hydraulic mining with water jets, 1912. J.B. Lippincott Collection. See page 26

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In preparation for the meeting, the President, Vice President (Bill Pipes of AMEC Geomatrix), and the Executive Director (Kathy Snelson of Nossaman) developed a questionnaire for completion by the Directors. The questionnaire provided insights in several areas including input on 2010 strategic initiatives in light of the most important opportunities and challenges facing the Association. I am grateful for the valuable insights that assisted us in preparing for the strategic planning meeting.

During the planning meeting, we discussed updates to the Association's 2010 Strategic Plan and prioritized initiatives for 2010. The plan will undergo further revisions and will be posted on

Executive Director, the Directors were presented with a comprehensive financial assessment of the Association's events held over the past eight years. We will use this assessment, and ongoing updates, to improve both the value of events we offer members and the important revenue GRA derives from its events. Although the Association's work is primarily performed by volunteers, it is essential that GRA's events generate revenue to offset expenses. We will also explore offering programs in new formats, including webcasts, and greater coordination with local Branch meetings. The assessment also indicated that the number of event sponsors and exhibitors has declined. The Events Committee, co-chaired by Eric Reichard (USGS) and Ted Johnson (Water Replenishment District of Southern California), will oversee an outreach effort over the next two months to past sponsors and exhibitors to inquire about prospects for 2010 and what the Association can do to increase the value of these opportunities.

With California enduring the third year of a drought, the Directors agreed that one of GRA's primary events for 2010 will focus on the recharge of re-

Planning for 2010

By James Strandberg

On August 16, the GRA Board of Directors held its annual strategic planning meeting at DTSC's offices in Berkeley. During this meeting, the Directors, Officers, and Executive Director evaluated the Association's overall progress in achieving its mission of being California's leading advocate and educator of its members and the public on managing and protecting California's groundwater resources through education and technical leadership. This planning meeting, held the day after the usual third-quarter Board meeting, focused primarily on identifying and prioritizing new activities that could enhance member benefits and further GRA's pursuit of its mission. The budgetary impacts of new and/or enhanced activities were evaluated in conjunction with the development of the 2010 budget. I feel it's important to inform GRA members of these activities, and I have provided a summary below.

the GRA Web site following the November 2009 Board meeting. The strategic initiatives the Board prioritized for 2010 focused on three key areas: (1) planning statewide educational events, (2) membership development and enhancement, and (3) supporting GRA Branch activities.

"I am grateful for the valuable insights that assisted us in preparing for the strategic planning meeting."

As I noted in this column in the summer 2009 *HydroVisions*, attendance at GRA events has declined in concert with the continuing economic challenges facing California, the groundwater industry and GRA's members. Based on exceptional work by our Finance Committee Chair Sarah Raker (MACTEC Engineering and Consulting), Treasurer David Von Aspern (Sacramento County EMD), and the

cycled water. This important topic has numerous challenging facets, including state policy, regulatory, technical and legal aspects. Another key event will focus on groundwater contaminants. Previous events that included a range of inorganic and organic contaminants have been well attended, indicating high interest by GRA members. The Association will continue to strive

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Planning for 2010 – Continued

to offer high-quality events and be the leader in California in providing education to members and the public in fulfillment of GRA's mission. If members can attend only one event in 2010, due to budgetary constraints, our goal is to offer that "can't miss" event. If you have a specific topic that would provide the greatest value to you in your current position, please contact me or any of the Directors or Branch Officers to share that topic.

trol of Micropollutants/Hazardous Substances in Water." I would like to acknowledge and express GRA's appreciation to the co-chairs, Rula Deeb (Malcolm Pirnie) and Professor David Sedlak (UCB), and GRA's Executive Director for their very significant efforts to make this a successful event in light of the potential for a substantial revenue shortfall due to lower attendance than originally planned. I would also like to draw your attention to the

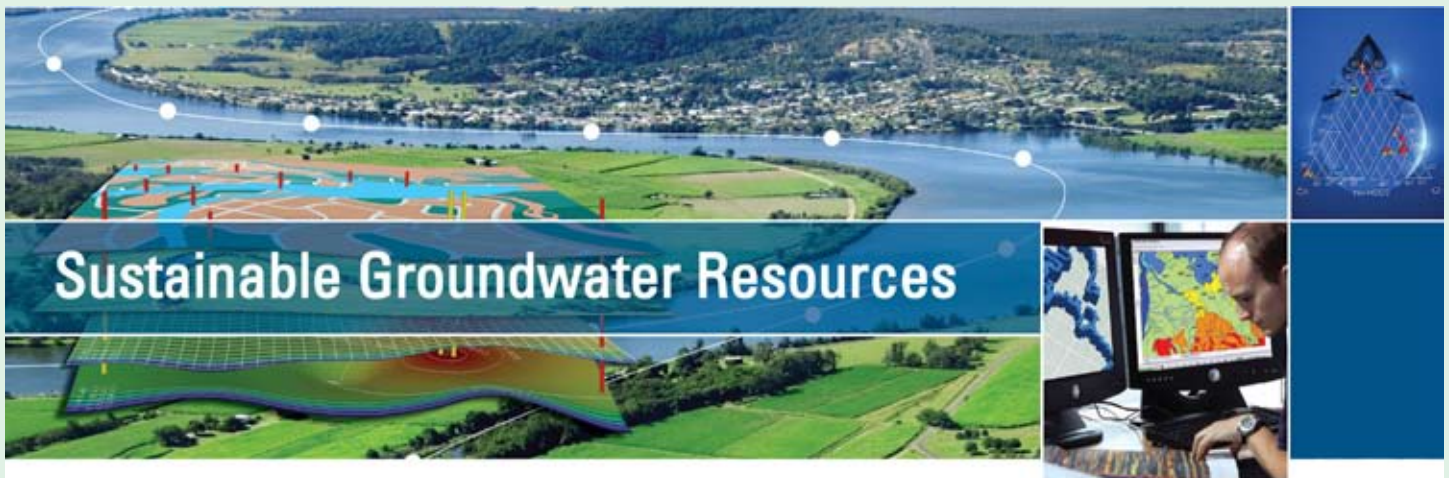
Vicki Kretsinger (Luhdorff & Scalmanini, Consulting Engineers), and the entire committee have worked very hard to identify topics and line up very knowledgeable speakers to make this an exceptional event.

Overall, the 2009 planning meeting met its objective of challenging GRA's leadership to look ahead and identify ways of continuously improving the Association. Despite a challenging year, GRA is healthy and in a prime position to be a strong voice in leading efforts to better manage California's groundwater resources. As always, please contact me with any comments or suggestions to improve the Association. 💧

"The 2009 planning meeting met its objective of challenging GRA's leadership to look ahead and identify ways of continuously improving the Association."

The feature article in this edition of *HydroVisions* pertains to GRA's co-sponsorship with the International Water Association of "Micropol & Ecohazard 2009, Assessment & Con-

upcoming 27th Biennial Groundwater Conference/GRA 18th Annual Meeting on October 6-7 in Sacramento. I know the event chairs, Christine French (UC WRC), Mary Scruggs (DWR) and



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at the Hyatt Regency Hotel at the San Francisco International Airport.

Conference Co-Sponsors and Collaborators

Co-sponsors of the conference included the California Department of Toxic Substances Control, the Federal Institute of Hydrology (Germany), Malcolm Pirnie, Inc., the United States Environmental Protection Agency (National Exposure Research Laboratory - NERL) and the University of California at Berkeley. Collaborators included the California Water Environment Association, Dechema (Germany), the Global Water Research Coalition, the International Association of Hydrogeologists, Microseeps, the National Water Research Institute, Pollution Engineering Magazine, the Water Environment Research Foundation and the Water Research Foundation.



From left, conference co-chair Dr. Rula Deeb (Malcolm Pirnie, Inc.) and IWA's Specialist Group Leader, Dr. Maria Fürhacker (University of Natural Resources and Applied Life Sciences, Vienna, Austria)

Overview of the Technical Program

The conference was organized into two parallel sessions over the course of two and a half days. Morning and afternoon sessions convened with plenary presentations. In total, the conference involved sixteen technical sessions, five plenary presentations and one panel discussion.

The technical sessions encompassed a broad range of topics related to micropollutants, including environmental chemistry; drinking water treatment; wastewater treatment; water reuse; toxicity; risk assessment; regulation; management; and fate, transport and removal in soil and groundwater. Specific session titles included the following:

1. Environmental Chemistry
2. Micropollutants in Wastewater - Effects and Occurrence
3. Micropollutants in Wastewater - Removal and What Are We Missing
4. Micropollutants in Wastewater - Removal Strategies
5. Drinking Water - Emerging Disinfection Byproducts (1 & 2)
6. Oxidation Strategies - How Effective Are They For Removing Micropollutants? (1 & 2)
7. Membrane Technologies: How Well Do They Work?
8. Watershed - Soil and Groundwater
9. Watershed - Biosolids
10. Watershed - Occurrence
11. Biological Degradation of Micropollutants
12. Nanomaterials - What are the Concerns?
13. Brominated Flame Retardants - New Issues
14. Ecotoxicology and Human Health Concerns

Five of the world's leading researchers on micropollutants gave 45-minute plenary presentations on the following topics:

- **Dr. Damia Barcelo**, Chemical and Environmental Research Institute of Barcelona, IIQAB-CSIC, Spain, *Fate and Behavior of Pharmaceuticals in Treated Wastewaters, Sludge and River Waters Followed by an Environmental Risk Assessment Using Hazard Indexes*
- **Dr. John Coates**, University of California at Berkeley, *Microbial Perchlorate Reduction – A Rocket Fueled Metabolism*



From left, conference attendees, Mr. Jerry Aarons and Mr. Brian Lewis of DTSC

- **Dr. Martin Jekel**, Technical University of Berlin, Germany, *Removal of Bulk and Trace Organics in Underground Treatment Systems*
- **Dr. Michael Plewa**, University of Illinois at Urbana-Champaign, *Water Micropollutants: In Vitro Mammalian Cell Toxicology to Human Toxicogenomics*
- **Dr. Shane Snyder**, Southern Nevada Water Authority, *Endocrine Disruptors and Pharmaceuticals in US Drinking Water*

A panel was convened to discuss regulation, management and risk communication issues associated with micropollutants. The discussion was moderated by Mr. Frans Schulting, the executive director of the Global Water Research Coalition (GWRC) and Mr. Thomas Mohr of the Santa Clara Valley Water District (SCVWD). Panelists included Dr. Mong Hoo Lim (Singapore Public Utilities Board), Mr. Ed Means (Malcolm Pirnie, Inc.), Dr. Peter Stoks (RIWA/IAWR, The Netherlands) and Dr. Rhodes Trussell (Trussell Technologies, Inc.). The panelists shared great insights on micropollutant issues, provided their personal perspectives on key issues, and entertained many questions from an engaged audience.

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Micropol & Ecohazard 2009 – Continued

Micropollutants Research – Around the World in Three Days

This section summarizes key research results from around the globe presented at the conference. This summary is in no way comprehensive. GRA members are invited to view speaker presentations on GRA's website for a more detailed overview of the work summarized below.

Australia

Dr. Ray Kookana (CSIRO Land and Water) discussed the occurrence and fate of endocrine disrupting compounds (EDCs) in wastewater treatment plants (WWTPs). Dr. Kookana indicated that the levels of EDCs in Australia were similar to those observed in other countries. His research suggested that treatment plants remove most of the estrogenic load from effluents, and that rapid biodegradation often takes place in aerobic systems.



