

Process Engineering at EEES



The Department of Environmental Engineering and Earth Sciences (EEES) encompasses a wide range of research and teaching interests. It took many years for the breadth of EEES to reach its current stage. Dating back to the 1960s, the main focus was on water and wastewater treatment. Guided by Professor L.G. Rich, the Department gained national recognition for its emphasis on interdisciplinary education and research, weaving together fundamentals in the sciences and environmental engineering applications. In response to developments on the national level in the 1970s and 1980s, the process engineering focus area expanded to encompass air quality monitoring and control, as well as solid and hazardous waste management. Professors Tom Keinath, Leslie Grady, Jr., and Tom Overcamp have played the leading role in the growth and expansion of process engineering at EEES. More recent areas of interest include sustainability in water treatment and

biofuels production. The core faculty currently aligned with the process focus area are:

- **Dr. Kevin FINNERAN**, whose research includes biodegradation and biofuels production and the impact of metabolic pathways, microbial community or population dynamics, and competing factors that influence the fate and transport of metals, radionuclides, and organic compounds;
- **Dr. David FREEDMAN**, whose research includes development of bioaugmentation cultures, characterization of cultures that chlororespire γ -hexachlorocyclohexane, and evaluation of bioremediation strategies to treat high concentration of halogenated methanes;
- **Dr. Tanju KARANFIL**, whose research includes the behavior of nanomaterials in engineered and natural systems; formation and control of disinfection by-products during water and wastewater treatment and in swimming pools; and phase separation, specifically sorption and membrane processes and technologies;
- **Dr. David LADNER**, whose research includes redesigning reverse osmosis (RO) and nanofiltration membranes to decrease fouling; development of polymeric membranes and coatings; redesign of RO desalination to make it compatible with renewable energy; and developing membranes and processes that for algal biofuel production;
- **Dr. Tom OVERCAMP**, whose research includes modeling the dispersion and fate of pollutants in the atmosphere; air pollution control including scrubbers and bioscrubbers; and use of satellite and other remote sensing to monitor air pollution and its long-range transport.

In addition to mentoring current EEES graduate students, the process engineering area faculty are spearheading delivery of the new BS degree in Environmental Engineering, which launched in the fall 2010 semester with 18 undergraduate students.

Faculty Profile



Dr. Timothy DeVol, Professor, came to Clemson University upon receiving his Ph.D. in nuclear engineering from the University of Michigan in 1993. He initially worked as a post-doctoral assistant under Dr. Robert Fjeld on an on-line pulse-shape discriminating flow-cell scintillation detection system prior to accepting a tenure-track position in 1995. Dr. DeVol's primary teaching and research interests are in the nuclear environmental engineering and science focus area. Dr. DeVol regularly teaches courses in radiation detection and measurements, radioactive waste management and the nuclear fuel cycle, and environmental risk assessment. Current research projects include nuclear forensics education program, statistical analyses of time-series data, development of in-situ and field-portable analytical instrumentation for radioactive environmental contaminant quantification (which has resulted in two U.S. patents), and development of a completely on-line radiation detection laboratory. Dr. DeVol oversees the Environmental Health Physics program which is accredited by the Accreditation Board of Engineering and Technology (ABET) Applied Science Accreditation Commission (ASAC). Dr. DeVol is a certified Health Physicist (C.H.P.) and received the Elda E. Anderson award from the Health Physics Society in 2004. Dr. DeVol is married, has four children, and enjoys helping his children in all of their activities particularly the outdoor ones.

Chair's Corner

Dear EEES alumni and friends:

I would like to take this opportunity to wish you a happy and safe Holiday Season and a prosperous New Year. Despite challenges around the country and in our state, our faculty, staff and students have shown amazing and exemplary professionalism, productivity, and citizenship throughout the past year. The new research awards of our faculty reached \$3.1M in the past year, several of which are from keen national competitions. This is very impressive for a group of 16 faculty. We had a large incoming graduate student class, bringing the total number of graduate students in the Department to 100. We started a new undergraduate degree in Environmental Engineering. The first cohort of 18 students began this Fall. We organized another very successful Hydrogeology Symposium with over 300 attendees and 20 exhibitors. These and many other accomplishments are testaments for the strong core that exists in the department that we all should be proud of.



