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Chem nEws

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Central Jersey Section

January Dinner Meeting

Enhanced Anaerobic Bioremediation for Chlorinated Aliphatic Hydrocarbon Contaminants in Groundwater

by Dr. Al W. Bourquin

Tuesday, January 21, 2003

Enhanced anaerobic bioremediation (EAB) is the newest technology in our continuously evolving biological treatment for chlorinated solvent contaminated groundwater. Developments in our understanding of the biodegradation of chlorinated aliphatic hydrocarbon compounds (CAHs) in the past five years now allows us the option to stimulate in-situ anaerobic biological dechlorination reactions.

EAB relies on the addition of sufficient organic compounds into contaminated groundwater and soil to induce highly reducing or methanogenic conditions necessary to achieve complete and rapid reductive dechlorination of many CAH compounds. Thus, naturally occurring biodegradation rates of CAH compounds are potentially enhanced by the addition of organic substrates (i.e., electron donors), particularly at sites where available electron donor is limited. By inducing highly reducing conditions, EAB may improve both the extent and rate of biological dechlorination reactions leading to complete detoxification.

A large number of field demonstrations and projects are being conducted using various organic substrates to enhance the reductive dechlorination of CAHs. These systems involve the introduction of acetate, lactate, methanol, ethanol, or molasses into the aquifer as means of supplying electron donor necessary for driving dechlorination reactions. Recent work includes the successful addition of vegetable oils, compost and milk or cheese whey to groundwater as electron donor substrates.

The economics of EAB is somewhat dependent upon site groundwater having low levels of alternative competing electron acceptors (e.g., oxygen, sulfate, iron, and nitrate), such that a minimal addition of organic compound is necessary to achieve and sustain a highly reduced environment. However, competing electron acceptors can be overcome through the addition of organic substrate. The presence of indigenous microorganisms capable of the complete dechlorination of CAH compounds to innocuous ethene and ethane prevents the accumulation of toxic intermediates. The complete dechlorination process is complex involving multiple species of organisms at different redox conditions. However, any microbial limita-

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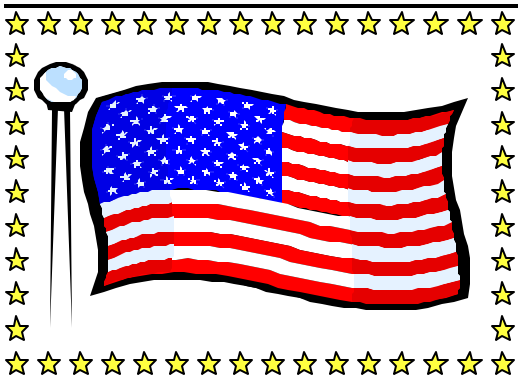

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Message from the Chair

Happy New Year! I hope you all had a wonderful holiday season, and wish you all the best for the new year. The local section had some interesting meetings this past year, covering topics from the historical basis of engineering to considerations of quality control in the pharmaceutical industry. During the past two months there have been a flurry of postings on the national AICHE news group about the function of local AICHE sections and what meeting topics are popular. The growing diversity of engineering and science professions has made it difficult for local sections to provide a scientific program of common interest. Locally we have seen this with the shift of employers changing from the traditional petrochemical industry to the life science industries. We hope to be able to offer you a program that will be of interest to our diverse membership, and attract more of our local members to our meetings. If any of our members have suggestions for meeting topics please contact me (benziger@princeton.edu).
Hope to see you soon!
Professor Jay Benzinger

* If you have a change in your mailing address, contact Martha Pelensky
* If you have an article to contribute or want to help out with E-Week, contact David Marabello
* If you have an idea for a meeting, contact Prof Jay Benzinger or Derk Huibers
* If you are job hunting, contact Mark DeLuca

GOD BLESS AMERICA !

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The Central Jersey Section website is
www.princeton.edu/~cjaiche

ENGINEER'S WEEK IS FEBRUARY 17 – 23, 2003.

Would you like to volunteer an hour of your time to tell some bright high school students why Chemical Engineering is a great career choice?

Please call Dave Marabello at 732-225-7000 x 691 by January 21st if you can spare the time.

Professional Development

The New Year column is when I typically discuss all the exciting possibilities for Chemical Engineers. Normally as traditional Chemical Engineering jobs, like petrochemicals, move over seas, new technologies, like pharmaceuticals, replace the old jobs. This cycle is being broken. The new technology and new ideas that create jobs are moving overseas before we get a chance to participate in the cycle. For example, stem cell research is shunned in the United States, but is being done is Australia and England. The technology to grow new pancreas cells for diabetics or new brain cells for people with Parkinson's will be created overseas. The science of today creates the engineering of tomorrow. Scale-up will take place near the scientists that create the technology.

Looking at the more immediate picture, the job outlook is still poor. There are a dozen engineers looking for work right now through the local AIChE. Some of them are getting close to the end of their unemployment benefits. There are more section members out of work that have not yet contacted me. There are many local section members that have jobs, but wish they had better jobs.

On a more positive note I am working on a web page that lists all of the employers of chemical engineers in our area. http://www.del-engineering.com/employ.html A company on the list may not have new openings right now, but the page can give you the a sense of the employment picture for Chemical Engineers. With your help I can add new companies to this list. As you learn about new companies, please share the information with me. Thanks.