From left, conference co-chair Dr. Rula Deeb (Malcolm Pirnie, Inc.), student presentation competition winners Kristin McClellan (Arizona State University), Saskia Zimmermann (Eawag, Switzerland) and Kurt Rhodes (Stanford University), and student presentation awards committee chair Dr. Susan Richardson (USEPA)



Mr. Thomas Mohr (SCVWD) kicking it up with his wife Maria during the conference's dinner cruise on Tuesday evening

Dr. Kathryn Linge (Curtin University) spoke about the fate of disinfection byproducts (DBPs) during reverse osmosis (RO) treatment of secondary wastewater. Dr. Linge stated that it is difficult to predict concentrations of other nitrosamines based on ni-

trosodimethylamine (NDMA) levels in water, but that NDMA has the highest percentage of detections in secondary wastewater. She indicated that while post-RO concentrations sometimes exceed health guidelines, the potential public health impact due to NDMA is considered to be low. She concluded that the optimization of microfiltration/RO units during wastewater treatment and precursor removal may reduce post-RO nitrosamine concentrations.

Dr. Julien Reungoat (University of Queensland) compared activated carbon (AC) adsorption and biological filtration for the removal of micropollutants from treated wastewater. She concluded that biological activated carbon (BAC) showed performance equivalent to AC.

Mr. Nhat Le-Minh (University of New South Wales) discussed the removal of micropollutants in a membrane bioreactor (MBR) and indicated that MBRs removed selected EDCs and

antibiotics at comparable or better rates than conventional activated sludge. He concluded that MBRs can be used as an alternative option to septic tanks for decentralized treatment.

Spain

Dr. Damià Barceló (IDAEA-CSIC, Department of Environmental Chemistry, Barcelona, Spain) gave a plenary presentation on the fate and behavior of pharmaceuticals in treated wastewaters, sludge and river waters. He noted that high removal rates during wastewater treatment were mainly achieved for analgesic and anti-inflammatory compounds, and that other pharmaceutical groups showed lower removal rates. Dr. Barceló noted that the elimination of pharmaceutical residues from wastewater was enhanced when using MBR treatment and that flat-sheet MBRs achieved higher elimination rates than hollow fiber MBRs. Dr. Barceló also talked about the wide spectrum of

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Micropol & Ecohazard 2009 – Continued



From left, conference attendees Dr. Michael Kavanaugh (Malcolm Pirnie, Inc.), Dr. Martin Jekel (Berlin University of Technology, Germany) and Dr. Rhodes Trussell (Trussell Technologies, Inc.)

substances detected in receiving river waters, and reinforced that wastewater treatment plant outlets are major contributors of pharmaceuticals in the aquatic environment. His work on the Ebro river basin involved calculating the hazard posed by pharmaceuticals to different aquatic organisms. This study revealed that no significant risks were found to be associated with the presence of pharmaceuticals in surface water and treated wastewater effluent, and that a reduction of micropollutant concentrations was taking place after wastewater treatment followed by dilution once pharmaceuticals are discharged in receiving river water.

France

Mr. Samuel Martin Ruel (CIRSEE, Suez Environment) evaluated the removal of organic priority and emerging substances during activated sludge treatment through seven on-site sampling events. His work identified new substances with potential environmental impacts, quantified the performances of conventional wastewater treatment processes for the removal of these micropollutants and developed predictive tools for evaluating the fate of micropollutants in sludge.

Germany

Dr. Martin Jekel (Berlin Institute of Technology) discussed the removal of bulk and trace organics in underground treatment systems. He suggested that natural underground filtration can be an effective removal step for organics, and that a mix of aerobic and reducing conditions appeared to be favorable for the improved removal of a wide range of micropollutants. Dr. Jekel recommended retention times of one month under aerobic conditions and four to six months under anoxic conditions.

Dr. Thomas Ternes (BFG) discussed the formation and occurrence of biological transformation products and ozonation products of iodinated contrast media and betablockers in the urban water cycle. Dr. Ternes highlighted the challenges of elucidating the transformation pathways of organic contaminants. His research revealed that 47 transformation byproducts of four iodinated contrast media were detected in contact with soil, sediment and activated sludge.

Dr. Arne Wick, also from BFG, discussed the fate of psycho-active drugs (analgesics, tranquilizers, antidepressants, etc.) during biological wastewater treatment.

Dr. Wick's work focused on examining removal processes and the formation of transformation products. He noted that limited information is available in the literature about biological transformation products of micropollutants. His research showed significant removal of select compounds during conventional wastewater treatment, and that removal is restricted to the biological transformation of opium alkaloids. He concluded that a "non detection" of a contaminant is insufficient to prove its "elimination" in WWTPs.

Japan

Dr. Keisuke Kuroda (University of Tokyo) gave a presentation about groundwater contamination by sewage in central Tokyo. Dr. Kuroda noted that unconfined and shallow confined aquifers were found to be quite susceptible to contamination by sewage. His research showed that out of six pharmaceuticals, carbamazepine and crotamiton were most frequently detected and found to be more effective tracers of sewage than *Escherichia coli*. Based on carbamazepine detections, Dr. Kuroda estimated that 0.8% of dry-weather flow was leaking into unconfined aquifers in central Tokyo.

Norway

Dr. Benedek Plósz (Norwegian Institute for Water Research) discussed dynamic modeling of sorption, biodegradation and parent-compound formation processes for antibiotics in an activated sludge system. He developed guidelines to fractionate the antibiotics content of municipal wastewater and to assess fate model parameters for antibiotics. Dr. Plósz concluded that parent compound formation is an important process, and that the influent non-detected fraction can be assessed based on the measured parent compound concentration. He concluded that dynamic models can be successfully used for decision support and process control.

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Micropol & Ecohazard 2009 – Continued

Sweden

Mr. Berndt Björlenius (Stockholm Water Co.) elaborated on the removal of pharmaceuticals from municipal wastewaters. He reinforced the theme that today's WWTPs do not remove all pharmaceuticals, and that biological technologies are not sufficient (removal efficiencies below 70%). Of the range of alternative technologies, ozonation and activated carbon give the most promising results. Mr. Björlenius concluded that ecotoxicological studies are essential for evaluating treatment technologies, and that we need to know more about the environmental effects of pharmaceuticals before introducing new treatment steps.

Switzerland

Dr. Juliane Hollender (Eawag) spoke about the elimination of organic micropollutants in a municipal nutrient removal plant upgraded with an ozonation unit followed by sand filtration. She showed data demonstrating that ozonation is an efficient technique for the elimination of micropollutants. Dr. Hollender concluded that ozonation significantly reduces both specific and non-specific ecotoxicity, and that significant reduction of pathogens and partial reduction of the total plate counts are additional benefits. She also indicated that sand filtration is appropriate as an additional barrier for elimination of ozonation byproducts (e.g., NDMA).

Ms. Saskia Zimmermann, also from Eawag, spoke about the assessment and modeling of full-scale ozonation as a treatment step during municipal wastewater treatment. She suggested that micropollutants are increasingly oxidized along the ozone reactor with increasing exposure to ozone and hydroxyl radicals. Ms. Zimmermann's modeling efforts successfully predicted micropollutants oxidation within a factor of 1.5.

United States

Dr. Michael Plewa (University of Illinois) spoke about in vitro mammalian cell toxicology and human toxicogenomics as they relate to micropollutants in water. He started his presentation by stating that current EPA-regulated disinfection byproduct (DBP) classes such as trihalomethanes (THMs) and haloacetic acids (HAAs) are substantially less toxic than emerging DBPs such as the iodinated forms. The occurrence of these emerging DBPs is on the rise due to changes in source water quality combined with an increased use of alternative water disinfectants. Dr. Plewa suggested that iodinated DBPs pose adverse health concerns, and concluded that bi-

ologists, chemists and engineers should form teams to address problems posed by these hazardous micropollutants in water. He recommended that systematic, comparative in vitro toxicology be integrated as a feedback information loop into new engineering methods to remove and degrade micropollutants and disinfect water, and that the biological mechanisms of toxicity of emerging micropollutants be included with molecular epidemiology studies. Dr. Plewa also recommended that we must develop systems to prevent unintended toxic consequences as we move forward in the implementation of new methods to desalinate, decontaminate and disinfect water.

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Micropol & Ecohazard 2009 – Continued

Dr. Karl Linden (University of Colorado at Boulder) discussed the presence, fate and treatability of estrogenic contaminants in wastewater and biosolids. In the introduction to his presentation, Dr. Linden explained that conventional wastewater treatment plants do not completely eliminate estrogenic compounds. He suggested that the removal of EDCs and estrogenic activity is related to the removal of total organic carbon, and that EDC partitioning into the biosolids fraction is evident and significant. He also indicated that stronger oxidation processes (ozone/advanced oxidation) are needed to further degrade EDCs during wastewater treatment.

Dr. Eduardo Sáez (University of Arizona at Tucson) spoke about the fate of polybrominated diphenyl ethers (PBDEs) in wastewater from treatment to biosolids land application. He stated that PBDEs are the most widely used type of flame retardants in North America, and that wastewater treatment plants are inefficient at PBDE destruction although some removal occurs during anaerobic sludge digestion. As a result, PBDEs tend to accumulate in soils of recharge basins and in biosolids and soils amended with biosolids.

Dr. Craig Criddle (Stanford University) spoke about another group of micropollutants, fluorocarbons, and their potential to biodegrade in the environment. He stated that partially oxidized acid forms of perfluorinated molecules may enter the food chain through land application of waste sludge or bioconcentration from sediment. Due to a limited potential to biodegrade once released into the environment, Dr. Criddle concluded that analyses are needed to weigh benefits against long-term risks of continued use of fluorocarbons.

Take-Home Messages

It was clear after synthesizing the research results presented throughout the conference that interesting and relevant

research is taking place nationally and internationally. Most of the studies that were presented at the conference were new to practitioners since most of the research had not yet been published in peer-reviewed journals. Conferences such as Micropol & Ecohazard 2009, which focus strictly on micropollutants

ity to low detection limits. Dr. Daniel Schlenk (University of California at Riverside) discussed how Toxicity Identification Evaluations (TIE) for EDCs are now feasible in effluents and effluent-affected streams, and how TIE will likely constitute an important component of ecotoxicological assess-



From left, conference attendees Dr. Elizabeth Wagner (University of Illinois at Urbana-Champaign), Dr. Gianluca Li Puma (University of Nottingham, UK), Dr. Michael Plewa (University of Illinois at Urbana-Champaign) and Dr. Susan Richardson (USEPA)

and engage researchers from across the globe, are an important venue for sharing technical information and for fostering and enhancing collaboration between research groups.

Several important themes were highlighted at Micropol & Ecohazard 2009. One important theme revolves around the efforts of environmental chemists to overcome the inherent inadequacies of traditional analytical methods related to limitations of method detection limits (MDLs) and the large number of micropollutants that can be present in a sample. Specifically, Dr. Jennifer Field (Oregon State University) discussed how large-volume injection of water samples can overcome the insensitiv-

ment methods to inform future permits for dischargers of treated wastewaters. Dr. Berndt Björlenius (Stockholm Water Co., Sweden) stated that standard toxicological and ecotoxicological methods are being developed and/or standardized. Finally, Dr. Eric Dickenson (Colorado School of Mines) suggested that surrogate compounds may be used as a tactic to overcome the challenge of sampling for a large numbers of micropollutants.

Another important topic of interest to GRA members was that of nanomaterials. Nanomaterials are becoming more widely used, and can be beneficial or harmful to the environment depend-

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Micropol & Ecohazard 2009 – Continued

ing upon use, environmental transport and ultimate fate. Several presentations by conference speakers on nanomaterials are available to GRA members on GRA's website.



