



The Official

# Newsletter

of the Oregon Section Association of Engineering Geologists

Serving Professionals in Engineering, Environmental, and Groundwater Geology

## FEBRUARY 2004 SECTION MEETING

GUESTS: DAVE MORGAN AND STEVE HINKLE, USGS

### PRESENTATION: GEOCHEMICAL FRAMEWORK AND NITROGEN TRANSPORT MODEL FOR AN AQUIFER RECEIVING ON-SITE WASTE SYSTEM DISCHARGE, LA PINE, OREGON

A shallow, sandy aquifer serves as both source of drinking water and receptor of septic tank effluent for most residents in the vicinity of La Pine, Oregon. High concentrations of  $\text{NO}_3^-$  (>10 mg  $\text{NO}_3^-$ -N/L) first were observed in study area ground water in the early 1980s. A framework for understanding  $\text{NO}_3^-$  dynamics and a numerical  $\text{NO}_3^-$  transport model that can be used to evaluate management scenarios are described in this presentation.

Geochemical and hydrogeologic data were collected at a variety of scales to develop an aquifer scale (640 km<sup>2</sup> area, 37-m thickness) understanding of  $\text{NO}_3^-$  source, advection, dispersion, and fate. A network of 193 existing wells, two transects of monitoring wells installed along ground-water flow-paths, a dense array of direct-push wells installed perpendicular to one of the transects, and wells installed in septic tank effluent plumes were sampled and variously analyzed for common ions, nutrients, dissolved organic carbon, field parameters, dissolved gases, isotopes of water and nitrogen, and age-dating tracers (CFCs, <sup>3</sup>H, <sup>3</sup>H/<sup>3</sup>He).

Nitrogen isotopes, N/Cl<sup>-</sup> relations, age gradients, and hydraulic considerations indicate that septic

tank effluent is the dominant source of  $\text{NO}_3^-$  in the aquifer. Most  $\text{NO}_3^-$  currently resides within the upper 5 m of the aquifer, due in large part to low recharge rates (CFC-based ground-water age gradients indicate a median recharge rate of 5.1 cm/y) and low hydraulic gradients that limit advection. High concentrations of  $\text{NH}_4^+$  (up to 39 mg  $\text{NH}_4^+$ -N/L) were observed in deep (generally > 37 m) ground water (water that, for the most part, resides beneath the primary aquifer). Nitrogen isotopes, N/Cl<sup>-</sup> and N/C relations, <sup>3</sup>H data, and hydraulic considerations point to a natural, sedimentary organic matter source for this  $\text{NH}_4^+$ . Relations between  $\text{NO}_3^-$ , Cl<sup>-</sup>, and geochemical indica-

tors of redox conditions, and relations between concentrations and isotopes of N<sub>2</sub>, indicate that denitrification is extensive in the study area. Denitrification occurs near the oxic/suboxic boundary. Laboratory denitrification experiments with aquifer sediments confirm the existence of a denitrification capacity in sediments currently exposed to  $\text{NO}_3^-$ , and also demonstrate a latent denitrification capacity in sediments collected from what is currently  $\text{NO}_3^-$ -free ground water.

Our data allowed development of a framework and a conceptual model for a  $\text{NO}_3^-$  transport model.

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### This Month's Meeting is on Tuesday February 16

**Lucky Labrador Brew Pub**  
**915 SE Hawthorne**  
**Portland, Oregon**

6:00 pm Social  
 7:00 pm Dinner  
 8:00 pm Presentation

\$12.00 dinner (\$6.00 for students)  
 Options: chicken or Veggie Bento

Call URS at 503-222-7200 by 4 pm  
 Thurs. Feb. 12 with your  
 reservation.

There is a \$2.00 surcharge for those  
 who do not reserve by the deadline.  
 Call now!

