Wisconsin Ground Water Association Newsletter

INSIDE THIS ISSUE:

President's Message

This year's fall field trip was certainly another fantastic time! I have to say the combination was unbeatable—great stops, beautiful weather, and gorgeous fall color that rivaled the best I've ever seen. Grandfather Falls was a site to see, especially with the unique penstocks. We were able to view up close a landfill gas extraction and leachate collection system, as well as hear its storied history. And who knew that jellyfish fossils would look so cool? A retired life-employee gave us the insider's tour at the Anderson-Johnson quarry, not to mention a polished slice of the ruby red granite to each of us. We saw lots of meltwater potholes in outcrops, including one easily five foot in diameter! Plus feasting like royalty! Hearty thanks go out

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Rib Mountain was in all her glory!

The wood penstocks carrying water to hydroelectric turbines.

Jayne Englebert finding the first jellyfish fossil of the day.

The newsletter is published four times per year. If you have any suggestions or submissions, please contact us at: Wisconsin Ground Water Association, c/o Marilyn Weiss, WGWA Treasurer, P.O. Box 8593, Madison, Wisconsin 53708-8593. Email: wgwainfo@wgwa.org; Web site: http://www.wgwa.org. The deadline for submissions to the 1st quarter of 2006 newsletter is February 15, 2006.

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to the yeoman efforts of Jayne Englebert and her hard-working crew of D'Arcy Gravelle, Paula Richardson, Brenda Halminiak, Brian Hahn, and Boyd Possin (and various others who chipped in along the way).

It's hard to believe 2006 is less than seven weeks away! Speaking of which, the election for President-Elect and Treasurer will be taking place soon. Although I am glad for Brian Hahn's career move, unfortunately for us it has meant his moving out of state and thus leaving a vacancy for President in 2006. However, I'm pleased to announce the post has been filled by the equally capable and talented Becky Caudill. Thanks Becky for your willingness to step in!

Lastly, it has been a pleasure to serve this year as President—WGWA is made up of great people who care about one of our great resources. Keep in the flow!

Dave Nemetz, P.G.
WGWA President

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2006 Board Changes

President - Becky Caudill
Past President - Dave Nemetz
President Elect - to be determined
Treasurer - Lee Trotta
Secretary - Janis Kesy
Editor - Troy Thompson
Board Members - Tom Riewe,
Mike Raimonde, Ken Wade, Corey Pagel.

ITRC Upcoming Free Internet Training Schedule

December 6—*Site Investigation and Remediation for Munitions Response Projects*, 2:00 p.m.-4:15 p.m. Eastern.

December 8—*Current Information on Perchlorate Contamination,* 11:00 a.m.-1:15 p.m. Eastern.

December 13—*Geophysical Prove-Outs for Munitions Response Projects*, 2:00 p.m.-4:15 p.m. Eastern.

December 15—*Operational Small Arms Firing Ranges-Environmental Management at Operational Outdoor Small Arms Firing Ranges,* 11:00 a.m.-1:15 p.m. Eastern

If the Earth were smooth, the ocean would cover the entire surface to a depth of 12,000 feet.

Newsletter Changing of the Guard

Troy Thompson

This issue marks a change in the newsletter editorship. After 4 years as WGWA Newsletter editor Lee Trotta is stepping down to take on the position of WGWA Treasurer. I would like to thank Lee for his tireless dedication to keeping the newsletter interesting and useful for the membership. I doubt that any of us realize just how much time he dedicated to producing each issue. I will be taking over as newsletter editor. Lee will continue to assist with the newsletter as a staff person (right Lee!???). Joan Viney will continue in her role of assembling and posting the newsletter to the website.

As the new editor my two principle goals are to increase membership participation in the newsletter and to modify it to better meet the membership's needs and desires. The way I see it, the newsletter should be a way for the general membership to share information and participate in the larger organization, and not simply be a publication put out by a small group of people.

I would like to emphasize that the newsletter is, and always has been, open to contributions by all WGWA members. I believe this is essential for the newsletter to remain relevant to the membership, particularly since for many members it is probably the only direct tangible benefit they are receiving from their membership, if they are not participating in any of the meetings or field trips.

I would like to keep the format and content of the newsletter fairly flexible and open. Below are some of my ideas. These are not written in stone and I would love to hear other suggestions.

- Collections of articles and article summaries from local Wisconsin newspapers related to groundwater and environmental issues. If we can publish enough of these, it should give us a better feel for where the public stands on issues relevant to our profession and on trends that may be of particular interest to our work.

- Amusing stories related to hydrogeology. Perhaps a series on field work in Hell, or one on some of the more interesting or amusing ideas about groundwater that we have heard from clients or the general public. Alternatively, if you want to try to be the Dave Barry of groundwater - go for it.

- Articles on emerging trends or technologies in the area of groundwater and environmental consulting.

- Articles exploring the interrelations between groundwater and social/political issues.

As I said, I am open to other suggestions. The only caveats are the obvious ones like avoid or minimize political or religious advocacy, avoid commercialism, and no attacks on other people, companies, or organizations (I do not think Lee will want to have to worry about finding money to defend against libel suits). Also, while the newsletter is not intended to be a scientific journal, technical articles should stay reasonably close to accepted mainstream ideas. Unusual alternative ideas could potentially be explored in the context of a discussion of social issues. The newsletter editorial group and the WGWA Board, as appropriate, will provide final guidance on what is acceptable.

So if you are tired of writing dry technical reports, here is a chance to indulge or explore your creative/journalistic side. You do not have to commit to anything more than one contribution.

Troy Thompson

ALL WET

Conservationists dispute Waukesha water needs Duchniak claims city has right to Lake Michigan

By DENNIS A. SHOOK - GM Today Staff
August 24, 2005

MILWAUKEE - There is hardly a tide of support for selling Lake Michigan water to Waukesha, based on comments made Monday at a public hearing.

Only a few people out of dozens who spoke at the state Department of Natural Resources session at the State Fair Park's Youth Center spoke in favor of the idea, which is floated in the proposed Great Lakes Basin Water Resources Compact now before the Council of Great Lakes Governors.