From left, Dr. Thomas Ternes (Federal Institute of Hydrology, Germany) and Mr. Frans Schulting (Global Water Research Coalition) enjoying a glass of champagne aboard the Hornblower San Francisco Bay Cruiseline

Finally, with respect to groundwater, several key messages were reinforced as follows:

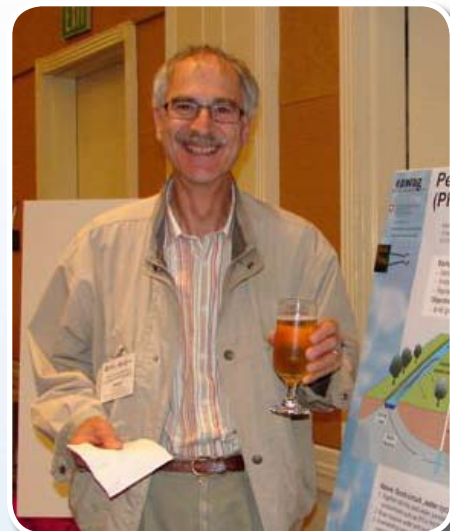
- Biological and chemical treatment steps (ozonation) create byproducts such as NDMA. Concerns about micropollutant byproducts are growing. We may need to start monitoring for these kinds of compounds.
- Biosolids are posing increasing concerns, especially with respect to leaching of hydrophobic compounds, including brominated flame retardants, triclosan, triclocarban and perfluorinated compounds (PFCs).
- The biotransformation of micropollutants in soil and groundwater is potentially an important subsurface removal mechanism.

Student Presentation Competition: Sponsors and Results

Students were encouraged to attend Micropol & Ecohazard 2009, and over 60 students attended; most of these students presented their work during the platform or poster sessions. A large number of these students entered a student presentation competition. The primary student author of each winning presentation (oral and posters) was recognized during the conference's closing session. Financial awards were presented to the following student winners:

- **First Place** – Platform Presentations: Elizabeth Hodges Snyder (University of Florida at Gainesville), *Risk Assessment of Biosolids–Borne Triclocarban (TCC)*
- **Second Place** – Platform Presentations: (1) Kristin McClellan (Arizona State University), *Nationwide Assessment of Pharmaceuticals and Personal Care Products in U.S. Biosolids*; and (2) Saskia Zimmermann (Eawag, Switzerland), *Assessment and Modeling of a Full Scale Ozonation Step of Municipal Secondary Wastewater Effluent*
- **First Place** – Poster Presentations: Kurt Rhoads (Stanford University), *Use of On-site Bioreactors to Determine the In Situ Biotransformation Kinetics of a Model Fluorochemical at a Full-Scale Wastewater Treatment Plant*
- **Second Place** – Poster Presentations: Cecilia Law (University of Hong Kong), *The Effect of Combined Colloid-Organic Fouling on the Performance of Nanofiltration Membrane in Wastewater Treatment and Reuse*

The student presentation competition sponsors included the following organizations that either provided conference registration fee waivers or financial rewards for the winners: AMEC Geomatrix, Carollo Engineers,



Dr. Eduard Hoehn (Eawag, Switzerland) presented a poster on PFCs in groundwater

CH2M Hill, GRA, GRA San Francisco Branch, the National Water Research Institute, Trussell Technologies, Inc. and the Water Research Foundation.

About the Authors

Dr. Rula A. Deeb is a Senior Associate and Technology and Applied Research Leader at Malcolm Pirnie, Inc. in Emeryville, CA. Dr. Deeb's work focuses on alternative site closure strategies at complex sites, and the environmental fate and transport of emerging contaminants. She is the recipient of the 2007 Berkeley Engineering Innovation Young Outstanding Leader Award.

Dr. David Sedlak is a Professor in the Department of Civil and Environmental Engineering at the University of California at Berkeley. His research addresses water quality engineering with a focus on trace contaminants and their fate in natural and engineered systems. Dr. Sedlak is a recipient of the NSF CAREER award, WERF's Paul L. Busch Award and a Fulbright Senior Scholar Fellowship.

Photo credits: Dr. Rula Deeb of Malcolm Pirnie, Inc., and Mary Megarry, GRA. 💧

GUEST EDITORIAL

Who Moved My Compliance Target?

By Thomas K.G. Mohr

In my recurring dream, I swing the bat and finally connect, hitting a line drive deep into left field – a base hit. But as I tear down the first base line, I see that first base has suddenly moved; somehow, it ended up in the middle of the outfield! This dream has puzzled many a therapist, but to the reader of this column, its interpretation is probably obvious: I suffer from trying to stay abreast of the ever-changing drinking water regulations and toxicity guidelines. In this column, I present a few examples of moving regulatory targets that have vexed groundwater professionals striving toward site closure or drinking water compliance, and summarize the progress made and challenges remaining to improve the scientific basis for water quality regulation.

In most cases, California drinking water standards for known or probable carcinogens are established to manage water quality to a risk endpoint that is at or less than the one-in-a-million cancer risk. However, there are some notable exceptions; arsenic and perchloroethylene (PCE) come to mind, where the regulatory standard is set much higher. The risk level to which non-cancer toxicity endpoints are regulated is more ambiguous. For several contaminants, the adopted Maximum Contaminant Levels (MCLs) are set substantially higher than the health-based Public Health Goals (PHGs) because technical, analytical, and economic feasibility are taken into account. Examples include arsenic, cadmium, PCE, 1,1,2-TCA; 1,1,2,2-PCA; 1,2-DCP; vinyl chloride, and trichloroethylene (TCE). This circumstance presents a challenge to drinking water utilities because the Calderon-Sher bill requires that public water systems notify their customers at least once every three years when they are consuming water with contaminants at levels above their

PHGs. For example, if a utility has a well with PCE at 1 ppb, i.e. above the 0.06 ppb PHG for PCE but five times lower than its MCL, that utility faces the difficult customer relations burden of notifying consumers that while their drinking water is in compliance with state standards, the public health goal is exceeded. In effect, the Calderon Sher bill sets a second tier of reporting requirements for water utilities, and focuses the public's attention on the PHG, while the utility has usually focused its operations on compliance with the MCL.

Organic contaminants may form breakdown products that are more toxic than the parent compound. A well known example is TCE, which has a MCL of 5 ppb and a PHG of 1.7 ppb, but TCE's biodegradation daughter product, vinyl chloride, has a MCL of 0.5 ppb, and an even lower PHG – 0.05 ppb. Less widely considered or regulated is the biodegradation product of Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane; California's MCL is 1,200 ppb). Chloro-trifluoroethylene, the fluoride homolog of the carcinogen vinyl chloride, may form from the biodegradation of Freon 113 where sulfur-reducing conditions are present; its drinking water action level was set at 5 ppb in New Hampshire. It is therefore apparent that compliance with the standard set for the target compound may not be enough if its breakdown products are regulated at a lower level or have lower public health goals.

Some compounds have been regulated for their potential carcinogenicity; however, further examination reveals that the compound itself does not initiate cancer, but its impurities and additives may. The solvent stabilizer most often added to methyl chloroform (1,1,1-trichloroethane), which is no longer commonly used, was 1,4-diox-

ane. 1,4-Dioxane has been regulated as a probable human carcinogen with a MCL of 6.2 ppb in Colorado; however, a May 2009 draft toxicity study released by US EPA's IRIS program suggests a steeper cancer slope factor and a correspondingly lower drinking water advisory level or standard. Some industry toxicologists calculate that the new draft 1,4-dioxane study, if adopted, would mean that California should lower its 1,4-dioxane Notification Level from 3 ppb to 0.17 ppb.

Other compounds are being revisited with consideration given to lowering the regulatory standard. The media focus on legacy effects of TCE on military families at Camp LeJeune, North Carolina has led to federal re-examination of TCE's toxicity and possible lowering of its regulatory standard. In contrast, California's Office of Environmental Health Hazard Assessment (OEHHA) adopted a final PHG for TCE in July 2009 that is twice as high as the previous PHG, established in 1999. Several years ago, US EPA Region 9 lowered the Preliminary Remediation Goal (PRG) for TCE's vapor intrusion pathway 70-fold in view of the toxic action of its metabolic by-products in the liver, because the same haloacetic acids are present in most treated drinking water as a disinfection by-product.

There are also examples of standards being raised. In 2006, OEHHA released revised PHGs for three commonly encountered chlorinated solvents – methyl chloroform (new PHG is 1 ppm; MCL is 0.2 ppm); and cis- and trans- 1,2-dichloroethylene (new PHGs are 100 ppb and 60 ppb, respectively; California MCLs are 6 and 10 ppb). The California Water Boards have been issuing cleanup orders based on cleaning up to background or at least to

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Who Moved My Compliance Target – Continued

their MCLs, which remain lower than the new 2006 PHGs. Bear in mind that a PHG is not a regulatory standard. However, health effects have been the driver for the MCLs used to regulate these chemicals, as their taste and odor thresholds are higher than their MCLs. It is therefore incumbent upon us to ask: How much money has been spent remediating cis-1,2-DCE at concentrations between 100 and 6 ppb? I will venture a guess: tens of millions of dollars in Silicon Valley alone. How does this moving target affect the willingness of responsible parties to cooperate, or how much will this reconsideration and shift to higher toxicity thresholds motivate an approach of hesitate, appeal and litigate?

These examples underscore the moving targets that form the shifting landscape through which groundwater professionals that manage site cleanups and drinking water compliance alike must navigate. The perchlorate example illustrates this dilemma especially well. The federal PRG for perchlorate was 24.5; now it is 15 ppb; meanwhile, the California drinking water Action Level (now called the Notification Level) was 18 ppb until 2002, then 4 ppb until 2004, and is now equivalent to the 2007 MCL, 6 ppb. These changing thresholds erode the public's confidence in our profession. One disgruntled well owner whose well is contaminated with perchlorate told me, "If we put all you water bureaucrats in a big burlap sack and beat it with a stick we'd be hitting the right one!"

Hydrogeologists have grown accustomed to relying upon enduring scientific principles: Darcy's Law, Fick's Law, water flows downhill, etc. So why does it sometimes seem that the scientific framework governing toxicity determinations is fluid and fleeting? The answer – and the cause of this syndrome of moving regulatory compliance targets – is actually good news: the science is getting better, and as improved methods become available, better decisions are being made about

the toxicity of drinking water contaminants. But as the toxicology improves, it also grows more complex.

A limitation to determining the toxicity of drinking water contaminants has been reliance upon the *in vivo* laboratory assay, i.e. the studies of toxic effects of contaminants on rats, mice and other species, which can be very difficult to control. For example, in 121 replicate rodent carcinogenicity assays there was concordance of only 57% between the overall rodent carcinogenicity classifications (Gottman, et al., 2001). Even when an *in vivo* study is unanimously considered good in all respects, there remains the precarious matter of extrapolating the high dose used in the rodent assay down to the acceptable drinking water concentration.

The field of environmental toxicology is undergoing a paradigm shift from dependence upon the cumbersome process of animal testing (*in vivo*)

to the use of new cell-line methods (*in vitro*) and computational toxicological methods (*in silico*). The new methods provide mechanistic details of events at the cellular and molecular levels. Pharmacologists and biotechnologists have taken the lead in developing these methods to accelerate the clinical testing of pharmaceuticals; however, these techniques also have ready application to the toxicological assessment of chemicals and chemical products. *In vitro* methods permit the observation of changes at the molecular level, including DNA alteration at a target organ site, and changes to proteins in cell membranes and within cells (Bhagal et al., 2005). The "omics" methods – genomics, proteomics, and metabonomics – make it possible to develop molecular profiles to identify the key steps that trigger toxicity and cause adverse health effects to target

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Who Moved My Compliance Target – Continued

organs and to entire living organisms (USEPA, 2006). Physiologically based pharmacokinetic (PBPK) models have improved significantly in the last 20 years, and in vitro testing is supplying better data to calibrate PBPK models. These new approaches to evaluating toxicity may also permit a more comprehensive analysis of the effects of multiple contaminants through multiple exposure pathways, opening the possibility of conducting quantitative, exposure-based assessments of the joint toxic action of chemical mixtures. These new innovative tools can also help to resolve the backlog of thousands of chemicals awaiting toxicological assessment, now needed for DTSC's Green Chemistry policy and the European Union's REACH policy (Registration, Evaluation & Authorization of Chemicals) – a task that would be entirely unworkable using conventional methods.