Until Next Month……**Mark DeLuca, P.E**

(engineer@del-engineering.com)

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tion can be overcome through the addition of specific cultures that are many times lacking from natural sites.

Recent advances (past year) in EAB technology indicate the injection of high concentrations of soluble organic compounds (e.g.- lactate) combined with enhanced microbial activity causes an increase in dissolved contaminant concentrations. This increased soluble contaminant phase increases the potential for reductive dechlorination and subsequently reduces sorbed contaminant mass (i.e.- DNAPL). This process is critically important in reducing the time to meet remediation goals and costs.

In summary, EAB of CAH compounds is a very effective remediation technology that has been proven in over three-hundred field sites. CDM has a number of systems in the field with excellent results. Substrates used by CDM are the most prevalent in the industry and include lactate and Hydrogen Release Compound (HRC®). This presentation will present basic information critical for implementation and the mechanisms involved. Data from field sites will be used as examples.

SEE BELOW FOR TIMES

The meetings will be held at Princeton University with dinner at the Prospect House & the presentation at the Friend Engineering Center - Room 108.

This will require a leisurely 5 minute walk between dinner and the presentation. Be prepared for all weather conditions.

Call Amanda Meyer at 609 258-4572 or email at (ameyer@princeton.edu) for dinner reservations.

Social hour……..…5:30 - 6:00 PM
Dinner……..…6:00 - 7:30 PM
Presentation……...7:45 - 9:00 PM

Cost: Members & Guests……..$20
Unemployed & Retired.…$10
Students w/ ID…..…….$10

No cost if coming for the presentation only.

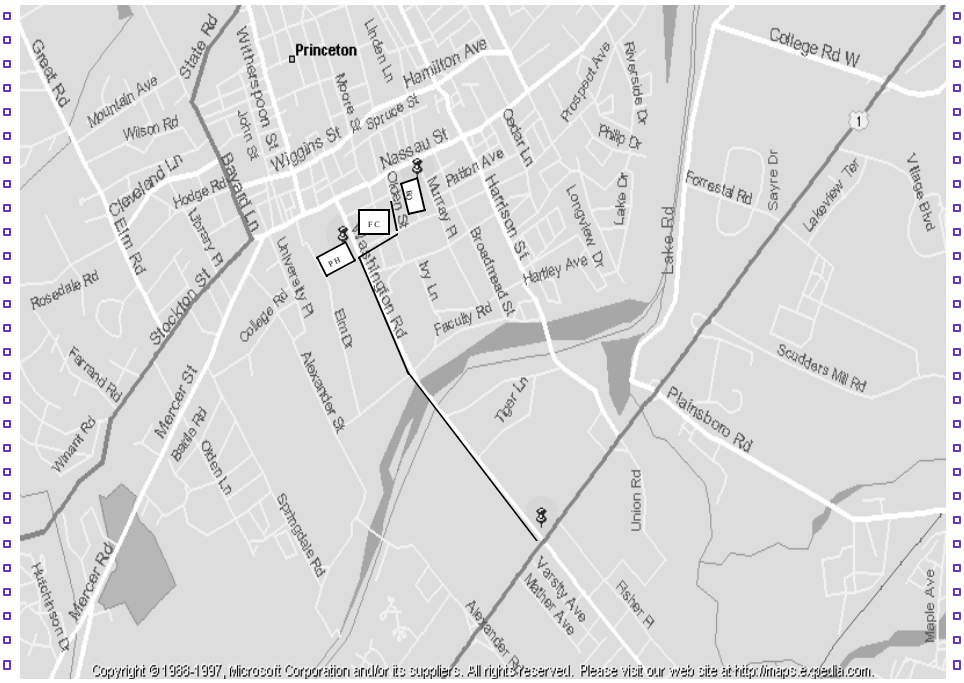
Cash or check made out to Central Jersey AIChE will be collected before dinner.

For Directions to the University go to **http://www.princeton.edu/cgi/map** or look under Travel and Weather on the Princeton University main website and you can find directions to Princeton and a detailed campus map.
Or call 609 258-2222 for general directions to Princeton University.

DIRECTIONS to PRINCETON UNIVERSITY

Directions to Engineering Quadrangle/Friend Center:
Take Washington Street (Rt 571) West into Princeton from Rt 1 South or Rt 1 North. At the second light make right turn onto Prospect Street. Continue to the first street on left and turn onto Olden Street. The Engineering Quadrangle will be on your right and the Friend Center on your left behind the building that fronts onto Olden. Parking available on the street along Prospect Street, William Street, Olden Street, and at night in the University Parking lots in back of the Engineering Quadrangle or on William Street. If you cannot make it to dinner and wish to join us afterwards, remember to ask a student for the building if you cannot find it easily.

To get to Prospect House:
There is NO parking available in front of Prospect House which is in the center of campus. Park near the E-Quad and walk to Prospect House. Walk east on Olden Street (away from Rt 27) and walk south on Prospect Street to the light at Washington Road (Rt 571). Cross Washington Road and proceed through the arch into the main part of campus. After going through the arch you will be facing the Music Building and Architecture Buildings. Prospect House is directly in back of the Music Building (on left). Continue straight on the walk between the two buildings and you will get to the front entrance of Prospect House just beyond the pavement circle & grass center.



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