The proposed language in the new compact would allow a "community within a straddling county" to be served by the basin. That definition would likely include Waukesha.

Waukesha is west of the subcontinental divide that marks the western edge of the basin. But the eastern part of Waukesha County is within that basin, particularly those parts east of Sunnyslope Road in New Berlin. In fact, the subcontinental divide runs nearly through the middle of Brookfield Square.

Waukesha has a pressing problem with too much radium in its water and has sought ways to meet impending federal requirements to deal with the problem.

Waukesha Water Utility Manager Dan Duchniak was one of the few speakers advocating for the deal.

He said Waukesha could solve its radium problem if it could switch from groundwater to surface water, adding such a change would allow the shallow underground aquifer to be refilled by normal precipitation.

Duchniak has argued Waukesha is actually part of the Lake Michigan basin because its groundwater has historically flowed back to that lake. That eventually ended in the 1950s and 1960s when development caused a proliferation of wells to be drilled.

Waukesha Alderman Larry Nelson vowed to push waster conservation measures if the city was allowed to purchase Lake Michigan water.

"If we can use Lake Michigan water, it will be very good for Waukesha and the Great Lakes," he said at the hearing. "As a current alderman and candidate for mayor, I am willing to publicly commit to making conservation efforts a reality."

While Duchniak and Nelson were received politely by the large crowd, almost everyone else spoke against the straddling counties language of the proposed compact - including many Waukesha residents.

Members of several Waukesha environmental groups also spoke against the plan.

Ellen Gennrich, a Brookfield member of the Waukesha County Environmental Action League, called the Waukesha groundwater stand "phony science."

"It is inappropriate to divert our neighbor's water resource when we guzzle up and pave over our own," she said.

If Waukesha gets water, must it return water?
Need, logistics of Lake Michigan connection questioned

WEST ALLIS - Waukesha officials might well have had a sinking feeling if they had heard most of the people speaking at Monday's hearing on allowing diversions of Lake Michigan water.

Yet even if the water connection was allowed under the new compact, there is the issue of the requirement to send wastewater back to Lake Michigan for treatment to help replenish the water levels.

Waukesha Water Utility Manager Dan Duchniak estimated at the Monday meeting that such an effort "could cost hundreds of millions of dollars."

But Waukesha Mayor Carol Lombardi made the argument Monday that Waukesha should not have to return

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wastewater to Milwaukee because it already does just that through groundwater.

"The groundwater return to the (Lake Michigan) basin is scientifically here," she said. "Certainly Waukesha would hope the conference of governors would understand that (process) has happened for a long time."

Lombardi said if the city were forced to return all of its wastewater there would be a reduction in the water level in the Fox River.

"There would be no Vernon Marsh any more," she said.

The mayor said the city needs the opportunity to scientifically show that its groundwater naturally returns into the basin and that will only be aided if Waukesha is allowed to tap into Lake Michigan.

"I am thinking positively," she said. "I am hoping we can get through the politics and look at the science. There is also regionalism for all of Waukesha County and southeastern Wisconsin region. If we are able to access the water we will be able to show the opportunity and have the ability to collaborate."

As for the critics who say Waukesha receiving water equates to social injustice against low-income people in Milwaukee, Lombardi pointed out that many low-income people and everyday workers live in Waukesha.

The mayor also said the water being requested by the city is "a drop in the bucket" compared to the water being taken out of the system and not returned by Chicago and other Illinois communities.

One Milwaukee politician who sees it differently is Alderman Michael Murphy, who said at the meeting "Waukesha does not have a water shortage problem. Waukesha has a water management problem."

Murphy criticized the decision to develop the Pabst Farms area in western Waukesha County and called it an example of improper planning in the county.

"That was a groundwater recharge area," he said. "Waukesha County needs to control its growth, practice water conservation and build affordable housing" in order to reverse its policies.

Public comment is being taken until Sept. 9. The Council of Great Lakes Governors is expected to take action sometime later this year.

Dennis A. Shook can be reached at dshook@conleynet.com

This story appeared in the Waukesha Freeman on August 23, 2005.

Joint WGWA/AIPG Field Trip "Falls" Just Right

This past October 14th and 15th saw the completion of the second joint field trip between WGWA and the Wisconsin Chapter of the American Institute of Professional Geologists. While the attendance was lighter than for the first joint field trip, the participants were no less enthusiastic. A special thank you must go to the field trip organizers Jayne Englebert and her hard-working assistants D'Arcy Gravelle, Paula Richardson, Brenda Halminiak, Brian Hahn, and Boyd Possin, as well as others. They selected the stops, made arrangements for access, obtained the assistance of special speakers, and arranged the bus, the food, and lots of other things. They even picked the weekend to coincide with the change of Fall colors.

The field trip provided a great overview of central Wisconsin geology against a backdrop of perfect Fall weather and great Fall color. The stops provided a nice break from the usual environmental activities/glacial deposits in which most of us spend our days. We had a chance to dust off (or derust) our knowledge of igneous and metamorphic petrology (so what is the difference between a syenite and a monzonite, and how do you tell a metavolcanic from a meta-sedimentary rock?). And of course there was the opportunity to see the famous Cambrian jellyfish.

Penstocks and the Wisconsin River Bed Exposed

The first stop of the first day, after leaving Wausau, was the Grandfather Falls Recreation Area Dam where Bill Bloczynski of Wisconsin Public Service provided a summary of the history and operations of the power-generating facility at the site. We viewed the dam that creates the reservoir, the power house, and the ingenious way that the power company has taken full advantage of the fall of the river with a pair of decades old, ¼ mile long wooden penstocks (wooden pipes). Flow through the penstocks has reduced flow in the adjacent Wisconsin River exposing an amazing set of potholes in the bedrock of the river bed.

Wisconsin River potholes with our fearless President, Dave Nemetz, for scale.

