PAYMENT DETAILS

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- Payment via CASH / CHEQUE / BANK-IN TRANSMISSION / BANK DRAFT / MONEY ORDER / POSTAL ORDER / LO / WALK -IN will be considered as NORMAL REGISTRATION
- For online registrations, please note that **payment MUST be made before the closing date** at the latest.
- If payment is not received and verified within the stipulated time, the registration fee will be reverted to the normal registration fee.
- **FULL PAYMENT** must be settled before commencement of the course, otherwise participants will not be allowed to enter the hall. If a place is reserved and the intended participants fail to attend the course, the fee is to be settled in full. If the participant failed to attend the course, the fee paid is non refundable. Registration fee includes lecture notes, refreshment and lunches.
- The Organizing Committee reserves the right to cancel, alter, or change the program due to unforeseen circumstances. Every effort will be made to inform the registered participants of any changes. In view of the limited places available, intending participants are advised to send their registrations as early as possible so as to avoid disappointment.

REGISTRATION FORM

Fax: 03-7957 7678 Email: wahida@iem.org.my
Website: www.myiem.org.my

Name(s)	Membership No. / Grade	Fees (RM)
Total Amount Payable		

Company:____

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(Please write clearly as the "Confirmation Update will be sent via email)

Contact Person:____________________________ Designation:_______________________

Signature:__________________________________ Date:___________________________

☐ Cash RM___________

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(non-refundable) and made payable to "**THE INSTITUTION OF ENGINEERS, MALAYSIA**" and crossed '**A/C Payee Only**

Half Day Seminar on Bioremediation of Heavy Metal Contaminated Groundwater

(Organised By : Environmental Engineering Technical Division)

25 January 2013 - Friday
9.00 am – 1.00 pm
C&S Lecture Room, 2nd Floor,
Wisma IEM, Petaling Jaya

BEM Approved CPD/PDP Hours: 3.5 hrs
Ref. No.: IEM12/HQ/246/S

REGISTRATION FEES

Grade	Normal Fee	Online Fee
IEM Student Member	RM 40.00	RM 30.00
IEM Graduate Member	RM 80.00	RM 50.00
IEM Corporate Member	RM 150.00	RM 100.00
Non IEM Member	RM 230.00	RM 200.00

Closing Date: 21 January 2013

Important Note: IEM members are required to produce their membership cards for CPD scanning at the start and end of the seminar.

FOR FURTHER DETAILS, PLEASE CONTACT:
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Bangunan Ingenieur, Lots 60/62, Jalan 52/4,
P.O. Box 223 (Jalan Sultan) 46720 Petaling Jaya
Tel: 603-7968 4001/2 Fax: 603-7957 7678
E-mail: wahida@iem.org.my Website: www.myiem.org.my

Tentative Programme

0800am	-	0900am	Registration & Breakfast
0900am	-	1000am	**PAPER 1**
1000am	-	1100am	**PAPER 2**
1100am	-	1130am	Tea Break
1130am	-	1230pm	**PAPER 3**
1230pm	-	100pm	**Q&A**
100pm			**Session Ended**

SYNOPSIS

PAPER 1 : Deep subsurface biodiversiy: Remarkable novelty and flexibility despite proposed geochemical constraints (Prof. Esta van Heerden, PhD)

Microbial populations in the deep subsurface extend to depths below where nutritional and environmental parameters limit the ability of microbes to survive. Highly diverse microorganisms occur in expanses where carbon sources are not evident. The studies of the deep subsurface exposed valuable information of the ecology of microbes, the chemical and geological factors associated with these thriving and diverse microbial populations and more insight were gained into their metabolism using genomic and proteomic tools.