A reservation made is paid

## MESSAGE FROM THE CHAIR

By now you may have recognized that AEG's leaders, the executive committee, and administrative staff are committed to re-vamping the Association to provide increased service and benefit to our members. To that end, we have asked members to participate in updating the Mission, Vision, and Values statement, and to participate in membership surveys, and policy statement updates.

I have been asked recently if there is interest in forming a chapter or subsection within the Oregon Section for Idaho or southern Oregon AEG members that do not have opportunity to participate in the monthly meetings regularly held in the Portland area. This would be an opportunity to increase AEG representation in your local area, and perhaps establish new contacts in the profession through local meetings, outings, or other events. If there is interest in developing a subsection or chapter, please do not hesitate to contact any of the Oregon Section board members and we

will assist.

Also on the local front, we would like to seek input from members regarding establishing student scholarship award criteria. Our board members have voted to establish an Oregon Section sponsored Student Scholarship, and we have considered some general criteria as far as award value and eligibility, and now we want your ideas to enhance student appreciation of the benefits of becoming involved with our profession.

The Oregon Section board would like to welcome, **Soren Clark** of Portland State University, as the newly elected chair of the PSU Student Chapter of the Association of Engineering Geologists. We look forward to participating in the Student Night planned for the April Meeting. This has become an annual event which has been well attended by students from several institutions as well as practicing professionals.

A formal announcement will be forthcoming soon, but I wanted to

hint that our Field Trip Planning Chair, **David Scofield**, has discussed with me some very interesting field trip ideas for the coming months. I won't steal Dave's thunder, but through his employer, the U.S. Army of Corps of Engineers, and contingent upon our good behavior, we may be able to gain insider access to some very large and noteworthy transportation engineering projects with which the Corps is involved. I'll let Dave make the official announcement when he obtains all the requisite approvals etc. But, be prepared to respond promptly upon notice as space may be limited.

On a final administrative note, I ask that the Oregon Section Board Members, and committee chairs plan to meet for a Section Board Meeting at 4:30 PM on the afternoon of the February meeting. That's all I have for now!

Regards,  
*Warren Krager*  
*AEG Oregon Section Vice Chair*

### AEG OR CALENDAR

**Mar. 16:** Rick Lahusen, USGS CVO, Real-time monitoring of debris flows

**Apr. 20:** Student Night

**May. 18:** George Priest/Charlie Hammond, Johnson Creek Landslide

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News items are invited and should be sent to: Charlie Hammond, OR Section AEG Newsletter Editor, Cornforth Consultants, 10250 SW Greenburg Road, Portland, OR 97223, email: or.aeg.news@cornforthconsultants.com, phone (503) 452-1100. Electronic media is preferred. Deadline for submittal is Friday three weeks before each meeting.

Please notify Charlie if you have a change to your email or mailing address.

# PSU AEG STUDENT CHAPTER

## 2004 Officers

Soren Clark: President  
Josh Mathisen: Vice-President  
Susan Wacaster: Secretary  
Aaron Fox: Brownbag and Field Trip Wrangler  
Scott Burns: Faculty Advisor and Lead Wine Taster

## Website

<http://web.pdx.edu/~clarksk/aeg.html>

## Winter Quarter 2004 Brownbag Schedule

Thursday, Feb 12, 2004, 12:00-1:00 PM Terry Jacques, Geo-Tech Explorations, Inc.: "Drilling basics and the driller-geologist partnership"

Thursday, Feb 19, 2004, 12:00 - 1:00 PM Greta Siegel, PSU Science Librarian: "Scientific Journals: Costs, cuts, and self-publishing"

Wednesday, March 3, 2004, 3:30 - 4:30 PM Planning Session (Student Night, Spring Quarter Seminars and Field Trips, Membership Drive, etc.)

Brownbags are held in Cramer Hall, Room 69, on the PSU Campus. Talks are informal and are usually accompanied by fresh-baked goodies. The audience is usually a mix of PSU undergraduate and graduate geology student, with a smattering of departmental staff and professors.

We are beginning to look for Spring Quarter speakers; if you would be willing to give a brownbag talk, email Aaron Fox (afox@pdx.edu).