State Rock

The next stop was at the Granite Heights Quarry. This quarry is the source of the red granite that was selected as the Wisconsin State Rock. The visit included a guided tour by Don Huff, a retired quarry employee, of the cutting area and the quarry, as well as a chance to look at the rough-cut and final products. Everyone left with a free sample of the State Rock, and possibly some ideas for their next kitchen remodeling project.

Degassing a Landfill

For those feeling a need to see something more familiar, or the few trip participants that do not work in the environmental industry, the day ended with a stop at the former Krause Haase Landfill in Wausau. There Dave Erickson of the City of Wausau explained and showed the landfill gas collection system.

We returned to Wausau for a special buffet (just for us) at the Hereford & Hops Restaurant. We even convinced them that 14 geologists, and their spouses, could drink as much as 40 regular people and got them to open the bar in our private room.

Cambrian Jellyfish, Trace Fossils, and Ripple Marks – Oh My!

The second day began with what for many people was probably the most anticipated stop – a chance to view the famous Cambrian jellyfish in the Krukowski Stone Quarry. While fossils of jellyfish are obviously extremely rare, what was most surprising was how common they are at the quarry. They have been found in seven different layers of sandstone, and in each of those layers they are found across the entire quarry. In fact most of the jellyfish-bearing stone is quarried and sold along with the non-jellyfish bearing stone. Just a few small areas of the quarry have been set aside for researchers working on the jellyfish. We were even free to collect whatever we wanted.

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Lots of Jellyfish Fossils with Hammer for Scale

In addition to jellyfish fossils we saw a number of excellent examples of preserved ripple marks and some very impressive trace fossil tracks. A few people bagged some ripple mark specimens. Unfortunately no one was successful in finding a portable jellyfish specimen to take home.

Fossil Animal (or Motorcycle?) Tracks

An Aggregate Lesson

An impromptu stop at the Mathie Quarry near Wausau was arranged by two trip participants (thanks Jim and Mark) that are employees of the quarry owner. At the quarry igneous bedrock is quarried and processed into different types of aggregate. They showed us the different aspects of an aggregate production operation and explained some of the finer points of quarrying rock. We also learned how far you could go with a full-size bus without getting it stuck.

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On Top of Old Rib Mountain

We had a brief stop at Rib Mountain where we viewed the scenery, learned more about the area geology, and the bus driver got to perform some more bus gymnastics. One of the more interesting things discussed was how Rib Mountain likely consist of a (very large) Precambrian quartzite xenolith embedded in a much larger igneous pluton.

Meta-what?

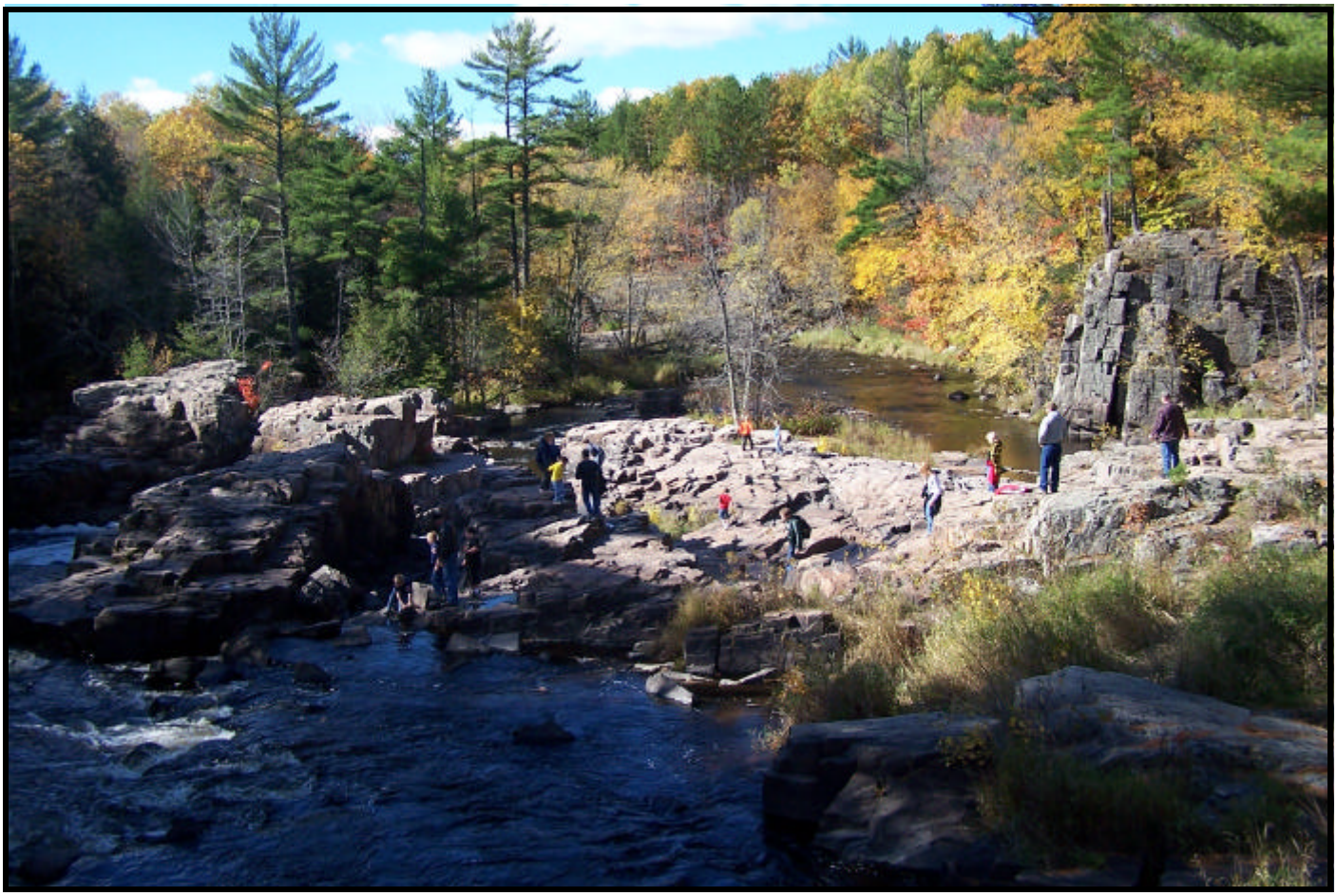
We then proceeded to a stop at the Dells of the Eau Claire (River) county park. There we had lunch (after performing a little boulder rolling to help the bus driver), then debated the finer points of meta-volcanic and meta-sedimentary rock differentiation. Even if we did

Pillows and Rock Beds

The final two stops provided further looks at additional aspects of the Precambrian Geology of central Wisconsin. The first of these was to look at outcrops bearing pillow basalts. The group had a good time scurrying from one outcrop to the next looking for the best examples of the pillow basalts.