Two new faculty, Drs. Finneran and Ladner, joined the department at the beginning of the Fall semester. Dr. Grady received 2010 Industrial Water Quality Lifetime Achievement Award from the Water Environment Federation. Dr. John R. Wagner received The Catalyst Award, which is the South Carolina Science Council's highest award for a science educator. These are significant honors reflecting the significant career and contributions of Drs. Grady and Wagner to their fields. Several of our faculty have continued to serve on editorial boards of journals and national assignments. We are also very proud of the accomplishments of our students; several of them have received impressive national awards and recognitions as documented in this newsletter.

Our faculty and graduate students continue to explore interesting and challenging research problems, winning awards and recognitions, and successfully representing the Department at national and state meetings. This newsletter documents some samples of those activities. On the cover, you will see our feature article about our Process Engineering Program. This program was started by Dr. Linvil Rich in 1968, and it has been one of the strengths of the department for many years. Please visit our web page for additional information.

Alumni support can not be more meaningful at such challenging times. We greatly appreciate your contributions, and we are thankful for your continued and most generous support. THANK YOU!

Tanju Karanfil, Ph.D., P.E., BCEE
Professor and Chair

Student Awards

Ben Sharp, EE&S PhD, was selected as one of the recipients of the prestigious 2010 EPA STAR Fellowship.

Ting Shao, EE&S PhD, received the best paper award in from the Water Environment Federation Student Paper Competition in the Masters Division.

Christopher Patterson, Hydrogeology MS, has been named as one of the seven students nationally who have been named National Association of Geoscience Teachers Outstanding TAs for 2010.

John Kroon, Hydrogeology MS, has been selected as the 2010 recipient of the Donald A. and Mary O'Nesky Named Grant of the American Association of Petroleum Geologists. The AAPG Grants-in-Aid award is made in support of John's thesis research, "Molecular Biogeochemistry of Lower Huron and Cleveland Shales in Eastern Kentucky and Southern West Virginia. The Donald A. and Mary O'Nesky Named Grant is awarded annually to a deserving graduate student through the American Association of Petroleum Geologists Grants-in-Aid program, and is endowed by the AAPG Foundation with generous contributions from Don's many friends and associates.

Andrea Hicks, EE&S MS, was awarded a travel grant to attend the North American SETAC meeting in Portland, Oregon in November. Andrea will present her research titled "Greenhouse Gas Emissions from Small-Scale Conventional Wastewater Treatment".

Department/Faculty News

Environmental Engineering Undergraduate Degree

EEES now offers an Environmental Engineering degree. We offer a BS degree with two concentrations: Process Engineering and Natural Systems. This is the only program of its type in South Carolina. The degree is generating a lot of interest with students. Watch our video on our website about the new degree, <http://www.youtube.com/watch?v=1wBQ09zZgQA>

Faculty News and Accomplishments



Dr. David Ladner joined EEES in the Fall of 2010. He received his PhD in Civil and Environmental Engineering from the University of Illinois at Urbana-Champaign in October 2009, working with Mark Clark. His dissertation topic was membrane fouling in desalination facilities facing Red-Tide algal blooms. His research is making membrane-based water treatment processes more sustainable.

Dr. Kevin T. Finneran also joined EEES in the Fall of 2010. He received his PhD in Microbiology at the University of Massachusetts at Amherst in 2001. His research focuses on bioremediation of organic and inorganic contaminants, biofuel production by altering microbial metabolic pathways, and sustainable remediation. He is a co-Editor in Chief of the International Journal of Soil, Sediment, and Water. Before coming to EEES, he was an assistant professor in the Department of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign.