USEPA's Computational Toxicology Research Program focuses on the integration of advanced computing methods with molecular biology and chemistry, and enables scientists to better prioritize data; inform decision makers on chemical risk assessments; understand a chemical's progression from the environment to the target tissue within an organism; and ultimately to understand mechanisms of toxic effects. A key goal of computational and in vitro toxicology is to reduce uncertainties in the extrapolation of effects across dose, species, and chemicals (USEPA, 2006). An example of USEPA's computational toxicology initiative that accelerates the prediction of chemicals' toxic effects is ToxCast™, which provides rapid and cost-effective tools for prioritizing the toxicity testing of large numbers of chemicals.

Leveraging computer technologies to enhance toxicity determinations has yielded good dividends, but it may also have a drawback. Agency toxicologists used to be free to conduct scientific analysis of the toxic effects of chemicals without involvement by parties

with political or economic interests in the outcome. EPA insiders note that the advent of rapid internet access to study results and Freedom of Information Act policies have worked to both improve access to information and to politicize regulatory decisions before reports are finalized. Stakeholder involvement in studies has evolved from post-analysis to nearly real-time, influencing the process earlier and earlier. The change in the timing of stakeholder involvement makes the independence of regulatory toxicology groups both more precarious and more vital. As one agency staffer noted, the simile comparing sausage making to creating legislation may now extend to the development of scientific conclusions in regulatory toxicology – the unfinished product can be perplexing to the lay observer.

Bhogal, N., Grindon, C., Combes, R., and Balls, M., 2005, Toxicity testing: Creating a revolution based on new

technologies. *Trends in Biotechnology* 23(6):299–307.

Gottmann, E., Kramer, S., Pfahringer, B., and Helma, C., 2001, Data quality in predictive toxicology: Reproducibility of rodent carcinogenicity experiments. *Environmental Health Perspectives* 109(5): 509-514.

U.S. Environmental Protection Agency (USEPA), 2006, ORD's computational toxicology research program implementation plan (FY 2006 – 2008). Office of Research and Development, April 2006.

Thomas Mohr is a Director and Past President of GRA, and a hydrogeologist with the Santa Clara Valley Water District (SCVWD). The views and opinions expressed here are his alone and do not reflect the policies or positions of either GRA's Board of Directors or SCVWD, nor was the preparation of this column supported by or endorsed by either GRA or SCVWD. Your comments and responses to this column are welcome: editor@grac.org.

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GUEST EDITORIAL

Geology Board Eliminated – Geologists Join Engineers

By Timothy K. Parker

Governor Ronald Reagan signed legislation creating the Board of Registration for Geologists and Geophysicists in 1968, which initiated professional licensure for the geoscience professions in California. Subsequently, geologists, geophysicists, engineering geologists, and hydrogeologists would become licensed and regulated under the renamed Board for Geologists and Geophysicists (BGG) within the California Department of Consumer Affairs. This action came largely as a result of landslides, slope failures, and significant property damage, including the infamous Portuguese Bend Landslide on Palos Verdes peninsula, due to engineering technical design lacking foundational geologic evaluations and practices. The purpose of the Board is to protect consumers and public safety by ensuring that people practicing geology and geophysics in the State of California have sufficient education, work experience, and knowledge to competently carry out their duties, including:

- Inspecting the ground where construction is planned;
- Mapping soils and rocks;
- Assessing landslide risk;
- Groundwater resources evaluation and development;
- Groundwater quality assessment;
- Using satellite or aerial photos to investigate the structure of an area;
- Investigating the subsurface with seismic methods;
- Drilling boreholes and logging the rocks they penetrate; and
- Assessing mineral deposits.

California is one of 34 states that currently license the practice of geology, and one of only two states that

license the practice of geophysics (the other is Texas).

After more than 40 years, recently passed legislation abolishes the BGG, and licensing and regulation of geologists and geophysicists will now be administered under the Board for Professional Engineers and Land Surveyors (BPELS). This action is mandated under Assembly Bill ABX4 20, signed by the Governor on July 28, 2009 (http://www.leginfo.ca.gov/pub/09-10/bill/asm/ab_0001-0050/abx4_20_bill_20090728_chaptered.pdf); the entire process occurred in less than 11 weeks, very rapid from a policymaking perspective. It is my understanding that the bill will take effect 90 days from enrollment.

This action was a cost-cutting measure to address “the fiscal emergency” declared by the Governor on July 1, 2009. However, based on the LAO’s 2009-2010 Budget Analysis Series, the BGG was originally proposed to be consolidated into the State Mining and Geology Board (SMGB), and no actual savings was projected (http://www.lao.ca.gov/analysis_2009/general_govt/gen_anl09004008.aspx#zsee_link_1_1233252482). The original rationale for consolidating SMGB and BGG was to eliminate supposed overlap of their missions. What has occurred with BGG being consolidated into BPELS has nothing to do with eliminating overlap, and does not create synergy, because geology and engineering are separate, distinct practices:

- Geology is the science and study of the solid and liquid matter that constitutes the Earth, and the field of geology encompasses the study of the composition, structure, physical

properties, dynamics, and history of Earth materials, and the processes by which they are formed, moved, and changed. The field is important for natural resources development including mineral, hydrocarbon and groundwater resources development, protection of natural resources, identification and mitigation of natural hazards, and understanding past climates and environments, and also is a major academic interest.

- Engineering is the science, discipline, art and profession of acquiring and applying technical, scientific and mathematical knowledge to design and implement materials, structures, machines, devices, systems, and processes that safely realize a desired objective or inventions.

Specific legislated changes, based on my (a hydrogeologist, not a lawyer) interpretation of the bill, include:

- Consolidation of the BGG into BPELS and responsibility for implementation of the BGG Act is under BPELS.
- BPELS receives the equivalent of two full-time staff from BGG.
- All references to BGG Board Members have been repealed, and there are no provisions in the legislation for geoscience representation on BPELS.
- All references to the “Board” in the Geologist and Geophysicist Act now refer to BPELS.
- BPELS provides the nomination for the State Geologist to the Governor and Director of the Department of Conservation, and may grant the nominee registration as a geologist.

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Geology Board Eliminated – Geologists Join Engineers – Continued

The BGG licenses more than 7,600 geologists and geophysicists, and currently has an annual budget of \$1.4 million, and a staff of 9.6 authorized positions (reduced to two under the new legislation). BPELS licenses and regulates engineers and land surveyors. The board administers the Professional Engineers Act and the Professional Land Surveyors Act. BPELS has more than 114,000 licensees, and has an annual budget of \$9.5 million, and a staff of 53.9 authorized positions.

Previous and Sustained Review of the BGG

In 1994, the Business and Professions Committee initially reviewed whether BGG should be merged with any other entity, including BPELS. At that time, no changes were made to BGG.

Historically, the BGG has gone through a critical sunset review every three years, by a Sunset Review Committee and the Department of Consumer Affairs, including 2008, 2005, 2002, 1999, and 1996. Each time, the Sunset Review Committee and DCA recommended that the BGG be continued as an independent board and not be combined with any other entity.

Geosciences stakeholder input to the BGG sunset review process generally has been led by the California Council of Geoscientist Organizations (CCGO) (<http://www.ccgо.org/home.html>), of which GRA is a member along with AEG, AIPG, AAPG and several other organizations. GRA joined this organization to provide support and to be part of a united front for advocating the use of sound geologic knowledge and practice in California and monitoring statutes, regulations, and public policies related to geologic practices. GRA is a diverse group of professionals, including engineers, chemists, hydrologists, attorneys, toxicologists, geologists and hydrogeologists, and the GRA Board felt it most appropriate to be a member of CCGO and have CCGO be the voice

for GRA and its geoscientist members in matters concerning the BGG.

The Future for California Licensed Geologists and Geophysicists

The Geologists and Geophysicists Act requires licensure of the practice of geology in California. Therefore, unless further legislation is passed, it would appear that candidates for licensure will continue to take exams, apply for licenses, and pay and renew fees. It is uncertain, however, how enforcement of the Geologists and Geophysicists Act will be implemented under BPELS. Also uncertain is how the fees collected from licensure will be designated and applied.

With BPELS on track to administer the BGG Act and an 80% reduction in BGG-related staff, it seems the following will likely occur in the short term:

- Loss of institutional knowledge
- Increased time to make decisions on subject matter new to BPELS
- Increased workload for BPELS

Facing these uncertainties, CCGO and other geoscience-dominated organi-

zations may consider opening a dialogue and working closely with and assisting BPELS, as appropriate, to develop an approach and plan to implement its new geology-geophysics charge.

It is safe to say that the majority of professional geologists in California will continue to support appropriate regulation of the practice and being provided the opportunity to inform and educate elected representatives about the importance of measuring and sustaining high standards of practice, particularly as this relates to having qualified and licensed professional geologists integrally involved with groundwater projects.

Timothy K. Parker, PG, CEG, CHG, of PARKER GROUNDWATER and GRA Legislative Chair and Past President, may be reached at tim@pg-tim.com. The views and opinions expressed here are his alone and do not necessarily reflect the policies or positions of the GRA's Board of Directors, nor was the preparation of this column supported by or endorsed by GRA. Your comments and responses to this column are welcome: editor@grac.org.

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Dates & Details

GRA EVENTS & KEY DATES

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

27th Biennial Groundwater Conference/GRA 18th Annual Meeting
Oct. 6-7, 2009 | Sacramento, CA

GRA Symposium
Nanotechnology for Environmental Cleanup & Pollution Control
Nov. 3, 2009 | Burlingame, CA

GRA San Joaquin Valley Branch Symposium
Groundwater Withdrawal – Induced Land Subsidence in the San Joaquin Valley: A 2009 Perspective
Nov. 4, 2009 | Fresno, CA

GRA Board Meeting
Nov. 14, 2009 | Fountain Valley, CA

GRA Shortcourse
Introduction to Groundwater & Watershed Hydrology
Mar. 1 & 2, 2010 | Davis, CA

Nanotechnology for Environmental Cleanup and Pollution Control

Science, Implementation, and Regulatory Issues

NOVEMBER 3, 2009 – BURLINGAME, CA

To Register: <http://grac.org/nanotech.asp>

The Groundwater Resources Association of California (GRA) is pleased to present this one-day symposium to be held on November 3rd, 2009, at the Hyatt Regency, San Francisco Airport, Burlingame, California. The symposium is co-sponsored by the California EPA/Department of Toxics Substances Control and AMEC Geomatrix, Inc.

GRA seeks to provide a forum for leading nano researchers, practitioners, and nano policy and regulatory experts to share and express the latest research findings, case studies, and regulatory issues of nanotechnology. The focus of this symposium will be on the application of nanotechnology for groundwater remediation, surface water treatment, and pollution control.

Session topics will include:

- Nanotechnology for Groundwater Remediation
- Nanotechnology for Surface Water Treatment and Pollution Control
- Delivery/Application Methods of Nanomaterials for Water Treatment
- Regulatory Issues with Nanomaterials and Nanotechnology
- Case Studies

Confirmed speakers include:

Wei-xian Zhang, Ph.D.

Associate Professor of Civil and Environmental Engineering, Lehigh University
Dr. Zhang is a pioneer in the synthesis and application of nanoscale zero valent iron (ZVI) technology for in situ groundwater remediation.

David L. Sedlak, Ph.D.

Professor of Civil and Environmental Engineering, U.C. Berkeley
Dr. Sedlak's research focuses on oxidation of contaminants by iron nanoparticles in the presence of oxygen.

Dongye (Don) Zhao, Ph.D.

Associate Professor of Environmental Engineering, Auburn University
Dr. Zhao's research focuses on developing innovative nanomaterials for environmental cleanup uses.