The last stop was at an outcrop in Wausau near the hotel that served as the trip base. There we examined an exposure of syenite in one of a series of five plutons found in the Wausau area.

By Troy Thompson



Field Trip Participants (and a few others) Investigating the Mysteries of Precambrian Metamorphics at the Dells of the Eau Claire

Top Story - Are your field soil screening procedures providing you with practical and accurate information?

Most of us have been performing routine field activities for years. However, it does not hurt to periodically review our knowledge of how to perform those activities - especially if our performance of those activities is becoming less routine. The attached reprinted article provides information on the fine points of using a PID and an FID. See if you learn something new, or recognize a bad practice that you, or people in your firm, may have slipped into because it is convenient.

Environmental consulting activities frequently require that on-the-spot decisions be made in the field concerning the presence or absence of volatile, or even semi-volatile, organic compounds (VOC's) in soil. There is nothing that can replace the value of field experience in "making the right call" when the trucks are lined up, the backhoe operator is waiting, and the client is watching the hole in the ground get bigger and bigger. However, the application of basic knowledge and consistent methodology to your field procedures can assist you in the interpretation of field soil screening results.

First, are you using the right piece of equipment for the job? You have to understand the capabilities and limitations of the Organic Vapor Analyzer (OVA) you are using.

A Photo-Ionization Detector (PID) will be limited in its response by the electron voltage (eV) output of the lamp in the instrument. Most VOC's have a published Ionization Potential (IP). PID's are equipped with a 9.5 eV, 10.6 eV, or 11.7 eV lamp. The 10.6 eV lamp is the most common. In order for a PID to respond to a particular VOC, the IP of the compound of interest must be less than or equal to the eV output of the lamp. There are some compounds that a PID will not detect, most notably methane. In addition, methane can chemically mask the presence of VOC's. PID's are subject to poor performance in the presence of high humidity in moist soil. Perhaps the greatest advantage in using a PID is that it does not require a hazardous gas for operation. This can be a great consideration in logistics or cost when traveling or working in an isolated area.

A Flame-Ionization Detector (FID) will respond to most VOC's by nature of its destructive detector function. An FID will not be adversely affected by the presence of humidity in moist soil. An FID can be used in methane determination or differentiation by using a charcoal filter adapter. FID's are calibrated to methane. A charcoal filter adapter absorbs VOC's that are present in a sample. Therefore, the determination or differentiation of the presence of VOC's can be made in the presence of methane. Perhaps the greatest disadvantage in using an FID is the need for zero-grade or ultra-high purity (UHP) hydrogen for the detector's flame fuel source. Once again, this can be a great consideration in logistics or cost when traveling or working in an isolated area.

Whichever OVA you are using, current manufacture instruments provide sub-parts per million (ppm) digital performance and, usually, dynamic ranges of 10,000 ppm, or higher. Due to the differing responses instrument to instrument, do not change from a PID on one phase of work to an FID on another phase of work. From a practical perspective, both instruments are field-screening tools, not laboratory analysis equipment. If a soil sample exhibits a gross VOC odor that you cannot even stand to get near, you may actually harm the instrument you are using by analyzing such a sample. You may want to consider a company standard field note procedure for such samples rather than risking the contamination of the OVA's detector system.

Second, you have to understand the nature of volatile organic compounds and semi-volatile organic compounds as they relate to actual laboratory-testable product in the soil sample versus the amount of vapor in a soil sample headspace. The principle is simple. The headspace vapor-in-air concentration of a highly volatile compound may be higher than the actual laboratory-testable amount of the compound in the soil sample as you go from contaminated to clean soil. The opposite is true for semi-volatile organic compounds. The headspace vapor-in-air concentration of a semi-volatile compound may be lower than the actual laboratory-testable amount of the compound in the soil sample as you go from contaminated to clean soil.

Third, are you simply waving the instrument's sample probe over an open split-spoon, handful of soil, or open excavator bucket or are you head-spacing your soil samples?

There are too many uncontrolled factors present in simply waving the instrument's sample probe over an open split-spoon, handful of soil, or open excavator bucket. In most instances, your OVA will only respond to gross levels of contaminants when using this method. Additionally, outdoor ambient airflow will affect the sample that gets drawn into the OVA. In windy conditions, you might actually be detecting VOC's from a background source, such as heavy construction equipment or gas pumps.

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This method provides no controlled methodology to make a determination of what's happening sample to sample. It also allows no time for semi-volatile VOC's to release vapors that can be detected by an OVA.

Head-spacing soil samples provides for the best possible application of consistent and controlled methodology to your field soil screening procedures. The key word here is consistent. The container you use, amount of soil you collect, or amount of time the containerized soil sample sits are not so important as being consistent with each one. Glass jars with foil and zip-closure bags are commonly used for head-spacing procedures. Use the same type of container for all phases of work. Glass jars heat up faster and stay cold longer than a zip-closure bags. If using zip-closure bags, test a bag first to make sure that it does not in itself release VOC's that will be picked up by your OVA. Collect the same amount of soil with each sample. Most importantly, allow each containerized soil sample to sit for the same amount of time. A very common error is to collect samples over the course of the day and then check them all at the end of the day. One sample may have been sitting for five minutes while the first one has been sitting for five hours! It is usually sufficient to allow a sample to sit for a matter of minutes to provide for a practical indication of the presence or absence of VOC's.

