

# Fall 2007 EWRE Seminar Series

**Thursday, November 29**

3:30 PM ECJ 1.204

**Con Pelekani, Ph.D.**

**Senior Process Engineer, Water Treatment Design Group  
South Australian Water Corporation**

*Design, Operating and Research Experience at the Penneshaw Seawater Desalination Plant, South Australia*

The South Australian Water Corporation is a wholly-owned public water utility, responsible for the management of water and wastewater supply, treatment and distribution infrastructure, for more than 90% of the state's population (~ 1.2 million people). Amongst its infrastructure, SA Water operates a 300 m<sup>3</sup> /day seawater reverse osmosis (SWRO) desalination plant for the island coastal community of Penneshaw. Desalination was established as the most cost-effective supply option, when the existing source water, an open dam on a farmer's property, was deemed a very high microbiological risk to humans, particularly with respect to *Cryptosporidium* and THM formation. SWRO was determined to provide lower cost water than constructing a new pipeline to connect with treated water from an existing conventional water treatment plant in the mid-west of the island.

Built in 1998, the SWRO plant has provided an opportunity to develop a knowledge base for the design and operation of seawater desalination issues. Driven by the environmentally sensitive nature of the local marine environment, the requirement for the plant to be 'chemical-free' has resulted in numerous challenges for process design. The current operating recovery of the RO membrane system is low (by world standards), at 28%, in an attempt to mitigate calcium carbonate scaling. Mechanical integrity issues with the use of 15" diameter pressure vessels resulted in a shift to established conventional 8" RO membrane elements, with significant improvements in plant operation. An improved understanding of seawater corrosion issues and the critical importance of reliable and robust pre-treatment filtration and post-treatment conditioning systems have been positive outcomes from the various upgrades to the plant undertaken from 2001-2005.

In 2005 a research program was initiated to improve our understanding of the relevant fouling mechanisms of the open intake feed water on the RO membranes. The results confirmed significant biofouling activity, even with a pre-treatment system incorporating UV disinfection. Pre-treatment efficacy was found to be reasonable, especially in light of the absence of coagulant addition. Most SDI measurements were below 4, with more than 50% below 3. HPC count analysis using marine agar yielded a removal efficiency near 90%. However, the removal of transparent exocellular particles was relatively poor for bacteria (< 5%). Removal of clumps was far more efficient (>85%). In relation to inorganic fouling, quantitative mass balances for key chemical species across the membrane system did not adequately predict the dominant inorganic foulants, when compared with the analysis of spent chemical cleaning solutions.

An acid dosing trial, undertaken in early 2005 to assess operational, water quality and environmental impact from operating at a higher recovery (40%), confirmed positive

performance benefits. With the existing 'chemical-free' process regime, a discharge permit was not required for the waste concentrate.

Seawater RO desalination will become an integral component of SA Water's strategy for securing its customer's future water supply needs. Improved understanding of what unit processes work best for seawater pre-treatment will help contribute significant financial savings for large-scale projects.

## **Biography**

Con Pelekani graduated with Bachelor in Chemical Engineering (First Class Honours) from the University of Adelaide in 1995. A recipient of an Australian Fulbright postgraduate scholarship, he completed Master of Science (Environmental Engineering) and Ph.D. (Environmental Engineering) degrees, specialising in water and wastewater treatment, from the University of Illinois at Urbana-Champaign, USA, in 1997 and 1999, respectively. His doctorate focused on the role of adsorbent pore size distribution on the competitive adsorption of synthetic organic micropollutants and natural organic material in drinking water on activated carbon.

Con joined the Engineering & Projects group in January 2002. Reporting to the Principal Process Engineer (Water), Con is responsible for providing an efficient and responsive investigation, design and advisory service for capital works projects and operations, while developing and maintaining leading-edge capability on all aspects of drinking water quality and treatment. His key areas of expertise include process design, membrane technology for water and wastewater purification (including desalination), MIEX ® DOC process, water conditioning and activated carbon adsorption.

Prior to joining the Engineering group, Con worked for 2 years as a research officer in the Water Treatment Unit at the Australian Water Quality Centre (a wholly owned business unit of SA Water). His key responsibilities included laboratory and pilot-scale investigations of the MIEX ® DOC process, investigation of conventional and alternative treatment processes for the removal of dissolved organic material from drinking water, investigation and development of novel desalination processes and providing technical advice to internal and external clients on aspects of drinking water quality and treatment.