Low cell mass samples were concentrated by either massive or tangenial flow filtration systems. Complete biodiversity studies were done using 16S and 18S rRNA gene clone libraries, operational taxonomic units (OTU) were calculated using distance based and richness parameters (DOTUR). Microbial isolations were attempted using selective media followed by pyrosequencing and annotation analyses. Proteome analyses, including expression and kinetic, were completed on various proteins from subsurface microbes. Each geological setting provides new insight into its particular associated geochemistry and how it influences the biodiversity. With increasing depth and temperature lower diversity is recovered, however several sites reveal surprisingly high interspecies diversity, even for eukarya.

We extend the current knowledge on subsurface cycling by comparing of anaerobic and chemolithotrophic metabolic reactions to indicate that SO_4^{2-}reduction is the dominant metabolic process at high and low salinities and that matrix diffusion can sustain planktonic fracture microbial concentrations of ~10^8 cells mL-1. Methanogenesis becomes more dominant with declining salinities. Neither acetogenesis nor syntrophic degradation of abiogenic hydrocarbons appears to be the source of the observed carboxylic acids, but regardless respiration leads to direct *in situ* carbonation within the fractures.

PAPER 2 : In Situ Biosequestration of Arsenic in Groundwater (Mary F. DeFlaun, PhD)

The precipitation and sequestration of arsenic (As) as sulfide minerals under sulfate reducing conditions in groundwater is a well-known geochemical mechanism, but one that had not been widely utilized for remediation because the long-term stability of these As-sulfide minerals was unknown.

A SERDP funded research study that included both bench-scale and field-scale studies conducted at Avon Park Air Force Range in Florida demonstrated that: a) soluble electron donors and sulfate addition can promote the activity of sulfate reducing bacteria and the precipitation of As-sulfide minerals (e.g.orpiment, realgar and arsenopyrite); and b) these As-sulfide minerals remain stable, with dissolution of only 1 to 2% over the course of at least 16 years, when exposed to highly oxygenated groundwater. The success of these studies led to the opportunity to demonstrate this technology at two client sites, both former phosphate fertilizer manufacturing facilities, located in New Jersey and Kansas. A pilot test was conducted at the site in Kansas. Due to the location of the site as well as the fact that it is an active facility, it was most expeditious to use a long-lasting rather than a soluble electron donor, and to deliver the amendments by direct push injections rather than the recirculation system used at the Avon Park site. A single direct push event was used to introduce the amendments into a 30' by 30' field plot between depths of 35 and 50 feet below ground surface in the As source area. Three wells within the test plot and one well immediately downgradient were monitored for a period of one year post-injection.

The success of this pilot test led to selection of As sequestration as the preferred remedy. Design of the full-scale remedy is expected to be completed this year. At the New Jersey site, a treatability study was conducted that tested both this technology as well as an iron-based amendment for As sequestration. Although As-sulfide formation was demonstrated, the hydrogeochemical controls as well as the heterogeneity of the subsurface environment precluded an *in situ* strategy for As remediation.

PAPER 3 : Pilot-scale Bioremediation of Hexavalent Chrome-contaminated Water – a South African First (Prof. Esta van Heerden, PhD)

During the early 1940's, the current site of the Lyttelton Dolomite mine in Marble Hall, Northern Province, South Africa was used to produce chrome-based tanning salts for the production of military footwear. During this time various unlined dumps of solid waste material containing hexavalent chrome were formed. As a result, extensive leaching of chromate into the water table has taken place during the 70-year history of the site. In order to circumvent any further negative environmental impact at this site, an effective and sustainable treatment strategy for the removal of hexavalent chrome from the groundwater is essential.

Biological chromium recovery is possible through a process of *in situ* immobilization of soluble hexavalent chrome via microbial reduction to insoluble trivalent chrome. This treatment approach employs natural biological processes to create anoxic conditions by controlling the oxidation reduction (redox) state of the system. The first phase of the project was to employ a laboratory-scale study using a continuous up-flow column reactor to determine whether site-specific indigenous bacteria could colonise the reactor matrix and remediate hexavalent chrome-contaminated water using citric acid as electron donor. During operation of the reactor the electron donor was carefully managed to maintain a robust bacterial consortium able to reduce hexavalent chrome, while preventing excessive biomass accumulation. Anoxic conditions were reached after 4 days of operation, while complete hexavalent chrome reduction was achieved after 8 days and maintained for a further 80 days before reactor termination. Post-termination results confirmed the establishment of biofilm on the reactor matrix, as well as trivalent chrome precipitation within the reactor.