The best possible scenario for controlled soil sample screening, using the headspace method, is to split samples between two containers. This applies to soil samples that are being screened for potential submission to a laboratory and to soil samples that are being screened for differentiation of VOC's and methane. In the first instance of screening, the sample to be screened should be containerized for head spacing. The potential laboratory sample can be tightly wrapped in a zip-closure bag, wrapped in foil, and placed in a cooler for later use, if necessary. In the second instance of methane differentiation, the sample should be split between two containers, and then screened individually using the FID on one and the charcoal filter adapter on the other. A single sample headspace will be depleted by the first analysis and leave an inadequate sample for the second analysis.

In closing, apply these basic principles and procedures to your field soil screening activities. You will find that your field data will provide you and your project professionals with more accurate data. Best of all, though, you'll find that you will more quickly gain the experience necessary to "make the right call" when it counts most, in the field.

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Enviro-Equipment, Inc. 2005

"Model Speak"
Poeter Named 2006 Darcy Lecturer

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Dr. Eileen Poeter has been chosen as the 2006 National Ground Water Association (NGWA) Darcy lecturer. She is currently a Professor of Geological Engineering at the Colorado School of Mines and Director of the International Ground Water Modeling Center. Before entering academia, she worked for Golder Associates in the early 1980s and has continued to consult throughout her academic career.

Poeter earned a B.S. in geology from Lehigh University in 1975, and an M.S. in engineering in 1978 and a Ph.D. in engineering science in 1980 from Washington State University. Her research focuses on groundwater modeling, parameter estimation (she is author of UCODE, a universal inversion code), multi-model evaluation, water resources evaluation, and evaluation of heterogeneous and fractured aquifers. She is part of the JUPITER (Joint Parameter denTification and Evaluation of Reliability) development team. JUPITER is an application-programming interface (API) intended to energize the science and technology of evaluating sensitivity, assessing data needs, estimating parameters, selecting/ranking models, and evaluating uncertainty. This API, and associated codes, is currently under development by the U.S. Geological Survey, in coordination with the U.S. Environmental Protection Agency to interface with their software modeling frameworks.

Poeter's lecture, "All Models Are Wrong: How Do We Know Which Are Useful?", details how the groundwater profession today is searching for appropriate approaches to developing conceptual models, evaluating which are useful, and describing the uncertainty associated with their predictions.

Formulation of a reasonable set of alternative conceptual models coupled with quantitative representation is critical to the process, but is unfortunately more difficult than numerical modeling as it must address the realm of human nature and judgment. In addition, the dense, opaque character of the subsurface that makes data acquisition expensive, causing the work to be accomplished with sparse, uncertain information, exacerbates the problem. Nevertheless, movements to meet this challenge are gaining momentum in the groundwater profession. Poeter's presentation will discuss currently available practical approaches to the problem in down-to-earth terms, as well as address future challenges.

"Groundwater Guardian" Water Well Fouling

Mike Schnieders, Hydrogeologist
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While it is not hard to imagine the possibility of customer complaints of a rotten egg odor, the other effects of well fouling may be hidden. A gradual loss in production can occur over time resulting in a well that is both ineffective at meeting supply demands, but also too expensive to operate. Production loss is often associated with mineral scale but can also be a result of a bacterial presence within the well. Screen bridging as well as heavy growth within the gravel pack can effect production rapidly. Other troubles can develop unseen without little insight until it is too late. A corrosion condition could develop within the lower portion of the well, rapidly degrading screen quality and shortening the life of the well considerably. High turbidity, excessive iron, discoloration and odors are just a few of the lengthy list of parameters resulting from well deterioration that are addressed in water-quality regulations.

Why does fouling occur? This is an often asked question with many answers. Even though a pump house is clean and the pump efficient with steady production, trouble could be brewing just beneath the surface. Water wells act as a great concentrator, taking on characteristics of multiple aquifer waters as well as the lithologies present and even soil characteristics. Ions and various influences, including biology, from throughout the supporting aquifers converge to a central point, the well. Here in this great gathering location, disrupted subsurface gravel pack and aquifer material are intermixed at the screen with air from the surface. The concentration effect occurs at this point, the convergence of ions, temperatures and bacteria, often with diverse results.

The most common occurrence is the precipitation of a mineral scale. Minerals develop within the well because alkalinity, pH, ion concentrations and temperature are altered to a level when the saturation point is reached and precipitation occurs. Carbonates, such as calcite, dolomite and magnesite, are common to the well environment. Just as frequent are metallic oxides such as iron oxide and manganese oxide. In some cases, sulfates can develop, including calcium sulfate.

Mineral scale development is often enhanced by the presence of a biofilm, a slimy polysaccharide exopolymer, extruded by sessile type bacteria. Bacteria exude this slime to attach themselves to a smooth surface. Biofilms act as sprawling communities within a well system, developing in numerous locations, sustaining life and rapidly expanding throughout the well environment. Biofilm can coat gravel pack material and take up pore spaces between the granules, thereby decreasing porosity and the flow of water. Matter trapped in the biofilm matrix will not readily release, requiring special treatment procedures.

Present throughout nature, biofilms are an excellent source for the adhesion of minerals within a well system. Biofilm can thus promote mineral buildup by providing an excellent surface for adhesion.

Furthermore, biofilm can harbor troublesome bacteria. Sulfate reducing bacteria, anaerobes that reduce sulfate and produce hydrogen sulfide, can cause taste and odor problems with well water as well as corrosive environments down hole. Coliforms, used as an indication of contamination, can often mask themselves within biofilms, and require additional efforts to remove them for disinfection and the achieve a passable coliform test.