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Nanotechnology for Environmental Cleanup and Pollution Control

– Continued


David M. Cwiertny, Ph.D.
Assistant Professor of
Chemical and Environ-
mental Engineering,
U.C. Riverside

Dr. Cwiertny's research focuses on the application of nanotechnology for pollution control.

Todd H. Rees, Ph.D.
Principal Engineer,
Golder Associates

Dr. Rees has over 13 years experience working with nanoscale materials and technologies.

The combination of invited speakers and experts from key areas, along with talks chosen from submitted abstracts, will make this an important event for all professionals interested in the environmental application of nanotechnology. Please feel free to contact Mary Megarry (mmegarry@nossaman.com or 916-446-3626) if you would like additional information on this symposium.

Registration information and symposium updates can be found at <http://grac.org/nanotech.asp> 



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Topics to be addressed in plenary sessions and technical sessions include:

- Socioeconomic Aspects of Agricultural Groundwater
- Climate, Energy, and Agricultural Groundwater
- Agricultural Groundwater Quality and Contamination
- Conjunctive Use, Agricultural Water Use, and Groundwater Management, Policy, and Regulation
- Groundwater at the Agriculture-Urban Interface
- Groundwater Linkages to Surface Water and Estuaries

Abstract submittal is open from September through December 31, 2009. Check the conference website, www.ag-groundwater.org, for details

The Groundwater Resources Association of California is coordinating exhibits. Contact Mary Megarry at mmegarry@nossaman.com or 916-446-3626 for more information.

Sponsorships are welcome. Contact Rita Schmidt Sudman at rsudman@watereducation.org or 916-444-6240 for more information.

Watch the website, www.ag-groundwater.org, for updates.

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The preliminary program, online registration, and exhibitor information are available on the Biennial Groundwater Conference website:

<http://www.lib.berkeley.edu/WRCA/WRC/GW27th.html>

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*Groundwater Resources Association of California (GRA), San Joaquin Valley Branch and
Association of Environmental and Engineering Geologists (AEG), San Joaquin Valley Chapter
present*

Groundwater Withdrawal-Induced Land Subsidence in the San Joaquin Valley: A 2009 Perspective

NOVEMBER 4, 2009 – FRESNO, CALIFORNIA

Sponsored by AMEC Geomatrix, Inc. in cooperation with the United States Geological Survey (USGS)

The prospect of renewed episodes of deep land subsidence in the San Joaquin Valley is very real: San Joaquin Valley groundwater levels are at historic lows; groundwater pumping is increasing in response to a drought and cutbacks in surface water deliveries; and Valley population growth has imposed an ever-increasing demand on water supplies. Deep land subsidence threatens infrastructure and buildings, water delivery systems, and long-term water supply capacity. This symposium will examine the current state of deep land subsidence in the San Joaquin Valley. Please join us for a day of presentations from a panel of distinguished speakers who will discuss the many aspects of this topic. Our panel includes representatives from:

- United States Geological Survey (USGS)
- National Geodetic Survey (NGS)
- California Department of Water Resources (CA DWR)
- San Luis Water District
- Central California Irrigation District
- AMEC Earth and Environmental
- Harris Galveston Subsidence District

We will address the following issues and topics:

- San Joaquin Valley groundwater supply and aquifer overdraft
- History of San Joaquin Valley land subsidence
- California water policy and implications for subsidence
- Historical and current impacts
- Remote sensing, GPS, and geophysical techniques for assessment
- Lessons learned and mitigation approaches in Phoenix, Arizona and Harris-Galveston, TX area
- Roundtable discussions

More Information

Please reserve the November 4, 2009 symposium date and join us to learn about the latest research findings and policy issues related to San Joaquin Valley land subsidence from aquifer overdraft. For more information, please contact Lynne Baumgras at lynne.baumgras@amec.com (559.892.2918) or Richard Fink at rfink@kleinfelder.com (559.577-1451). Check the GRA website at <http://www.grac.org/san-joaquin.asp> for registration details. 💧

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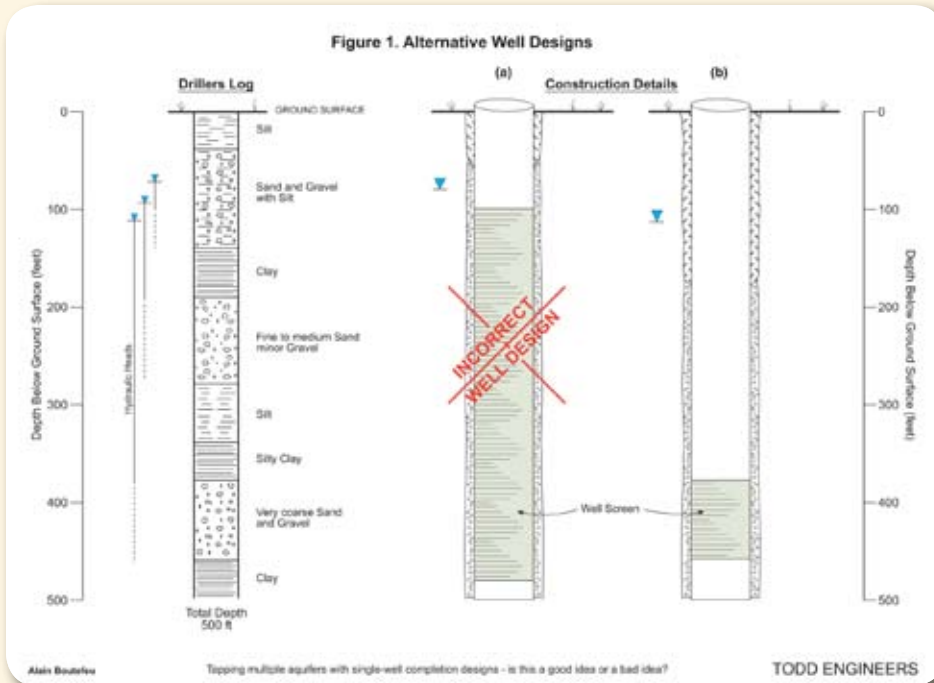
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Wells and Words

By David W. Abbott, P.G., C.Hg., Todd Engineers



Tapping Multiple Aquifers with Single-well Completion Designs – Is this a Good or Bad Idea?

This is a *really* bad idea that jeopardizes the environmental and economic values of groundwater resources and results from a fundamental misunderstanding of well and aquifer hydraulics. The proper design and vertical position of well screens is essential to maximize well longevity, reduce well failure, optimize well discharge, understand hydraulic and aquifer responses to resource development, and to reduce the costs of well construction, development, and maintenance. Tapping multiple aquifers with a single-well design maximizes well discharges (a good idea) at the expense of creating unintentional structural, geochemical, and/or environmental problems (a bad idea). A key element in well design is subsurface geology, which is often stratified, but can be divided into distinctive hydrogeologic units based on particle grain-sizes: aquifers (more permeable sands and gravels)

are usually separated by aquitards (less permeable silts and clays). Such units should be considered in both local and regional context because most local aquifers are part of a regional groundwater flow system.

“Tapping multiple aquifers with a single-well design maximizes well discharges (a good idea) at the expense of creating unintentional structural, geochemical, and/or environmental problems (a bad idea).”

The vertical position of well screens should promote proper groundwater resource development, protection, and conservation. The position is usually based on a balance between static water levels, aquifer permeability and depths, water quality, and desired well yields. Descriptions of subsurface sediments encountered during drilling are vital to the successful completion of a well and

resource management. Nevertheless, subsurface stratigraphy is often ignored in well screen design by way of one or more of the following justifications:

- ***Greater screen lengths will yield more water.*** This is a myth – the permeability and thickness of the aquifer determines the amount of available water – not the screen. Properly designed screen dimensions are adjusted to allow for the efficient transfer of water between the aquifer, well, and well pump. Strategically-placed well screens thereby focus precious development time and energy on the more permeable parts of the formation.
- ***Tapping several aquifers in a single-well design rather than several wells installed in separate aquifers reduces well installation and operational costs.*** This is also a myth. Multiple aquifer completions can be more complicated to construct, are difficult to develop properly, and lead to mixing of waters from different aquifers that may result in shortened longevity and increased maintenance costs.
- ***Stratigraphy is poorly defined or “I don’t want to miss any important***

water-bearing units. There is no excuse for the poor identification of subsurface sediments. Down-hole geophysical logging methods and drilling and sampling techniques can be used to clearly, easily, and cost-effectively identify stratigraphic units.

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Wells and Words – Continued

- *The casing and screen materials have been pre-ordered and “Screen everything below the water table” is the most egregious myth.* Anyone can “dig and design a hole in the ground,” but fewer people can design and engineer a well to properly protect groundwater resources.

Screens that are opposite silts and clays (Figure 1a) serve no useful hydraulic purpose and can adversely affect long-term well performance and water quality. Silts and clays supply relatively small amounts of water, which is often offset by contributions of poor water quality and influx of very-fine sand and colloidal particles producing elevated turbidity. Screens opposite the most permeable portion of the aquifer or stratigraphic section will yield a more productive and efficient well (Figure 1b) while reducing well development costs and long-term operating and maintenance costs.

For example, sand has a permeability of at least two orders of magnitude greater than silt. This means that 10 feet of sand would produce as much water as 1,000 feet of silt! The low permeability of fine-grained sediments results in greater residence times in the aquifer and allows groundwater to geochemically react with matrix materials, usually producing poorer water quality. In addition, each foot of well screen should be developed – well development costs for 200 feet of well screen are about five times greater than for 40 feet.


Turbidity is caused by the ongoing removal of minute particles near the well screen/filter pack/borehole interface. Chemical and mechanical methods (flocculants and desanders) can resolve turbidity and sand issues prior to distribution, but the persistent “mining” of these fine-grained particles will disrupt and weaken the geologic framework, resulting in catastrophic collapse of the ground surface near the well and eventual complete well failure. With the exception of karstic

(turbulent) groundwater flow and a few unusual geologic settings, groundwater is free of turbidity.

Tapping multiple aquifers using single-well designs also has significant hydraulic downsides. Water levels in aquifers usually vary with depth. These differences in water levels (Δs) between aquifers (Δz) or, vertical hydraulic gradients, can encourage uncontrolled and undesirable inter-aquifer groundwater movement between screened intervals. Water levels in groundwater recharge areas typically become deeper with depth and water flows downward from shallow to deeper aquifers (see left-side of Figure 1), whereas water levels in discharge areas become shallower with depth and water flows from deep to shallower aquifers; pumping of aquifers can reverse these flow directions and hydraulic gradients. The lower

Salinas Valley in California is a good example of where wells have been installed to maximize well yields by tapping multiple aquifers in single-well designs. These designs resulted in the unintentional inter-aquifer transfer of saline water from shallow to deeper aquifers, seriously impacting a regional and valuable freshwater agricultural resource.

The purpose of most well drilling projects is to design and build a production well with optimum well yields for the owner. Multiple aquifer completions using single-well designs represent short-term reduced costs coupled with potential long-term undesirable consequences, whereas multiple well completions in different aquifers offer engineered controls on aquifer management and proper protection of groundwater resources. 💧



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Legislative Update

By Chris Frahm and Paul Bauer, Brownstein Hyatt Farber Schreck and Tim Parker, Parker Groundwater

California's water issues have moved into the center ring of the legislative process. Prior to the Summer Recess, the 2009-10 Legislative Session was dominated by the fiscal crisis gripping the state. The Legislature passed, and the Governor signed, the budget nearly one month into the fiscal year. The budget issue has dominated the legislative dialogue in a manner like never before. The budget deficit was \$24 billion – closing the gap without raising taxes was a difficult process and demanded the full attention of the legislative leadership and the governor. With that issue resolved for the short run, an opportunity to discuss water policy has presented itself. The Governor and legislative leadership has identified the state's water policy as the next item on the "to-do list" for this legislative session. Since the Legislature's return to Sacramento on August 17th, water has become the number one issue pending in the legislature. The Water Committees of both Houses have an ambitious calendar of meetings between now and adjournment on September 11th.