Con is a member of Engineers Australia, a member of the Australian Water Association a corporate affiliate member of the International Desalination Association.

**Thursday, November 15**

3:30 PM ECJ 1.204

**Matt Harold**

**B.S. The University of Missouri - Rolla, Geological Engineering**

Groundwater remediation is a costly and time consuming undertaking, which starts with a guess and often ends with one too. Much time and effort is spent developing cleanup technology, yet very little time is spent maximizing the operation of those technologies. This issue of inefficiency in operation is addressed through the development of a product maximizing/price minimizing model. Using the API LNAPL Distribution and Recovery Model

(LDRM) and the Burdine and Mualem LNAPL relative permeability models, the model developed here seeks to solve a remediation systems optimal operation schedule through goal-seeking. Six groundwater recovery wells were modeled side by side using recoverable volume and transmissibility functions. The model was then run to optimize product recovery, through the use of both pump and treat methodology and free product skimming, while minimizing bulk groundwater removal (used as a substitute for cost). In light of initial modeling success, further work is planned with the goal of producing a more dynamic model. The eventual goal is an approach to recovery optimization modeling which can be easily tailored to any remediation system and any set of operational requirements.

**Stephanie Johnson**

**B.S. Civil Engineering and B.S. Environmental Engineering University of Wisconsin - Platteville**

**M.S. Civil Engineering (water resources emphasis) University of Minnesota**

*A General Approach to Bacteria TMDL Development: Texas Gulf Coast*

Numerous bays and rivers along the Texas Gulf Coast are listed on the US Environmental Protection Agency's (EPA) Section 303(d) List for bacterial impairments. The Texas Commission on Environmental Quality is interested in developing a general approach for completing bacteria Total Maximum Daily Load (TMDL) studies on these bays and the watersheds that drain into them. Existing modeling techniques are being combined with methods previously approved by the EPA, recommendations set forth in the June 2007 "Bacteria Total Maximum Daily Load Task Force Report", and emerging technologies to create a procedural outline of steps to be taken and tools to be used when completing these studies. Procedures are being developed within the framework of national datasets to encourage transferability and application outside of the immediate study area.

**Thursday, November 1**

3:30 PM ECJ 1.204

**Jasmine G. Dufreche, M.S. Student**

**B.S. Civil Engineering, University of Louisiana at Lafayette**

*Organoclays for the Capping of Contaminated Sediments*

Conventional capping of contaminated sediments with sand or other inert materials may not be effective in areas where sediments contain nonaqueous phase liquids (NAPLs) due to displacement or continued migration of NAPLs. The NAPL may migrate as a result of the disturbance associated with capping of the sediment, subsequently during consolidation or as a result of gas release. Organoclays can be an especially effective means of addressing migration of NAPLs and mobile dissolved phase hydrophobic organic compounds. The use of organoclays in laboratory, field demonstration and full-scale field applications will be reviewed. The effectiveness of organoclays in these applications will be summarized. Approaches to effectively place the material in the field will also be summarized. The potential for organoclay as a capping material will be evaluated primarily on the basis of laboratory measurements of flow and sorption characteristics of organoclay after exposure

to water, gas and NAPLs. Organoclays were found to provide good control of both dissolved and nonaqueous phase contaminants. Contact with organoclay gave rise to significant swelling of organoclays and a simultaneous reduction in effective permeability of the organoclay. This could serve to enhance effective utilization of organoclays by forcing lateral migration around seeps but also discourage subsequent migration of NAPLs into a treatment layer. Implications of these results for the design and implementation of organoclays for NAPL control in sediments were assessed.

**Virginia Smith, M.S. Student**  
**B.S. Civil Engineering, Georgia Institute of Technology**

Throughout the various regions of the United States, droughts have had severe impacts.

Several monitoring and mitigation tools exist to give insight into drought conditions throughout the country. Currently, the National Oceanic and Atmospheric Administration is developing a National Integrated Drought Information System (NIDIS) to improve drought monitoring and mitigation. In concurrence with this tool, the state of Texas is developing a Texas Integrated Drought Information System (IDIS).