Biofilms are not exclusively one type of bacteria, but are a mixture of anaerobic and aerobic bacteria, and can exist throughout the well system and throughout nature. Bacteria exist in many different forms. The sessile or attached bacteria, as just discussed, are the more abundant, but a variety of bacteria exist throughout the well. Planktonic or free swimming bacteria abound within the open casing environment of the well. Aerobic, bacteria that require oxygen, exist in the upper portions as well as any aerated zones. Anaerobes, bacteria that exist in anoxic conditions, can be found in the deeper regions of the well in addition to areas around clay lenses or other aquitards. Sumps, commonly added to well designs, can be excellent locations for anaerobic bacteria buildup as conditions become static and little oxygen reaches the area. Iron oxidizing bacteria are stalked bacteria that utilize iron as an energy source and secrete an iron oxy-hydroxide mass that can be very problematic in wells. Red water, metallic taste and slimey, stringy masses are commonly associated with iron bacteria problems. Corrosion is also an unwelcome problem associated with these bacteria. The iron oxy-hydroxide stalks can rapidly bridge screen openings and reduce flow in the system as well as cover the borehole wall.

Although highly dependent on the aquifer, wells can be susceptible to the infiltration of fine grained sediments such as mud and silt. Often this occurs in older wells, but new wells placed in adjoining silt beds can be just as likely to develop this problem. These fines plug pore throats as well as screen openings, reducing flow into

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the well and increasing the energy spent in pumping. Residual drilling mud remaining within a well after development can aid in this type of fouling by providing a starting point for fines accumulation.

Often a well rehabilitation project follows a predetermined method. The real question should be "how is this method determined?" When a patient visits the doctor, the Doctor has a large selection of medicines available to treat the variety of conditions that they may face. The same is now true of the well professional. With proper diagnosis, almost any well can be saved with production restored or even increased beyond original pumping rates.

The first step for any well rehabilitation should be accurate identification of the problem. This step includes an investigation of pumping and use records as well as a laboratory analysis. The laboratory analysis should include inorganic chemistry and a microbiological analysis. Determination of the actual problem occurring within the well allows design of the correct treatment. Treatment may require only mechanical work or may include chemical rehabilitation as well. The use of laboratory analysis is often disregarded as wasted funds, but this small investment could insure the correct procedure is followed to address the actual problem. A rehabilitation project that misses treating the actual problem is truly money wasted.

With the investigation complete, the well rehabilitation should be continued with the use of an experienced contractor. An experienced contractor should not only understand well construction, but also chemical cleaning and the correct and safe use of chemicals and their disposal requirements. The "dump and run" method of applying well treatment chemicals will not address a stubborn biofilm and likely be ineffective against mineral deposits as well. Proper chemical use, paired with correct mechanical application, is essential to the success of a rehabilitation project.

The use of biodispersants, relatively new to the well market, has increased the success of chemical rehabilitation projects. Biodispersants are utilized in conjunction with an acid or caustic wash to specifically address the exopolymers involved in biofilm accumulation, as well as improve the prevention of the re-precipitation of minerals. Although numerous products have begun to appear on the market, the Johnson Screen product NW-310, Layne Christensen's QC-21, and Design Water's Unicid Catalyst have proven most effective at enhancing well rehabilitation. The proper use and application of these chemicals is essential to their success. It should be noted that these companies are currently the only on the market that provide technical assistance and support in the use of their chemistry, an important consideration for rehabilitation success.

Following rehabilitation, care should be taken in the disposal of waste removed from the well. Regulatory stipulations should be followed, with attention paid to neutralizing the chemical effluent as well as returning the well to normal operating conditions.

Well fouling occurs for a variety of reasons. Traditional efforts at a universal solution to curing problem wells are no longer acceptable. Investigation and the design of a proper treatment process is essential for the success of a well rehabilitation project. Just as important is the choice of chemistry utilized and the use of an experienced contractor. With careful attention paid to both the problem and solution, wells can be rehabilitated and restored to acceptable operating levels.

In a one-hundred year period, a water molecule spends 98 years in the ocean, 20 months as ice, about 2 weeks in rivers and lakes and less than 1 week in the atmosphere.

"Out-of-Boundaries"
Did egg-sitting failure doom the dinosaurs?

June 22, 2005
Special to World Science

In China and some other places over the past decades, the ground has yielded up what some scientists say is a mystery: huge numbers of unhatched dinosaur eggs.

The numbers are "abnormal" and need explanation, said Hong-Yu Zhang of Shandong University of Technology, Zibo, China, in a recent email. For instance, there are far more fossilized eggs of dinosaurs than of other reptiles, he added.

Zhang and three colleagues say they have now found an explanation—a new theory on why the dinosaurs died out. The theory holds that the dinosaurs couldn't or didn't keep their eggs warm enough when prolonged cold spells hit.

Two Tyrannosaurus rex adults alert and ready to hunt, a pterodactyloid pterosaur overhead. The scene takes place on the margin of a floodplain in the future area of western Montana, during the late Cretaceous Period. (© 1985 Mark Hallett)

But the theory leaves some scientists unconvinced. Some disagree that there are too many eggs.
The presence of unusual numbers of eggs is is just one of the pieces of evidence for the theory, however, Zhang said.

The idea that dinosaurs couldn't incubate their eggs properly has been proposed before, he added, but his theory for the first time explains why this would occur, based on chemistry. It also explains another puzzle, he claimed: why many other animals, including non-dinosaur reptiles, survived the low temperatures.

Many scientists today believe a global temperature plunge, possibly brought on by an asteroid hitting Earth, finished off the dinosaurs. The new theory incorporates this idea, but goes further. It proposes that dinosaurs were particularly sensitive to low temperatures partly because of the amounts and types of amino acids—a type of chemicals—that their bodies contained.

The proposal took shape after the researchers found that reptiles alive today are very unusual among animals in the content of their amino acids. Zhang's team described its findings in a paper in the May 23 Web issue of the research journal *Biochemical and Biophysical Research Communications*.

Amino acids are one of the most ubiquitous substances in all living creatures. They make up the molecules, called proteins, of which the bulk of our bodies are made. Twenty different amino acids account for most of the content of these molecules in all life forms.