Before leaving for summer recess, the legislature amended 5 bills down to one sentence each and sent the bills to conference committee. Over the recess, the bills were amended into "pre-print" bill drafts. The 5 bills are:

- AB 39 Huffman - Delta Plan
- AB 49 Feuer - Water Conservation
- SB 12 Simitian - Delta Council
- SB 229 Pavley - Delta Plan
- SB 458 Wolk - Delta Conservancy, Delta Protection Commission

On Tuesday August 18th, the Senate Natural Resources and Water Committee and the Assembly Water, Parks and Wildlife Committee met jointly to hear presentations on the bills. The focus of the hearing was the legislation relating to the governance of the Delta, including a

Delta Stewardship Council, Delta Conservancy and an Independent Science Board. Also on Tuesday August 18th, Governor Schwarzenegger issued a letter to the legislative leadership indicating that he wants to take action on Delta solutions and a comprehensive water bond this year. The Governor takes issue with the bills as drafted; he is concerned that the legislation being considered will delay implementing actions. He also believes the legislation as currently drafted does not reflect the "co-equal goals" of habitat restoration in the Delta and water supply reliability.

The conference committee members have not been named at this time. A conference committee typically consists of two democrats and one republican from each house. Later this month, the conference committee will begin meeting with the intent of developing legislation addressing the Delta eco-system and water supply issues facing the state before adjournment on September 11th. There is a strong likelihood that a water bond of up to \$10 billion (or more) may be part of the final package. Once the conference committee finishes its work, the conference report goes directly to the floor of each House and may not be further amended. It is critical that funding for groundwater needs throughout the state and policies supporting GRA's positions be included, particularly in the areas of groundwater storage, conjunctive use and monitoring. Written testimony is being prepared for the official record regarding GRA's positions on the groundwater-related issues.

GRA continues to support the following bills moving through the legislative process:

AB 410 by Assembly Member Hector De La Torre as introduced in January authorized using Prop 84 dollars to support salt management plans. This bill has been amended in the Senate to reward

integrated regional plans that include salt management plans, but no longer creates a separate pool of funds for this purpose. The bill is pending in the Senate Appropriations Committee.

AB 1100 by Assembly Member Mike Duvall allows the transport of limited amounts of recycled water for the purpose of educating the public on the uses and safety of recycled potable water. This bill failed passage in the Senate Environmental Quality Committee and will be eligible to be heard in January. GRA testified in support of this measure in Committee and joined with other stakeholders in working to seek its passage next year.

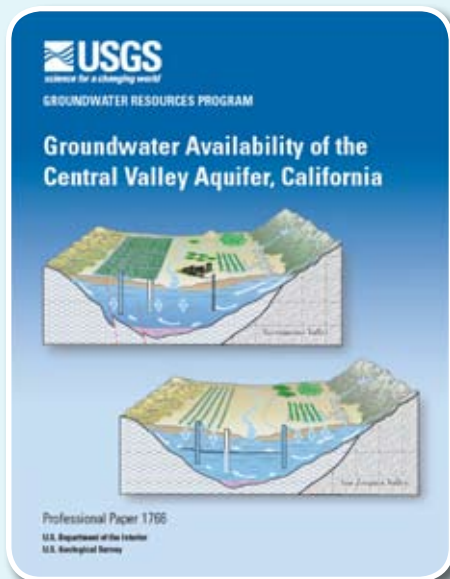
AB 1366 by Assembly Member Mike Feuer is the reintroduction of legislation from last year relating to the regulation of water softeners to combat salinity caused by the use of water softeners. This bill continues to move through the process and is currently pending in the Senate Appropriations Committee.

SB 122 by Senator Fran Pavley is the latest attempt to establish a statewide groundwater monitoring program. The legislation is the latest attempt to establish a program modeled after prior legislation SB 820 (2006) and SB 1640 (2007) both by Senator Keuhl and SB 178 (2008) by Senator Steinberg. This bill was held in the Senate Appropriations Committee due to concerns over the cost of implementing this legislation. This issue has resurfaced in the context of the conference committee dialogue. GRA continues to promote the concepts embodied in SB 122 and will work to seek its passage through the conference committee process. 💧

The Federal Corner

By John Ungvarsky

Groundwater Availability in California's Central Valley



The USGS has released results from a study on the largest water reservoir in the State of California, the Central Valley groundwater system. Overall, groundwater levels are declining in the southern, Tulare Basin portion of the San Joaquin Valley as more water is pumped out than recharges naturally. But the southern valley also shows the most promise for large-scale artificial groundwater recharge, particularly along the eastern side with its coarse-grained soils from river and alluvial-fan sediments. By contrast, groundwater levels in the Sacramento Valley and the northern portion of the San Joaquin Valley are generally stable. For more information, see: <http://pubs.usgs.gov/pp/1766/>.

New Assistant Administrator for EPA's Office of Water

The US Senate has confirmed Peter Silva as the USEPA's next Assistant Administrator for Water. Silva, a civil engineer, was most recently a senior policy adviser for the Metropolitan Water District of Southern California. At USEPA, Silva will be responsible for programs and regulations under the Clean Water and Safe Drinking Water Acts.

New Director for USGS California Water Science Center

Eric Reichard, a scientist with a long history in California water issues and a GRA Director, has been selected as the new director of the USGS California Water Science Center. For more information, see: http://ca.water.usgs.gov/news/ReleaseJuly6_2009.html.

Western States Source Water and Groundwater Protection Forum

Approximately fifty participants from USEPA Regions 8-10, western states, and various other source-water professions attended the May 2009 Forum. The Forum brought together source-water partners to share and

discuss solutions to source-water and groundwater protection challenges in the west. To view the proceedings and presentations, go to: <http://www.epa.gov/region09/water/groundwater/gwswp-forum/>.

A National Framework for Ground-Water Monitoring

The Subcommittee on Ground Water (SOGW), established in 2007 by the Federal Advisory Committee on Water Information, recently developed a proposed framework that establishes and encourages implementation of a long-term national ground-water quantity and quality monitoring network. The SOGW, which together with its working groups, includes more than 70 people representing the private sector and 54 different organizations, including nongovernmental organizations, state and local agencies, federal agencies, and academia. The proposed National Ground-Water Monitoring Network is envisioned as a voluntary, integrated system of data collection, management, and reporting. For more information, go to: <http://acwi.gov/sogw/pubs/tr/index.html>.

Continued on the following page...



PHOTO CREDIT: JOHN UNGVARSKY, USEPA

The Federal Corner – Continued

Recent Ground Water Rule Documents

USEPA has posted on its web site two additional documents to assist with implementation of the Ground Water Rule. The new documents, GWR Triggered and Representative Source Water Monitoring Guidance, and Ground Water Rule Corrective Action Guidance Manual, can be accessed at <http://www.epa.gov/safewater/disinfection/gwr/compliancehelp.html>.

FY 2010 National Water Program Guidance is released

USEPA's National Water Program has released the final FY 2010 National Water Program Guidance. This Guidance describes water program priorities and strategies, including the suite of water performance measures and their targets, for the coming fiscal year. The

final Guidance is available at <http://www.epa.gov/water/waterplan/fy10.html>.

Financial Responsibility for Geologic Sequestration Wells

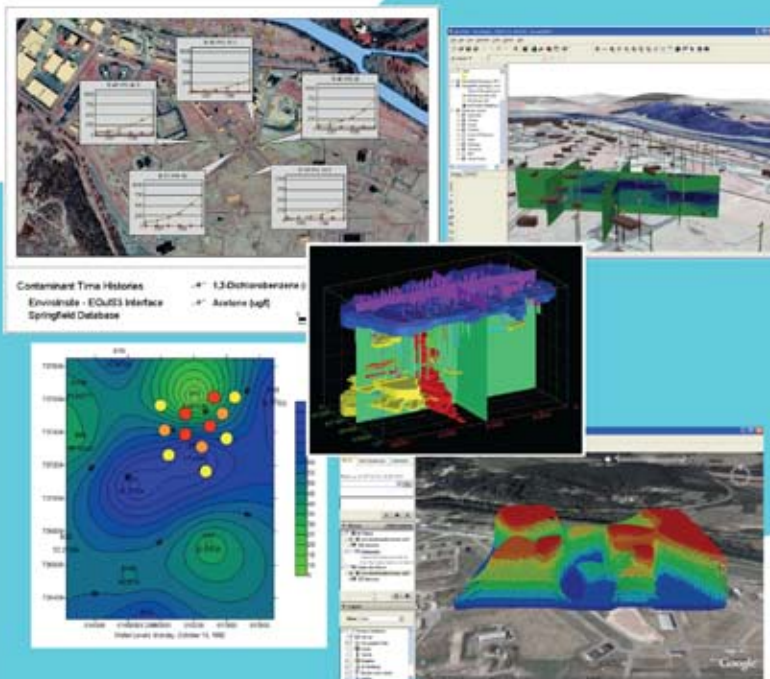
In April and May of 2009, USEPA sponsored a series of webinars on financial responsibility for carbon dioxide geologic sequestration (GS) wells. The goal was to encourage information sharing on potential financial mechanisms that well owners and operators could use to meet the financial responsibility requirements for GS projects. For a summary of the webinars and additional GS information, go to: http://www.epa.gov/safewater/uic/wells_sequestration.html#webcasts.

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 oversees source water protection efforts in CA, HI, and NV. For information on any of the above topics, please contact John at 415-972-3963 or ungvarsky.john@epa.gov.

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PBDEs: The Next Generation

By Bart Simmons

Polybrominated Diphenyl Ethers (PBDEs) have drawn much attention and considerable legislation, because they are hydrophobic and bioaccumulate to levels that have caused toxic effects in rodents. Increasing levels in Europe and the U.S. led to bans on the "Penta" formulation, which is the most prevalent form found in humans and animals.

"Previous research focused on PBDEs, the parent compounds, but there is now evidence that metabolites of PBDEs will be found extensively in water environments."

Previous research focused on PBDEs, the parent compounds, but there is now evidence that metabolites of PBDEs will be found extensively in water environments (*Environ. Sci. Technol.*, 2009, 43 (14), pp 5161–5163).

PBDEs have become the poster child for reform of toxic substances laws. PBDEs, like many commercial mixtures, were grandfathered when the Toxic Substances Control Act (TSCA) was enacted. Investigations found PBDEs in humans and many animals, at increasing levels. Decabrominated diphenyl ethers ("Deca") were not included in some of the bans on the basis that they were not considered to be biologically available, and were not bioaccumulating. Subsequent research indicated that Deca can biodegrade to form bioaccumulating PBDEs.

The new study found that PBDE metabolites, hydroxylated PBDEs (OH-PBDEs), can form dioxins during wastewater treatment.

Additionally, researchers at the University of Minnesota have found photochemical formation of halogenated dioxins (PXDDs) from OH-PBDEs and chlorinated derivatives (OH-PBCDEs) in aqueous solution.

An April report from NOAA (<http://ccma.nos.noaa.gov/about/coast/nsandt/PBDEreport.html>) found that PBDEs are "clearly ubiquitous" in U.S. coastal waters. Although

the NOAA report did not include data on OH-PBDEs and dioxins, the expectation is that wherever PBDEs are exposed to wastewater treatment, OH- and brominated dioxins will be formed.

The toxicity of polybrominated dioxins is uncertain, since they have been investigated much less than their cousins, the polychlorinated dioxins. 2,3,7,8-tetrachlorodibenzodioxin (TCDD) is notorious for its role in the contamination of Times Beach, MO, Love Canal, and other sites. Brominated dioxins are expected to exhibit toxicities similar to chlorinated dioxins, but much less is known about OH-PBDEs. OH-PBDEs have a longer half-life in the body than expected. It is also not known if OH-PBDEs are formed in the body, have bioaccumulated from past exposure, or both.