The goal of the Texas IDIS is to produce a website that will provide information and warnings concerning drought within the state. The website will obtain climate and hydrologic information and display it in a functional manner. This requires the development of webservices to integrate data from multiple sources. To establish this information system the Trinity River Basin and Lake Grapevine have been used as a prototype. The IDIS uses satellite data, drought indices, stream gage data and reservoir data to portray trends in drought progression through time. This allows for drought monitoring and classification on a river basin or county scale. In addition, a new survey interpolation technique has been used to extract a more precise bathymetry of Lake Grapevine. The precision of the bathymetry permits for a more precise analysis of the amount of water available in the reservoir.

**Thursday, October 25**

3:30 PM ECJ 1.204

**W. Andrew Jackson, Ph.D., P.E.**  
**Texas Tech University**  
**Associate Professor of Civil and Environmental Engineering**

*Production, Deposition, Occurrence, and Fate of Atmospherically Generated Perchlorate*

Perchlorate ( $\text{ClO}_4^-$ ) occurrence in groundwater has previously been linked to industrial releases and the historic use of Chilean nitrate fertilizers. However, recently a number of occurrences have been identified for which there is no obvious anthropogenic source. The possibility that  $\text{ClO}_4^-$  occurrence in surface and groundwater may have multiple origins (military, industrial, agricultural, or natural) complicates site characterization and efforts to assign responsibility for remediation. Other complications arise when assessing potential human exposure to  $\text{ClO}_4^-$ , especially if affected waters are used for drinking, livestock or irrigation of food crops. For example, human exposure to  $\text{ClO}_4^-$  has been documented in vegetation and in dairy milk. Our research shows that perchlorate is produced in the

atmosphere likely from reactions of  $\text{Cl}^-$  or  $\text{ClO}_x$  with  $\text{O}_3$ . This  $\text{ClO}_4^-$  is deposited through wet and dry deposition worldwide at low rates. In arid areas this deposition has accumulated along with other atmospherically deposited species resulting in a significant reservoir (up to  $1\text{kg/ha}$ ) of natural perchlorate present in the unsaturated zone of semi-arid and arid areas of the Southwest in the United States and potentially the world. The perchlorate is highly correlated to chloride concentrations which are known to have accumulated throughout the Holocene. This reservoir of perchlorate is sufficiently large to have a substantial impact on groundwater where irrigation from agriculture or urbanization is sufficient to flush accumulated salts. The final fate of deposited  $\text{ClO}_4^-$  is controlled by the subsurface vertical transport, microbial degradation and plant uptake. This relatively unexplored source may help to explain the growing reports of perchlorate in produce, milk, and other food items and should be considered when evaluating overall source contributions or drinking water standards.

**Thursday, October 18**

3:30 PM ECJ 1.204

**Thomas Pavlovic, Ph.D. Candidate**  
**B.S. University of Zagreb, M.S. Civil Engineering UT Austin**

*Impact on Ozone Formation from Sources with Variable Emissions of Highly Reactive Volatile Organic Compounds*

In the Houston area (HA), ground level ozone concentration can very rapidly reach unhealthy levels. The analysis of the sampled ambient data revealed that plumes of highly reactive hydrocarbons coming from the Houston industrial sites are those mainly responsible for the rapid ozone formation in the area. Ozone yields in these industrial plumes are roughly three times greater than those measured in the Houston urban plume. The study will test two major hypotheses.

First, the variability of emissions of industrial facilities, which are major sources of highly reactive hydrocarbons, plays a significant role in ozone chemistry in the HA. Second, the current modeling studies suggest emission reductions are more efficient when applied on actual continuously variable source, which most of the industrial sites are. Although HA is the focal point of this study, the basic modeling framework could be applied in other areas of the United States as well.

**Gookyoung Heo, Ph.D. Candidate**  
**B.S. Seoul National University**

*HO<sub>x</sub> radical chemistry in Southeast Texas: Diurnal variations and spatial distributions of OH and HO<sub>2</sub>*

Scientifically robust and feasible State Implementation Plans (SIPs) contribute to improving air quality for human health, and prevent the EPA from cutting off federal highway funds and bringing more severe regulations on air emissions as well. Air quality modeling supports SIP preparation processes by providing scientifically acceptable information; therefore,

photochemical modeling has been used in preparing ozone (O<sub>3</sub>) SIPs for the state of Texas for a long time.