Proteins containing certain amino acids are more prone than others to bend or distort under high temperatures. This can cause animals to malfunction or die in excessive heat. Similarly, proteins consisting of other amino acids tend more than others to effectively freeze or jam up in the cold, with similar results.

According to Zhang's group, dinosaurs had an amino acid makeup that left them vulnerable to this second scenario.

Modern reptiles, the researchers found, have a strikingly different amino acid content from every other class of animals: a much higher than normal concentration of the type that tends to distort proteins in the heat. This makes them somewhat vulnerable to excessive heat, but improves their cold-tolerance, because they have fewer of the amino acids that make proteins fail in the cold.

The other living dinosaur relatives—birds—have roughly the same amino acid distribution as all the other non-reptile animals, the researchers said. (Most scientists believe birds descend directly from dinosaurs, which would mean that technically the dinosaurs didn't completely die out).

(Continued on page 14)

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The amino acid findings suggest an explanation for the dinosaurs' demise, Zhang and colleagues continued. Dinosaurs, they reason, were probably like the birds and other animals in amino acid content. This would make them and almost all other animals relatively vulnerable to cold.

But among all these animals, dinosaurs may been least able to keep their young warm, the researchers added. This is because unlike mammals, they didn't keep their young inside their bodies—they laid them as eggs. And unlike birds, they perhaps didn't incubate their eggs effectively.

This may also explain why the living reptiles, the turtles, crocodiles and others, survived, Zhang and colleagues explained. Favorable mutations gave these dinosaur relatives an amino acid distribution that protected them against cold, so they survived, along with the birds, when the other dinosaurs died.

In fact, according to Zhang's group, almost every other class of animals had something to protect them from the cold. Fish and amphibians could lay their eggs in the water, which tends to be insulated against quick temperature swings, for example.

If Zhang and colleagues are right, dinosaur eggs might have been alone in the cold. This is how the situation looks based on the thousands of dinosaur eggs that have turned up in China's Henan and Guangdong provinces alone, "which is incomprehensible" otherwise, Zhang insisted.

The theory, he added, also could explain the large groups dinosaur eggs from eras before that of the exinction, as products of previous, less devastating cold spells.

His assertion that dinosaurs were uniquely vulnerable to the cold echoes a debate that has gone on for decades: whether dinosaurs were cold-blooded, or unable to control their own temperature from within.

The jury is still out on this. But the new findings suggest they were either cold-blooded or, in any case, not as good as birds are at maintaining proper body temperature, Zhang explained. Birds are warm-blooded.

If dinosaurs incubated their eggs, their incubation was probably "not as efficient as that of birds," Zhang wrote in an email. This could not "help them survive the disaster."

Another open question that would bear on Zhang's theory is to what extent dinosaurs incubated their eggs, and how.

Experts say the fossil record indicates at least some dinosaurs built nests, but that some dinosaurs must have been too big to sit on their eggs. These dinosaurs might have covered the eggs with vegetation or sand instead.

Did feathers help birds incubate their eggs better than dinosaurs could? Zhang wrote that his field of expertise doesn't cover that question, although "it seems reasonable that feathers [would] do good to birds to survive the disaster."

Another question that might influence whether scientists accept the theory is whether they agree there are, in fact, too many eggs.

Large dinosaur egg caches have turned up in several parts of the world. In Argentina, tens of thousands of unhatched ones have been reported. But globally, they're not "unusually abundant," wrote James Kirkland, state paleontologist for the Utah Geological Survey in Salt Lake City, Utah.

It is true there are many in China, he added, but in Colorado there are also many bird eggs from a period shortly after the dinosaurs vanished.

Zhang said he doesn't claim there is a specific number of eggs that would count as too many, and that would prove his theory. In fact, the eggs aren't the main evidence he offered for the proposal. Mainly, the theory proposes "a molecular link between low-temperature environment and dinosaur extinction," he wrote. "The explanation on the large number of dinosaur egg fossils is a byproduct."

WGWA Board Meeting Minutes
Tuesday October 25, 2005
Conference Call

Persons present: Boyd Possin, Janis Kesy, Dave Nemetz, Ken Wade, Corey Pagles, Lee Trotta

I. Call to order about 5:30 pm.

II. Last meeting minutes (August 4, 2005) - Minutes accepted. Minutes are posted on website.

III. Treasurer's Report – Non-available – Marilyn on vacation.

IV. Membership Report – No update

V. Old Business

- Membership drive – discussed ways to increase membership. Potentially have a membership drive in the beginning of 2006. Include membership fees with fee for annual conference. Think about recruitment.

- Discussed potential association with NGWA. Dave emailed information on the NGWA associate member status. Cost $250. Discussed value of WGWA becoming associate member. Motion made by Dave to try it for one year, Janis seconded the motion. Motion passed.

- Fall field trip –Trip was spectacular. Weather was great, stops interesting, fall color great. Low attendance on trip. Trend has been decreasing attendance. Discussed future trips – should they be one or two day trips, which day of the week is best. Possible to get "big name" guides. Discussed time of year for trip. Determine best to leave field trip in the fall and annual conference in the spring. Fall 2006 field trip – potential trip to SW Wisconsin/NE Iowa.

VI. New Business

- Recruitment of officers for next year. One candidate for 2006-2007 treasurer so far – Lee Trotta. Need a president elect. Also need a president for 2006 due to the departure of Brian Hahn. Brian has moved out of state. Discussed various potential individuals. Boyd offered to organize annual conference so that president-elect does not have to. Suggestion that the list of WGWA members be emailed to board. Board to review and determine potential officer candidates.

- Newsletter update – Lee reported that has an article regarding biofouling of wells (submitted by Water Systems Engineering), field trip article, and other potential articles. Newsletter coming together.