Dr. Leslie Grady was selected as the recipient of the 2010 Industrial Water Quality Lifetime Achievement Award from the Water Environment Federation. This award is an excellent and well-deserved recognition for all of the work his research group did in trying to understand the factors controlling the biodegradation of synthetic organic compounds as well as the work the industrial water quality group at Ch2MHILL did in putting this knowledge into practice. This is only the second year that this award has been given. Les will receive his award at the 2010 WEFTEC meeting in New Orleans.

Faculty News and Accomplishments, cont.



Dr. John R. Wagner, Professor Emeritus, received the South Carolina Science Council's highest award for a science educator on November 5th at the Council's annual convention at the Myrtle Beach Convention Center. The 'Catalyst Award for Educational Excellence' is presented each year to a science educator who has made a significant difference in the way science is taught in the state of South Carolina. Dr. Wagner was honored for his work in several K-12 curriculum development projects for the earth and environmental sciences, in particular the SC MAPS and SE MAPS programs; and for his many years of providing exemplary professional development opportunities for teachers through graduate courses, workshops, and field experiences.

Dr. Larry Murdoch received a new grant \$250K from NSF to evaluate how hydrologic processes alter the state of stress in the subsurface. The investigation will provide the scientific basis for new field techniques, theoretical analyses and instrumentation that will advance the ability to measure stress change in the subsurface."

Dr. Brian Powell and Yuji Arai will lead a \$1.18M project entitled "Development of a Self-Consistent Model of Plutonium Sorption: Quantification of Sorption Enthalpy and Ligand-Promoted Dissolution" funded by the DOE Office of Science, Biological and Environmental Research.

Drs. Larry Murdoch and Stephen Moysey have received \$450K from the DOE to study CO₂ storage. They plan to apply reservoir deformation techniques and high performance computing to CO₂ sequestration and possibly oil and gas production as well.

Dr. Tanju Karanfil received a new award in the amount of \$320K titled "Quantitative Structure-Adsorbability Relationships for Adsorption of Organic Chemicals by Carbon Nanotubes" from the National Science Foundation.

Dr. Stephen Moysey received two new grants from the Department of Defense to improve land mine detection using ground-penetrating radar.

Drs. Ron Falta and Fred Molz received an award entitled "Subsurface Thermal Energy Storage for Improved Heating and Air Conditioning Efficiency from DoD in the amount of \$971K.

Drs. Tim DeVol, Tanju Karanfil and Brian Powell received a \$400K Junior Faculty Development Award from the Nuclear Regulatory Commission.

Drs. Tim DeVol and Brian Powell both received Department of Homeland Security awards. Dr. DeVol received \$300K to develop nuclear forensic teaching capabilities; and **Dr. Brian Powell** received a \$300K junior faculty award.

2010 EEES Student Awards



A. Ray Abernathy Fellowship: **Christina Anderson**

Linvil G. Rich Fellowship: **Andrea Hicks**

Environmental Scholars: **Shanna Estes, Adam Mangel, Ting Shao**

Thomas F. Logan, Jr. Geology Merit Award: **James Christopher Ryan**

Jean G. Stillwell Award: **Chaquetta Denise Green, Austin Matthew Hodge**

Engineers Without Borders Projects

Liberia

For Clemson's chapter of Engineers Without Borders, the summer of 2010 began with two international trips to West Africa and Central America.

Jose Alfaro led a group of ten (10) students and one (1)

EWB sponsor to Liberia where they established an integrated rice-fish pond for growing tilapia and rice, repaired a rabbit nursery, built a peanut sheller, and taught local villagers how to construct an anaerobic digester for sustainable production of fuel.



El Salvador

Jim Chamberlain led seven (7) students and six (6) EWB sponsors to El Salvador to continue design of a potable water system extension to several villages. The students surveyed for the new water

lines and drilled a test well using a manual rotary drill rig that was donated to the local villagers. Dr. Mark Schlautman is a co-advisor for the group and Christina Anderson is the graduate student coordinator for two ongoing Creative Inquiry classes that continue to offer these excellent opportunities to undergraduate engineering students.