The presence of OH-PBDEs in the water environment is a new development in the BBDE story, and considerable research will be needed to understand their behavior and risk.

Bart Simmons can be reached at bartonps@aol.com. ☔



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WATER WASTE WATER STORM WATER

Introduction to the Hydro-History Corner

By Linda Vida, Director, Water Resources Center Archives

Overview

This is my inaugural column for *HydroVisions*. The Hydro-History column will include information about the Water Resources Center Archives (WRCA), its collections and services, digital projects and new research tools. The column will also include information about new web or electronic resources that are specifically geared for groundwater consultants. As some of you may not be familiar with WRCA, I will start by giving you an overview.

WRCA, widely known as “California’s Water Library,” is a specialized unit of the University of California, located on the UC Berkeley campus and open to the public. It was founded in 1957 with a specific mission to preserve and provide access to unique, hard-to-find engineering documentation about California’s water that would otherwise be lost. In addition to published books, journals, and maps, the collection includes a great deal of gray literature, such as reports by government agencies, consultants and non-governmental organizations. Manuscript collections and out-of-print books provide unique documentation of the history of water supply in the West. WRCA has just celebrated its 50th anniversary and its mission and services are now more important than ever!

In the last two years, WRCA has started making many electronic documents accessible and preserves these ephemeral resources using nascent web harvesting tools. This tool allows WRCA to wrap standardized metadata around digital documents and assign a persistent URL (purl) to each item, providing for easier discovery and long-term preservation of digital materials.



Hydraulic mining with water jets, 1912. J.B. Lippincott Collection

California Colloquium on Water

WRCA serves the California water community in other unique ways. Nine years ago, WRCA developed the *California Colloquium on Water* lecture series. In consultation with UC Berkeley faculty, WRCA invites eight lecturers of distinction to speak at the colloquia each year (four per semester). In fact, GRA has been a sponsor of this series since 2003. Each lecture is attended by 60-80 individuals and is overwhelmingly well-received. Streaming video of the talks and associated PowerPoint presentations are made available online following each lecture and these videotaped lectures receive more than 30,000 unique visitors each year.

The California Water DRoP (Data Repository Project)

WRCA is involved in interesting grant-funded projects, one example of which is DRoP. WRCA, in conjunction with the Berkeley Water Center and the California Digital Library, are embarking upon a survey and analysis of water resources data management in California. Environmental data management needs are increasing and many critical resources are not available online. In the next column, I will provide a summary of the results of the survey.

Please visit WRCA’s web site at <http://www.lib.berkeley.edu/WRCA/> to search the catalogs and discover more about our services and special projects.

Linda Vida may be reached at lvida@library.berkeley.edu. 💧

California Groundwater Association Notes

By Mike Mortensson, CGA Executive Director

CGA Convention Expands Educational Opportunities

CGA will hold its 61st Annual Convention and Trade Show on November 5-7, 2009 at the Silver Legacy Resort Casino and Reno Events Center. This year the educational options have been expanded. The ever-popular McElhiney Lecture has been scheduled for Saturday morning. W. Richard Laton, Ph.D., PG, CPG, of Cal State Fullerton, will present the lecture on "Boring Logs – What's Important and What's Not; A Scientific Perspective." Saturday afternoon sessions will include Drilling Fluids, Air Emission – Fleet Calculators, and The 3R's for CGA Volunteers.

Friday morning sessions will include Goulds VFD Analysis, Grundfos VFD Analysis, Safety: How to Organize a Safety Program in your Company, Safety: Lock Out – Tag Out for Water Well Drillers, and Water Treatment (panel discussion).

Thursday, all-day workshops will cover Ground Source Heat Pump Installation, and Coliform & Iron Bacteria – THE ANSWERS.

"Tools of the Trade" demonstrations will be held on Friday and Saturday on the exhibit hall floor. These half-hour sessions will cover Maps & GPS Usage, Well Blasting, VFD demo, Downhole Cameras, VDECS basics, and Chase'em Back Tools.

More info on the CGA convention and trade show is available at www.groundh2o.org. Online registration is now open.

CGA Continues Efforts on Unlicensed Drilling

CGA's case against the Semitropic Water Storage District for drilling wells without the required C-57 license, which was dismissed by the Superior Court of Kern County in late 2008, has been appealed. Briefs have been filed but a hearing has not been set. In a separate matter, CGA is working with local health departments, district attorneys and the Contractors State License Board in efforts to halt drilling by unlicensed contractors. It seems that every drought brings in persons wanting to "make a buck" but not following well construction standards. CGA urges any GRA member who may see questionable practices to contact CGA and do a license-check at www.cslb.ca.gov. Everyone in the groundwater industry should be working together to insure proper well construction to avoid groundwater contamination!

Carb Regulations

CGA continues to work with California Air Resources Board (CARB) officials to obtain extensions of compliance times for the multiple regulations affecting the groundwater industry. The portable engine rule eliminates the use of Tier 0 engines as of 1/1/2010. Industry surveys indicate about 30% of the drill rigs in CA use a deck engine (classed as a portable engine); a large majority of these engines are Tier 0. The loss of those drill rigs, will make it difficult to meet demands for groundwater, especially during the current drought. CGA is trying to get relief from this rule and the regulations for Off-Road Equipment and On-Road Vehicles. There is concern that the new regulations will result in downsizing of water well contracting firms, thus affecting the availability of groundwater.

For more information on any of these programs/activities, contact CGA at 707-578-4408; Fax: 707-546-4906; or email Mike Mortensson, CGA Executive Director, at wellguy@groundh2o.org.



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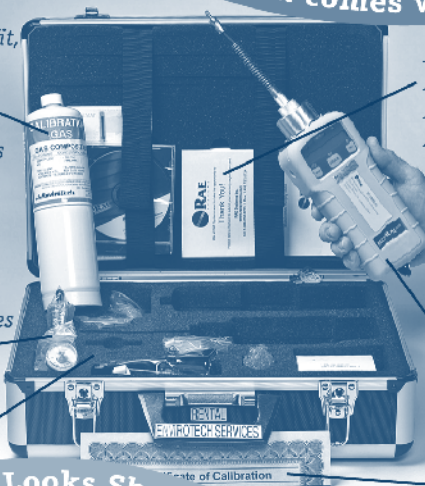
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Call for Nominations for Director Seats Open in 2010

The Association is now soliciting nominations for GRA Board of Director candidates to run for five (5) seats that commence service January 1, 2010. 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 a GRA Branch, GRA committees or GRA program activities, or like experience with a similar organization.

Nominating Guidelines and Procedures

1. Directors and members of GRA may nominate themselves or another member as prospective candidates to run for the Board as described below.
2. 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 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.
3. The Nominating Committee will review all nominations and evaluate the nominees based on their response to the above questions and their qualifications. The Committee will conduct interviews, if deemed necessary.
 4. 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.
 5. The approved slate of nominees shall be presented to the GRA membership in ballot form in accordance with the GRA bylaws.

To declare your desire to be nominated or to nominate someone other than yourself, please follow the guidelines in section number two above and forward the material to 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 7, 2009.**

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

GRA Extends Sincere Appreciation to its Co-Chairs and Co-Sponsors for the June 2009 IWA/GRA Micropol & Ecohazard Conference

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GRA Welcomes the Following New Members

May 16, 2009 – August 27, 2009

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Blacet, Danielle
De Arth, Thomas
Eidam, Lucy
Gomes, Kevin
Patten, Dan
Ward, Tony
Williams, Clyde Thomas

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Hydrogeologist

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e-mail: augerpro@sbcglobal.net

Friends of the Watershed Center,

I have had the pleasure of being the Director of the UC Davis Center for Watershed Sciences for ten years. This period has been the most challenging, yet most rewarding of my career. With the help of faculty, staff and students at UC Davis, and our many agency, NGO and foundation partners, the Center is tackling some of California's most important and vexing water resource and ecosystem restoration problems. From the Klamath Basin to the Sierras to the Delta, I believe that our engagement is helping to inform and shape better outcomes.

But every organization needs its leadership periodically refreshed --- and I have now exceeded by 5 years the usual term of a campus Center Director --- so I am stepping down as Director. My good friend and colleague Jay Lund, who has been co-Director for the past four months, will take over starting July 1st when I will take a long-deferred sabbatical to finish several book projects.

Although no longer Director, I will remain fully involved with the many projects at the Center.

I want to personally thank our partners who have helped build the program. The David and Lucile Packard Foundation contributed the vision and seed money to get us started. They, along with the Resources Legacy Fund and the Stephen D. Bechtel Jr. Fund have been particularly generous supporters. The Nature Conservancy California, California Trout, the Public Policy Institute of California, and numerous other NGOs have worked closely with us, providing support, expertise, facilities and an infinite array of interesting problems to tackle. Multiple agencies, including the CALFED Bay-Delta Program, the California Department of Water Resources, and the State Water Resources Control Board, have supported and welcomed our involvement even when the results of our work occasionally complicated their lives. Thanks again, to one and all, for your help, advice, and support.

It has been a privilege being Director of this Center. I look forward to many more years of fruitful collaborations with you all.

Best,

Jeff Mount

Jeffrey Mount is a Professor in the Dept. of Geology at UC Davis. He can be reached through the Center for Watershed Sciences at 530-754-9388. 💧

Seeking Volunteers

The Technical Committee of the Groundwater Resources Association of California (GRA) is seeking volunteers to help with developing/reviewing fact sheets, white papers, and technical papers. We are looking to work with people who have experience and expertise in the following areas:

- Hydraulics and Modeling
- Groundwater Management
- Climate Change and its Effect on Storage
- Water Levels/Storage
- Water Chemistry
- Soil/Unsaturated Zone
- Risk Assessment/Toxicology
- Technology
- Vapor Intrusion

Please Contact Either Co-chair if You Would Like to Volunteer

William E. Motzer, Ph.D., P.G.

Senior Geochemist

Todd Engineers

2490 Mariner Square Loop, Suite 215
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Fax: 510-747-6921

Email: bmotzer@toddengineers.com

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or

John A. McHugh, P.G. 6187, H.G. 391

Assistant Engineering Geologist

Groundwater Management Unit

Santa Clara Valley Water District

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San Jose CA, 95118

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By John W. Ayres,
Branch Secretary

May Meeting

The Sacramento Branch held a meeting featuring Brian Lewis, of the California Department of Toxic Substances Control (DTSC). Brian gave the Sacramento GRA's Annual DTSC Regulatory Update, and presented some of the reorganizational plans at DTSC as well as the roles and responsibilities of the agency.

DTSC currently oversees 9876 sites throughout the State of California, and is responsible for enforcement, emergency response, brownfields, and hazardous waste management permitting. DTSC is in the process of reorganizing to enable smoother operations within the agency. The new direction aligns work with measurable and environmentally important outcomes, while focusing on transparency and inclusion. The newly organized DTSC is less hierarchical and more team focused.

Brian discussed some emerging issues that DTSC is considering, including restrictions on the use of certain hazardous substances, toxics in consumer products, wood waste, pharmaceutical waste, and biomonitoring. DTSC desires the use of proven technologies and remedies (PT&R), and can expedite cleanup of metals sites that use the PT&R approach. DTSC operates a revolving loan fund that can be utilized to provide funds for cleanup activities, specifically hazardous substances and petroleum sites. Information on the loan program is available from Thomas Cota at tcota@dtsc.ca.gov.