Highly reactive radicals, OH and HO<sub>2</sub>, are key players in ozone pollution phenomena. However, significant under-predictions of OH and HO<sub>2</sub>, compared to the measurements during the Texas Air Quality Study 2000, have been found recently. In this study, concentrations of odd hydrogen radical (HO<sub>x</sub>; OH and HO<sub>2</sub>) in eastern Texas were simulated by using the Community Multiscale Air Quality model with the Model of Aerosol Dynamics, Reaction, Ionization, and Dissolution (CMAQ-MADRID). In the CMAQ-MADRID modeling, two different chemical mechanisms, Carbon Bond IV (CB-IV) and Regional Acid Deposition Model (RADM2) were used. The modeling period was a September 13 through 20, 1999 photochemical episode that occurred during the Big Bend Regional Aerosol and Visibility Observational (BRAVO) study. In this presentation, diurnal variations of OH, HO<sub>2</sub>, and the ratio of OH to HO<sub>2</sub> will be compared between modeling results from CB-IV and RADM2, and also between modeled concentrations and measurements to clarify the limitations of two chemical mechanisms in modeling OH and HO<sub>2</sub> correctly. In addition, spatial distributions of OH, HO<sub>2</sub>, and ratio of OH to HO<sub>2</sub> will be shown.

**Thursday, October 11**

3:30 PM ECJ 1.204

**Alison Skwarski, M.S. Student**  
**BS Environmental Engineering, Michigan Tech University**

Below the biologically active layer within sediment environments, porewater concentrations drive contaminant fluxes. Measuring porewater concentrations can provide an understanding of contaminant mobility and migration. However, low concentrations encountered in porewater can lead to difficulties in sampling and analysis. Solid-phase microextraction (SPME) has recently become a standard approach for extracting organic analytes from aqueous samples and studies have also shown it to be effective for sampling sediment porewater. While SPME contains many unique features, including the ability to detect extremely low concentrations and significantly reduce solvent consumption during extraction, many uncertainties still exist concerning the accuracy of this technique. This presentation will focus on the laboratory demonstration plan for using solid-phase microextraction to measure porewater concentrations. The overall goal is to move SPME from the laboratory into the field where porewater measurements can be taken in-situ. Along with the approach for sampling and analyzing porewater concentrations, two studies will demonstrate the use of SPME as a field tool.

**Shane Walker, Ph.D. Candidate**  
**BSCE, Texas Tech University**  
**MSE, University of Texas at Austin**

As global freshwater sources become increasingly scarce, the development of non-traditional drinking water resources, such as desalination, becomes important. The improvement of desalination technologies over the past several decades is promising, but

challenges in process recovery limitations, environmental hazards, and financial feasibility remain. This research investigates the performance of electro dialysis as an inter-stage treatment process to improve the recovery of typical brackish groundwater reverse osmosis treatment systems.

**Thursday, October 4**

3:30 PM ECJ 1.204

**Brad Eck, M.S. Student**  
**B.S. Mechanical Engineering, Texas Tech University**

Runoff from areas of bare soil, such as those found at construction sites and quarry operations impairs the quality of receiving waters by contributing suspended solids and other constituents. These areas must be stabilized and vegetation established before a Notice of Termination can be submitted to regulators. The objective of this project was to compare the stabilization performance of two composts (low and high organic matter), a wood based hydromulch, and seeded bare soil and to determine the amount of sediment and nutrients exported from each type of treatment. Ten test plots (8 feet x 40 feet) were constructed on a spoil pile at a quarry. Water quality and quantity data were collected for 12 storms during the first year after installation.

The data indicate that the compost mixtures were most successful at establishing vegetation, with almost full coverage after about four months. Runoff coefficients for the two types of compost were similar and about half that observed for the hydromulch and control plots, which were not significantly different. Water quality monitoring showed that the compost plots reduced the sediment discharge compared to the bare plots by about 97%. Even though both treatments reduced the load of total phosphorus discharged, dissolved phosphorus loads from all the treated plots were much higher than observed for the bare soil plot.

**Yongseok Hong, Ph.D. Candidate**  
**M.S. Civil Engineering, Korea University, Seoul, Korea**  
**B.S. Civil Engineering, Korea University, Seoul, Korea**

In sediments, metals are often contained in insoluble low bioavailability forms. Upon re-suspension, however, biogeochemical processes associated with the exposure to more aerobic conditions may lead to transformation and release of the metals, giving rise to exposure and risk in the water column. Further, tidal and other cyclic variations in oxygen, pH and other relevant parameters in the overlying water, may also lead to cyclic transformations and release of metals from surficial sediments. To understand the dynamics of the metal transformation and release processes and identifying the significance of these processes in the environment, a one dimensional diagenetic model was developed, focused on heavy metal speciation in sediment by implying surface complexation model. The model was compared with previously published experimental data and applied to zinc contaminated estuarine sediment to investigate the effect of overlying water pH changes in zinc release.