VII. Dave motioned to adjourn meeting at 6:50 p.m., Janis seconded motion.

News from the Treasurer
Marilyn M. Weiss

For Transactions Between: 7/1/05 to 9/30/05

Account Name	Withdrawals	Deposits	Balance
Beginning Balance			**$11,838.96**
Membership			
Dues	$0.00	$150.00	**$150.00**
Newsletters			
Production	$400.00	$0.00	**($400.00)**
Board Meeting			
Phone Charges	$118.50	$0.00	**($118.50)**
General			
PO Box	$24.00	$0.00	**($24.00)**
Misc.	$0.00	$100.00	**$100.00**
TOTALS	**$542.50**	**$250.00**	**$11,546.46**

The 2005 Board, Committee, and Area Coordinators

President (2005)
Dave Nemetz
Liesch Environmental Services, Inc.
Phone: 608.223.1532 Fax: 608.223.1534
dnemetz@madison.liesch.com

President-Elect (2006 President)
Brian Hahn

Secretary (2005-2006)
Janis S. Kesy, P.G., Senior Technical Consultant
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Phone: 920.496-6819; Fax: 920.497.8516
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Treasurer/Membership (2004-2005)
Marilyn M. Weiss
Public Service Commission
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marilyn.weiss@psc.state.wi.us

Past President (2004 President)
Boyd Possin
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At-Large Board Members

Kenneth Wade (2005-2007)
Wisconsin DOT
Phone: 262.548.6733 (Tu, W)
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kenneth.wade@dot.state.wi.us

Rebecca Caudill
Natural Resources Technology
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Corey Pagels (2003-2005)
Leggette, Brashears & Graham, Inc.
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Groundwater Guardian Committee
Vacant

Area Coordinators

We are looking for coordinators in many of the following areas. If you are interested, please contact Dave Nemetz.

Western Area
(LaCrosse, Black River Falls, Eau Claire, Chippewa Falls, surrounding area)
Position Open.

(Continued on page 17)

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Southern Area
(Madison and surrounding area)
John Tweddale
BT^2
Phone: 608-224-2830 and 608-224-2839
jtweddale@bt2inc.com

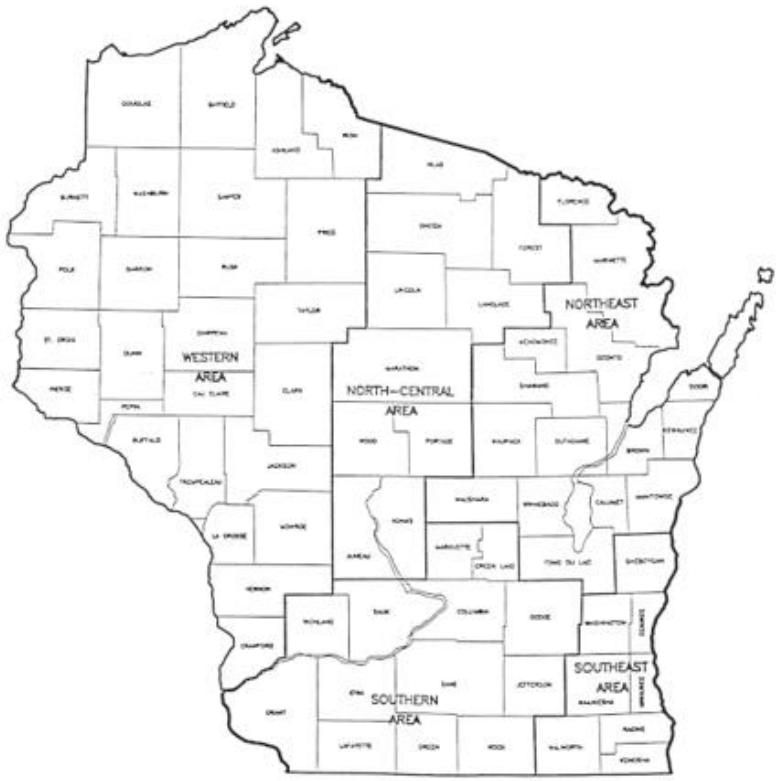
North Central Area
(Stevens Point, Wisconsin Rapids, Wausau, Rhinelander, surrounding area)

Tod Roush
Maxim Technologies
Phone: 715.845.4100; Fax: 715.842.0381
troush@maximusa.com

Northeast Area
(Green Bay, Appleton, Oshkosh, Fond du Lac, surrounding area)
Position Open.

Southeast Area
(Milwaukee, Sheboygan, Racine, Kenosha, surrounding area)

Michael Raimonde
Metcalf & Eddy, Inc.
Phone: 262.909.8316
mike.raimonde@m-e.com



Join the Wisconsin Ground Water Association Today!

WISCONSIN GROUND WATER ASSOCIATION MEMBERSHIP APPLICATION/RENEWAL FORM

Please take a few moments and become a member of, or renew your membership in, WGWA. Annual dues are $15 for students, $30 for individuals, and $25 per person for corporate memberships of six or more. Dues are payable to "WGWA." Complete the following form and send, with check, to:

Wisconsin Ground Water Association
P.O. Box 8593
Madison, WI 53708-8593

Individual Membership: Regular Member:____$30 Student Member:____$15
Name:_____ Title: _____
Firm/Agency: _____
Mailing Address:_____
City, State, ZIP Code: _____
Telephone Number:_____ Fax: _____
E-Mail:_____

Are you interested in participating in any WGWA Committees?

___ Newsletter ___ Membership ____ Web Site ___ Legislation ___ Program & Education
___ Please check if you do not wish to be listed in a WGWA membership directory.
___ Please check if you don't have e-mail access and need to receive the *WGWA Newsletter* via regular mail.

Corporate Membership Discount (six or more individuals): ____$25/individual
Firm:_____
Mailing Address:_____
City, State, ZIP Code: _____
Telephone Number:_____ Fax: _____
Corporate Individuals (include each individual's e-mail address, if available. Attached additional page if necessary):

Name	Title	E-Mail
1.)		
2.)		
3.)		
4.)		
5.)		
6.)		

___ Check here if your company does not wish to be listed in a WGWA membership directory.
___ Check here if you don't have e-mail, and need to receive the *WGWA Newsletter* via regular mail.