## Spring Break Field Trip

The Student Chapter is also in the planning stages for a Spring Break field trip (March 20 - 27 ) to the Mojave Desert of southern California. Anticipated stops include the Blackhawk Landslide, the San Andreas Fault at Hwy 14, the 1992 Landers Earthquake fault scarp, Joshua Tree National Park, and more. Feedback on additional applied/engineering geology-related trip stops in the area would be appreciated!

## NEWS ITEMS

### Shlemon Conference Earth Fissures April 1 - 3, 2004:

Hosted by the Engineering Geology Foundation and the Association of Engineering Geologists, the first annual Shlemon Conference in El Paso, Texas, will evaluate the present state of knowledge of earth fissures. For more information, contact either Bill Haneberg, bill@haneberg.com, 206-871-9359 or Jeff Keaton, jeff.keaton@amec.com, 714-779-2591 ext. 308. Please visit the conference web site for more information: [www.haneberg.com/fissure](http://www.haneberg.com/fissure).

Membership Information: If your membership information has changed, please take the time to update through the AEG Website or by contacting our Chief Staff Executive Becky Roland at (303) 757-2926 x307

"Seeking Old AEG Annual Directories": If anybody has any pre-1997 AEG annual directories, please email George Freitag, History Chair at [gfreitag@gri.com](mailto:gfreitag@gri.com). George is compiling our sections history.

His mailing address is: GRI Inc., 9725 SW Beaverton-Hillsdale Hwy, Beaverton, OR 97005

Receive Your Newsletter by E-Mail: PLEASE TAKE THE TIME TO SWITCH TO THE E-MAIL NEWSLETTER. This saves the Section money and simplifies the editor's job. Please send your e-mail address to [or.aeg.news@cornforth-consultants.com](mailto:or.aeg.news@cornforth-consultants.com)

## THANKS FOR SUPPORTING OREGON AEG!

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Septic tank effluent is the dominant  $\text{NO}_3^-$  source term; census data were combined with study area septic tank effluent data to estimate  $\text{NO}_3^-$  loading terms. Concentration data from a dense array of wells facilitated estimation of dispersion. Advection of  $\text{NO}_3^-$  occurs until  $\text{NO}_3^-$  reaches the oxic/suboxic boundary, at which point denitrification quickly results in reduction of  $\text{NO}_3^-$  to  $\text{N}_2$ .

Flow and transport simulation models were developed at two scales to assess the long-term effects of on-site waste disposal systems on groundwater quality. First, a sub-aquifer scale model was used to test concepts and estimate flow and transport parameters along a flowpath where detailed hydrogeologic and

geochemical data were available. Then, an aquifer scale model was calibrated assuming steady flow with transient historical  $\text{NO}_3^-$  loading and observed  $\text{NO}_3^-$  concentration data from 1960 to 2000. Groundwater age-dates and observations of hydraulic head and flux to streams were used to constrain and calibrate the models. Boundary flux conditions for the aquifer scale model were extracted using telescoping mesh refinement techniques from a regional scale flow model developed in a previous investigation of the Upper Deschutes Basin. The hydrogeologic framework for the models was developed using transitional probability geostatistics. Lithologic descriptions from 390 geologic logs were categorized into hydrofacies.

The three-dimensional hydrofacies model (realization) was constructed using information on volumetric proportions, mean lengths, and juxtapositional tendencies. The upper surface of an extensive low-permeability layer was mapped from well logs and merged with the geostatistical realization to complete the hydrogeologic model. The oxic / suboxic boundary within the aquifer was mapped using over 200 dissolved-oxygen measurements from shallow wells; the boundary was represented in the transport model as a  $\text{NO}_3^-$  sink. The transport model has been used to simulate the range of water-quality responses to various management scenarios, and implications for management will be discussed.

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## OREGON SECTION OFFICERS & COMMITTEE CHAIRS



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OREGON SECTION