June Meeting

The Sacramento Branch held a meeting with Dr. Thomas Harter of UC Davis as the key speaker. Dr. Harter's research focuses on nonpoint-source pollution of groundwater, and groundwater flow and contaminant transport modeling. His research group has done

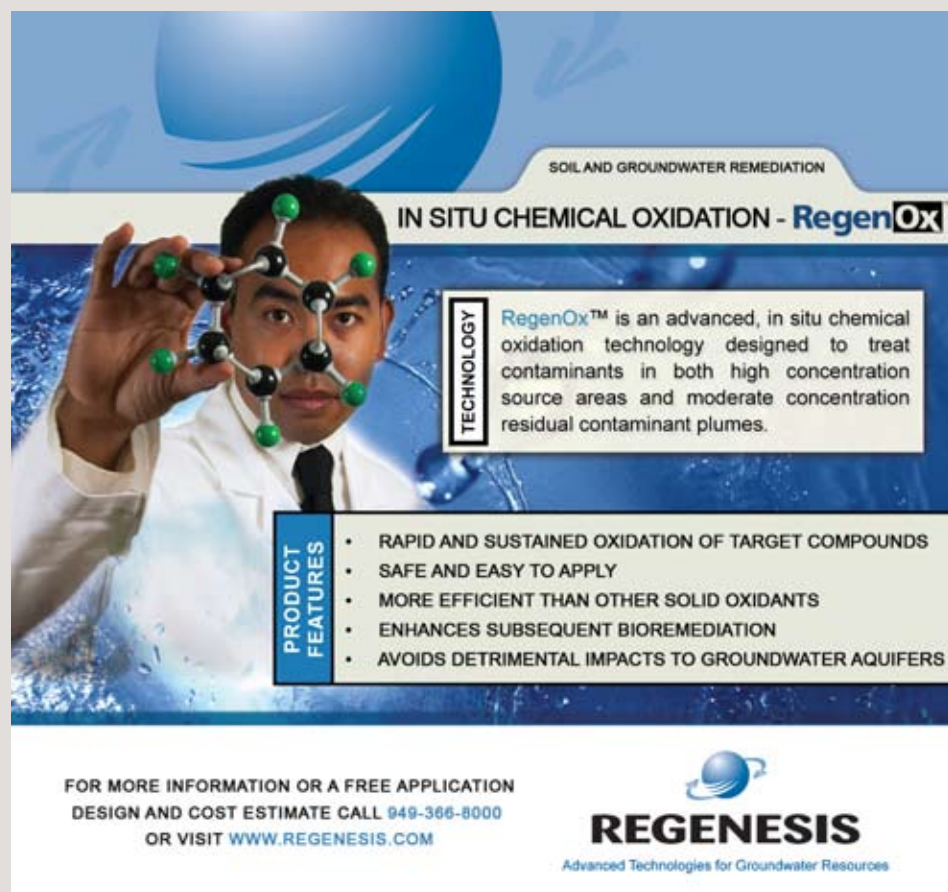


extensive work to evaluate the impacts of agricultural and other human activities on groundwater. For this meeting, Dr. Harter presented "So, Just How Much Salt Does a Typical Holstein Dairy Cow Produce Daily?" which discussed the issues of salt loading in the San Joaquin Valley.

Dr. Harter's presentation investigated the various sources of salt to groundwater from a dairy, including lagoons, the animal corral areas, and recharge from fields receiving manure applications. Salt was explored utilizing two methods: field mass balance using salt loading from manure and plant

nutrient uptakes, and field monitoring using an extensive well network.

Modern large-scale dairies import grain to feed the cows, and salt in this grain is digested and released in manure, contributing to the salt load in the vicinity of the dairy. The salinity from manure is typically found in the shallow aquifer, but the interconnect-edness of coarser-grained sediments can accelerate downward movement of these salts. A lively debate took place after Dr. Harter's presentation between members of the dairy industry present at the meeting and Dr. Harter, as well as other meeting participants. 💧



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San Francisco

By John Karachewski,
Branch Secretary

On April 22, Mr. Brian Lewis provided his fourth annual DTSC regulatory update. The presentation included an overview of DTSC, new directions and scientific leadership, proven technologies, vapor intrusion issues, and the revolving loan fund. DTSC is part of the California EPA, and has about 1,040 employees and an annual budget of about \$198 million, which is mainly special funded (>88%) by reimbursable projects, fees, and grants. During the past several years, the department has flattened its organizational structure by reducing management positions and emphasized a team orientation. For example, the “One Cleanup Program” is responsible for brownfields redevelopment, permitting, and corrective actions. The Berkeley office has also been re-organized into geographic areas in order to improve efficiency and consistency for remediation of sites with similar conditions. DTSC is pursuing new directions and scientific leadership in green remediation, pollution prevention, nanotechnology, green chemistry, and emerging contaminants. The groundwater pollution prevention team, for example, is collaborating with water agencies to proactively identify and address hazardous waste sites that are, or could potentially impact water supply wells. DTSC has also developed a Wiki website for crafting new legislation regarding green chemistry. During the past three years, DTSC has developed five guidance documents for proven technologies and remedies, such as remediation of metals in soil and remediation of chlorinated VOCs in vadose zone soils. These guidance documents include sample templates that consultants can use in preparing their submittals. Mr. Lewis also provided a regulatory update regarding soil gas sampling, vapor intrusion, and the new “Vapor Intrusion Mitigation Advisory” guidance document. Mr. Lewis concluded his presentation by



discussing the “Revolving Loan Fund” for redeveloping public or privately held contaminated sites through the use of low-cost financing at below market interest rates.

On May 20, Dr. Graham Fogg from UC Davis provided a very interesting and timely presentation on “Subsurface Storage and Recovery: Perspective on Climate Change and Sustainability of Groundwater Quantity and Quality in California.” Dr. Fogg started his presentation with an overview of the California water system focusing on the Sierra snowpack and runoff that supplies the state and federal reservoirs and conveyance systems in the Central Valley. He also provided graphs illustrating the long-term decrease in primary runoff from Sierran rivers over the past century during the April through July time period. These observations are critical for water management because they suggest that historically timed snowmelt for replenishing reservoirs may not function properly in the future due to the decreasing thickness and earlier melting

of the Sierran snowpack associated with climate change. Next, Dr. Fogg transitioned his presentation to focus on the hydrogeology and potential recharge of winter and spring runoff in aquifers of the Central Valley, which have an estimated storage volume of 10 to 50 million acre-feet. He provided an excellent overview of the complex and heterogeneous hydrostratigraphy and 3D facies architecture of alluvial deposits in the Central Valley. These alluvial aquifers typically consist of up to 20 or 30% sand and gravel hydrofacies by volume. Thus, Dr. Fogg stressed the importance of detailed hydrostratigraphic mapping in order to identify and protect the most promising areas and preferential pathways for artificial recharge of excess surface runoff. He described a case history illustrating these principles for surface water and groundwater interactions in the Cosumnes River basin. Dr. Fogg and his colleagues have suggested that increasing the setback for levees and restoring floodplains to their natural function could provide important benefits for groundwater recharge, as well as improving wildlife habitat and reducing the costs associated with geologic hazards. He also discussed the benefits of using winter recharge to improve groundwater quality in Central Valley aquifers. Dr. Fogg concluded his presentation with a higher vision of significantly improved management of surface water and groundwater resources in the Central Valley using this holistic approach. 💧

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Southern California

By Geniece Higgins,
Branch Secretary

April 28, 2009 Meeting: Great ShakeOut 2008: Lessons Learned for Southern California Water Resources

The Great ShakeOut (November 13, 2008) depicted a magnitude 7.8 earthquake striking the Southern San Andreas Fault, starting at the Salton Sea and rupturing northward 190 miles. The scenario was developed by a team of over 300 scientists and engineers led by the U.S. Geological Survey. In the scenario, the earthquake would kill 1800 people, injure 50,000, cause \$200 billion in damage, and have long-lasting social and economic consequences. The scenario was also the basis of the 2008 statewide Golden Guardian emergency response exercise that allowed multiple response and prevention agencies from all branches of government to work together in a simulated environment. The exercise included participants from more than 100 local, state and federal agencies.

The Southern California GRA Branch was fortunate to gather four of the key players from various water and governmental agencies to discuss the effect of the “the big one” on California’s water resources.

Ken Hudnut, geophysicist for the U.S. Geological Survey in Pasadena, California, is the Coordinator for the Southern California Region on the U.S. Earthquake Hazards Program Council and serves on the Board of Directors for the Southern California Earthquake Center. He presented the earthquake source design and computer simulations of the ShakeOut scenario, with minute-by-minute projection of earthquake shaking progression through the Greater LA area.

Katy Gibson has worked for 13 years in Emergency Management at Metropolitan Water District. Katy



2009 Southern California Officers (from left to right): Bill Sedlak (technical advisor), Toby Moore (technical advisor), Geniece Higgins (secretary), Sheila Rogan (vice-president), Emily Vavricka (president), Paul Parmentier (technical advisor), and Peter Murphy (treasurer).

summarized lessons learned and future goals, including MWD’s ability to communicate among member and outside agencies, their ability to respond to damage at multiple sites, identification of future capital projects to increase reliability of water delivery and treatment systems, evaluation of long-term economic impact of widespread disaster, possible reduction in water sales, and evaluation of other business impacts.

Gary Sturdivan is the Safety Regulatory Affairs Director at East Valley Water District. Gary discussed the estimated impact to that agency’s operations. He also discussed the formation of mutual aid groups on local, statewide and national fronts.

Craig Davis is the Geotechnical Engineering Manager for the Los Angeles Department of Water and Power, Water System, and has a specialized Earthquake PhD in Civil Engineering. Craig addressed the impact of a large earthquake on three aqueducts, with potentially 66% of un-met water demand within 24 hours, and addressed a timeframe for which critical conveyances may realistically be expected to return to service.

To learn more to ensure that you and your loved ones are prepared in

the event of an earthquake please visit: <http://www.earthquakecountry.info/>.

The SCGRA was also proud to award two scholarships during this meeting to Shelby Harrell and Gabriella Valenzuela. Ms. Harwell is a Cal State University Fullerton student pursuing a M.S. in Geology. Ms. Valenzuela is a Cal State University Long Beach student pursuing a M.S. in Hydrogeology. The April 2009 meeting scholastic sponsor was **Malcolm Pirnie, one of the largest firms in the U.S. focused exclusively on environmental issues.**

On June 24th, South Coast GRA visited the Roscoe Moss Facility in Los Angeles. Roscoe Moss personnel guided about 30 participants through each section of their long-established but very modern manufacturing facilities for well casings, well screens and other water well components. The tour was followed by an outdoor buffet with ample opportunity for technical and social interactions among GRA members.

Plans for future Southern California Branch meetings include a Saturday summer Field Trip at the Orange County Water District in conjunction with a UCI Extension class. 💧

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Half Dome and Tenaya Canyon, Yosemite National Park

This fall photograph shows an unusual perspective of Half Dome and glaciated Tenaya Canyon. Interestingly, the Tenaya and Merced glaciers that flowed through Yosemite Valley were augmented by ice from the adjacent Tuolumne River basin. The high elevation and extensive area of this basin contributed to the growth and thickness of the Tuolumne icefield. Glaciers from the Tuolumne icefield actually flowed over drainage divides towards the southwest to join both the Tenaya and Merced glaciers that eroded Yosemite Valley.

A number of geologic processes such as glaciation, weathering, and bedrock fractures play a role in causing rockfalls that contribute to the steep canyon walls. Water, ice, earthquakes, and vegetation also create forces that trigger unstable rocks to fall. Rainfall, snowmelt, and groundwater that seep through joints, exfoliation, and faults can freeze, causing the fractures to expand and ultimately fail. Most rockfalls in Yosemite are associated with “freeze/thaw” events that occur during the winter and early spring.

Tenaya Canyon is extremely rugged and is not traversed by any hiking trails. The National Park Service warns that hiking in Tenaya Canyon is dangerous and is strongly discouraged. This photograph was taken along the hiking trail from Tenaya Lake to Clouds Rest near the Sunrise Lake trail junction in Yosemite National Park.

Photograph by John Karachewski, PhD (DTSC).