**Thursday, September 27**

3:30 PM ECJ 1.204

**Lisa Moretti, M.S. Student**  
**Tufts University, B.S. Environmental Engineering**

A full-scale field study was conducted at the McCormick and Baxter Superfund Site in Portland, OR to test the efficacy of using an active cap of organoclay to control seepage. The McCormick and Baxter Site is a former creosoting facility located along the Willamette River. Free-phase creosote had been detected in the river due to off-site migration of creosote. To prevent creosote from seeping into the Willamette River, a sediment cap was installed which incorporated the use of organoclay in known seepage areas. Organoclay is a modified-clay with organophyllic properties that can sorb non-aqueous phase liquid (NAPL).

The organoclay cap was evaluated 1-year after implementation to assess the cap performance. This presentation will outline the testing procedures and results from the post-implementation study.

**Donghyun Rim, Ph.D. Candidate**  
**M.S. Civil Engineering, University of Texas at Austin**  
**B.S. Civil Engineering, Hanyang University, Seoul, Korea**

Elevated exposure to indoor air pollutants can pose serious potential risks to the occupant health. Inhalation exposure to gaseous and particulate pollutants is associated with respiratory and cardiovascular disease as well as with the transmission of airborne infectious diseases such as tuberculosis and SARS. Knowing the pollutant transport mechanisms in indoor environment is necessary for developing exposure prevention measures. The objective of the study is to examine applicability of Computational Fluid Dynamics (CFD) for analysis of airflow and pollutant transport in an occupied space. The study is based on controlled experiments and numerical modeling. The experimental mock-up tests provide the basis to establish a reliable numerical model, which is used for investigating the temporal and spatial pollutant concentration in distinct environmental conditions. The study evaluates different ventilation strategies for controlling occupant exposure. Furthermore, the study identifies important factors which should be adjusted in CFD models to predict the transient pollutant concentrations with an acceptable accuracy.

**Thursday, September 20**

3:30 PM ECJ 1.204

**Dr. Mary Jo Kirisits , Ph.D.**  
**Assistant Professor**

*Lab Safety Practices*

Many Environmental and Water Resources Engineering graduate students work in the laboratories, and we want this to be a safe experience for everyone involved. The purpose of this seminar will be to highlight important aspects of chemical and biological laboratory safety, including things that you should do and things that you should not do.

**Clark Siler, M.S. Student**  
**B.S., Brigham Young University**

*WRAP Display Tool: ArcGIS Interface to the WRAP Model*

The Texas Commission on Environmental Quality (TCEQ) uses computer simulated water availability models to predict if water will be available for new or amended water rights. The Water Rights Analysis Package (WRAP), created by Dr. Ralph Wurbs of the Texas Water Resources Institute (at Texas A&M University), is the primary water availability model used by TCEQ. The WRAP Display tool, developed by the Center for Research in Water Resources (CRWR), is an update to an existing ArcGIS tool used to display the results of WRAP simulations in a geographic information systems (GIS) environment. This tool converts the formatted text (ASCII) WRAP output into a geodatabase and subsequently displays map and time series data found therein. These functions allow for automated access to and display of cryptic simulation output data. Furthermore, the geographic display afforded by the tool may reveal spatial relationships not readily shown in the raw text output. Finally, the marriage of the WRAP output to the ArcGIS environment provides a platform of additional data transformation and sharing through various editing and export options.

**Thursday, September 13**

3:30 ECJ 1.204

**Pat McNamara , M.S. Student**  
**B.S. Marquette University**

*Reducing Polymer Usage at Hornsby Bend Biosolids Management Plant*

Hornsby Bend Biosolids Management Plant treats sludge from Austin's two wastewater treatment plants. Prior to composting, the sludge must be dewatered to 18% solids; polymer is used to aid in this dewatering. During the last fiscal year, over \$500,000 were spent on polymer, a significant increase compared to the \$300,000 spent the previous year. The objective of this research is to determine ways that polymer usage can be reduced at Hornsby Bend. Plant data for the past several years were analyzed to delineate the problem. Optimal polymer dosing was studied on both the bench and full scale. The future work involves running lab-scale anaerobic digesters to test effects of influent solids concentration and detention time.

