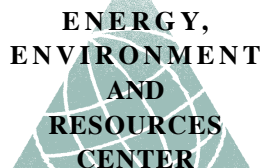


HIGHLIGHTS and INITIATIVES



EERC

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Jack Geibig,
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Office of Communications
David Brill, Director

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The EERC conducts unbiased, analytical,
and multidisciplinary research designed to
promote real-world solutions to problems
in the fields of energy, environment, tech-
nology, and economic development.

PROJECTS. Research Specialist **Kim Davis** and Research Scientist **Mary Swanson** (EERC's Center for Clean Products and Clean Technologies [CCPCT]) recently helped Green Seal develop an environmental standard and a *Choose Green Report* for floor finishes and floor strippers. Green Seal is a Washington, D.C., nonprofit that promotes environmentally responsible products. To encourage the manufacture and use of products that meet the guidelines, the standard lists environmental criteria for products that reduce or eliminate significant environmental impacts. The *Choose Green Report* makes specific recommendations of products that meet the criteria. Review the document on Green Seal's Web site at <www.greenseal.org/recommendations/CGR_floorcare.pdf>.

Senior Research Associate **Maria Socolof** (CCPCT) is serving on the development team of the Electronic Products Environmental Assessment Tool (EPEAT) project, which is funded by the U.S. Environmental Protection Agency. The multi-stakeholder project will design and implement a method for evaluating electronic products based on their environmental performance. To learn more, visit EPEAT's Web site at <www.epeat.net/index.htm>.

AWARDS. In April, EERC's Waste Management Research and Education Institute awarded \$3,000 stipends to six Ph.D. students who are conducting work in the area of waste management. This program, begun in 1995, attracts top students to UT and enables them to carry out their research. Award recipients are: **Ipek Celen (Biosystems Engineering)**, **Kendrick J. Curtis (Geography)**, **David Mann (Microbiology)**, **Pedro Tarafa (Civil/Environmental Engineering)**, **Ankur Roy (Earth and Planetary Sciences)** and **Jennifer DeBruyn (Ecology and Evolutionary Biology)**.

ENERGY. Energy Research Director **David Doane** recently completed an energy assessment for an East Tennessee auto-parts supplier. Based on his audit, **Doane** identified lighting, self-generation, heat-recovery, solar- and renewable-energy, and waste-reduction opportunities that will result in annual savings of \$200,000 for the customer.

Based on another recent assessment and **Doane's** recommendations, an East Tennessee wood products customer replaced its existing lighting system, achieving higher lighting levels and reducing its energy usage for lighting by 20 percent. **Doane** is conducting another study for this customer at a sister plant.

PUBLICATION. **K. Lynn Douglass**, a former graduate assistant (**Political Science**), and Research Scientist **Jean H. Peretz**, published "Experience from Three Residential Computer Collection Efforts in Knoxville, Tennessee," in *Natural Resources and Environmental Administration*, Spring 2004.

Probing Outer Space from Deep Underground



Each *Highlights and Initiatives* back page presents a closer look at one of our current projects or activities. This edition focuses on a collaboration that will help the National Aeronautics and Space Administration (NASA) in its search for life on Mars.

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Probing Outer Space from Underground

The Earth's most extreme environments, including ultra-deep South African gold mines, may help guide future research and exploration on Mars. • BY KRIS CHRISTEN

“What are the bacteria eating, what wastes do they generate, and how are things being recycled?”

USING TECHNIQUES developed for detecting microorganisms in deep, subsurface environments on Earth, University of Tennessee (UT) and Oak Ridge National Laboratory (ORNL) researchers are now working on tools to aid the National Aeronautics and Space Administration (NASA) in its search for life on Mars and beyond.

The idea is that just as subsurface microbial communities on our own planet have been isolated from the surface environment, so too have any microbes that may exist deep beneath the Martian surface, says Susan Pfiffner, a microbiologist with UT's Center for Environmental Biotechnology (CEB) and Center for Biomarker Analysis. Hence, methods developed to identify such microbes and the specific genes critical to their survival in extreme terrestrial environments could be brought to bear on any scientific and technological difficulties that may be encountered during the exploration of life on Mars.

With a five-year, \$5 million renewable NASA grant, the researchers are planning a series of laboratory and field experiments in extreme environments on Earth to help determine what types of life-detection instruments are needed for unmanned subsurface drilling probes on future missions to Mars.

As part of this effort, the UT and ORNL researchers have teamed up with others from Indiana University and Princeton University to form the Indiana-Princeton-Tennessee Astrobiology Initiative (IPTAI). Until it can get at Mars, the assembled IPTAI team of geochemists, chemists, microbiologists, and hydrologists will continue its investigations of life's origins and its physical and chemical

limitations in the deep and ultra-deep South African gold mines, Pfiffner says.

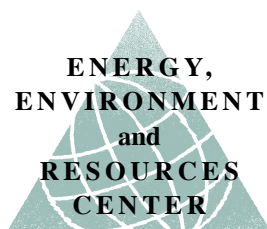
“We're looking at biogeochemical cycling—how are the bacteria going about their business, what are they eating, what wastes do they generate, how is that used, and how are things being recycled?” Pfiffner notes.

The team's next stop will be an Arctic field site whose environmental conditions are the most analogous to what one could expect to find on Mars. Here, they'll examine the microbial composition of the subsurface ecosystem and perform *in situ* experiments to see how these communities evolve in response to environmental changes.

In addition to the subsurface explorations and experiments, the researchers will also be conducting laboratory studies on the bacterial strains found at these sites to determine the processes that control energy and nutrient cycles in the deep subsurface. These experiments, which will rely on ORNL high-pressure bioreactors, will simulate the environmental conditions likely to be present at the Martian subsurface, such as very cold temperatures, low water activity, high salinity, and high carbon dioxide.

A key part of the IPTAI project also involves education and public outreach, which Pfiffner and **Kim Davis**, assistant director of EERC's Waste Management Research and Education Institute (WMREI), are heading up and CEB is helping to fund.

Overall, IPTAI's goal is to “gain a better understanding of our own world through research collaborations and the training of other scientists,” Pfiffner says. “This covers much more than astrobiology. The idea is as Earth changes, is there something we can learn from Mars to clean up our own systems?” •



For more information, contact Kim Davis, WMREI, The University of Tennessee, 311 Conference Ctr. Bldg., Knoxville, TN 37996-4134, or call 865-974-1847; or Susan Pfiffner, Center for Biomarker Analysis, The University of Tennessee, 10515 Research Dr., Ste. 300, Knoxville, TN 37932-2575, or call 865-974-8031.