Based on the results from the laboratory investigation, a fixed-film pilot bioreactor was designed and constructed at the Lyttelton Dolomite mine in Marble Hall, Northern Province, South Africa. The reactor consists of a lined concrete containment structure filled with dolomite stone, resulting in a matrix porosity of ~40%. The influent water is fed to the inlet of the reactor by gravitational feed and evenly distributed across the vertical cross-section of the media. Influent flow rates, electron donor injection and automated sampling are remotely controlled by a Programmable Logic Controller (PLC). The water flows through the matrix of the reactor, where hexavalent chrome is reduced and subsequently removed, resulting in remediated effluent which conforms to Class 1 drinking water standards at a minimal cost of $0.02/L. Based on the low concentrations of hexavalent chrome in the influent, it is estimated that the reactor would have a lifespan of several years. The talk will also describe changes and improvements made to the reactor and electron donors

SPEAKERS

PROF. ESTA VAN HEERDEN (PH.D) is a full Professor in Department of Microbial, Biochemical and Food Biotechnology, University of the Free State

She is a very active member of; South African Society of Biochemistry and Molecular Biology (1992 - present), South African Woman in Science and Engineering (1994 – present), CESA (Consulting Engineers of SA) Presidential Sounding Board and The International Astrobiology Society (ABS). (Invited Member). She is a Project committee for NELSAM – National Earthquake Laboratory In South African Mines. Also, she is one of the **Editorial Boards** of Saline Systems, Astrobiology. She also a reviewer supplement the Editorial Board: Minerals Engineering

Prof. Esta achieved so much awards includes: Faculty of Natural and Agricultural Sciences - Entrepreneurial Research Award – November 2007, Third World Academy of Sciences (TWAS) /Academy of Science of South Africa (ASSAF)/Department of Science and Technology (DST) Young Scientist Prize 2009, Faculty of Natural and Agricultural Sciences - Mentoring Award – November 2009, NSTF awards nomination – Innovation by teams through organizations – Metagenomics Platform.

MARY F. DEFLAUN, Ph.D.

She is a **Postdoctoral Research Fellow**, TuftsUniversityMedicalSchool, Boston, Massachusetts, 1990

Cloning Bacterial Adhesion Genes and Study of Adhesion-Deficient Mutants Survival in a Soil Environment

She have a **Ph.D., Oceanography**, University of SouthFlorida, St. Petersburg, Florida, 1987 – *The Distribution and Molecular Characterization of Dissolved DNA in Aquatic Environment. Also, she have a* **M.S., Oceanography**, University of Maine, Damariscotta, Maine, 1982 (*Adhesion Mechanisms and Seasonal Variations in Abundance of Bacteria in an Intertidal Environment)* and also got a **B.S., Biology**, BeloitCollege, Beloit, Wisconsin, 1978

Dr. DeFlaun is highly experienced in the development and implementation of in situ remediation technologies with over 20 years of related experience, and directs the firm's development and implementation of in situ remediation technologies for recalcitrant organics and metals, including monitored natural attenuation (MNA), biostimulation and bioaugmentation. She also has particular expertise in the biodegradation of MtBE and TBA, and holds two patents on the degradation of MtBE. As an internationally recognized environmental microbiologist and a molecular geneticist, she has worked extensively in the areas of microbial degradation and microbial transport, as well as in the assessment of remedial alternatives for impacted groundwater and the effect of these impacts on indoor air (vapor intrusion). Dr. DeFlaun serves as a technical consultant for innovative remedial technologies on a number of Superfund Sites in the northeastern U.S. and across the country. Dr. DeFlaun also develops and implements R&D programs related to the optimization of in situ hazardous waste treatment processes.