**Tony Smith , Ph.D. Candidate**  
**B.S. California Polytechnic State University**

*Evaluation of Biodegradation Potential in Contaminated Sediment to Determine Effectiveness of Capping*

A sediment cap is being considered for the remediation of Onondaga Lake in Syracuse, New York. The long-term effectiveness of the cap is dependent upon the ability of indigenous bacteria to degrade the contaminants of interest. Twelve sediment cores from the

southeast end of Onondaga Lake were tested for the biodegradation of BTEX, chlorobenzenes, and naphthalene by native bacteria. Pore water was extracted from cores by centrifugation then analyzed for concentrations of major ions. Pore water chemistry was reproduced in sediment slurries of either 1% solids (w/v) in aerobic conditions or 5% solids in anaerobic conditions. Contaminants were added to give a starting concentration of 1 mg/L. Slurries were incubated at 12°C and 22°C and contaminant concentrations were monitored for 3 – 5 months. Biodegradation was observed in most neutral pH slurries but not in alkaline slurries. Rates of gas generation in each core were also measured to assess the likelihood of gas-induced contaminant transport through the sediment cap.

### **Thursday, September 6**

3:30 PM ECJ 1.204

**Alexandria Boehm**  
**Assistant Professor, Environmental Engineering and Science**  
**Stanford University**

#### *Oceans and Human Health: Microbial Pollution of Coastal Waters*

In the USA, there were 20,000 beach advisory and closure days caused by elevated densities of fecal indicator bacteria (FIB) in 2005, up from 6,200 in 1999. These figures suggest that pollution of America's coastline is widespread, threatening the health of visitors who collectively make 930 million trips to the beach each year, and the tourism and recreation industries (the most rapidly growing sectors of the ocean economy). The majority (over 75%) of the advisories in the nation is caused by "unknown" pollution sources, limiting efforts to remediate contaminated coastal waters. Thus, uncovering FIB sources and elucidating how they may impact coastal water quality needs to be a top priority for coastal scientists and engineers.

I will illustrate how interdisciplinary studies using tools from molecular biology, coastal oceanography, and groundwater hydrology can elucidate important sources of FIB to nearshore waters. My lecture will include discussion of three important sources of FIB to nearshore waters, beach sand, polluted groundwater, and ebb flow from coastal lagoons, and the mechanisms via which they are transported from source to sea.

### **Thursday, August 30**

3:30 PM ECJ 1.204

**Jay Regan**  
**Assistant Professor, Civil and Environmental Engineering**  
**The Pennsylvania State University**

#### *The Ecology of Microbial Fuel Cell Anode Biofilms*

Microbial fuel cells (MFCs) harness the electrochemical activity of certain microbes for the production of electricity from biodegradable compounds, ranging from purified substrates such as acetate and glucose to complex wastewaters and cellulosic biomass. This

technology enables the capture of some of the energy stored in waste materials, presenting the potential for energy neutral or yielding waste treatment. While the power densities of these systems are still quite low relative to electrochemical fuel cells, they have increased by six orders of magnitude over the past decade largely due to improvements in reactor design that reduce the system internal resistance. With these advancements, the biocatalytic constraints at the anode biofilm are becoming rate limiting. A general model for anode reduction is that it is catalyzed by dissimilatory metal reducing bacteria, which make their living in natural systems by respiring extracellular minerals. Pure-culture tests with model iron reducers such as *Geobacter* and *Shewanella* spp. demonstrate the electrochemical activity of these bacteria, but the power densities achieved in these pure-culture systems is generally less than mixed-culture systems, perhaps due to synergistic interactions within the anode communities and the participation of currently unknown strains and mechanisms. My group has been using nucleic acid based techniques to characterize MFC anode biofilm composition and evolution. In some MFC systems we retrieve DNA sequences from known metal- and anode-reducing bacteria, but some biofilm communities show a dominance of bacterial groups with unknown phenotype. Bioprospecting with a novel isolation strategy has yielded unexpected isolates with iron- and anode-reducing capabilities, with some isolates approaching the power densities of mixed-culture systems. We are currently exploring biofilm architecture features, with the goal of better understanding this relatively unexplored microbial ecology to allow the engineering of biofilms that promote higher current densities.