



## BCOE Selected for ABET National Diversity Award

The accrediting body for applied science in higher education has recognized the College for its success in attracting underrepresented students to the engineering profession.

The Accreditation Board for Engineering and Technology (ABET) awarded one of three annual Claire Felbinger Awards for Diversity for the College's graduate and undergraduate recruiting record.

Chinya Ravishankar, accepted the award on behalf of UC President Mark Yudof, invited to attend the ABET Commission Summit on October 28 in San Antonio, Texas to accept the award.

## 'CE-CERT Process' to Debut in Riverside Clean Biofuel Pilot Plant

The California Energy Commission awarded a grant to CE-CERT to build a process demonstration unit (PDU) to convert biosolids and green waste from the City of Riverside into clean synthetic diesel fuel. The intent is to help California meet its goals for clean alternative transportation fuels.

The California Energy Commission (CEC) is investing \$1 million for a \$2 million project, to build a process demonstration unit at UCR's College of Engineering-Center for Environmental Research and Technology (CE-CERT) facil-

ity. The PDU scale unit will provide critical engineering data for a larger pilot plant targeted to be located at the City of Riverside's waste water treatment facility. This would be the final step prior to a full commercial-scale plant.

The CEC selected to fund the project which uses steam hydrogasification reaction invented at CE-CERT after an earlier project showed potential for converting wet waste streams to synthetic fuels at high conversion efficiencies. This project will focus on producing synthetic clean diesel fuel. See PILOT, p. 4

## Three Recognized for Service to CE-CERT

Three Distinguished Service Awards were awarded in the spring to recognize significant support of CE-CERT.

Jim Guthrie, president of Viresco Energy and Guthrie Construction Company, was presented the Distinguished Service Award for Industry for his many contributions to CE-CERT such as the establishment of the annual Guthrie Graduate Research Award.

Richard Luben received the Distinguished Service Award for Academia for his exceptional contributions to CE-CERT as Vice Chancellor of Research at UCR.



Dean Abbaschian (left) and Director Matt Barth (right) present a CE-CERT Service Award to Jim Guthrie.

James Boyd, Commissioner and Vice-Chairman of the California Energy Commission, was honored with the Distinguished Service Award for Government because of his outstanding support of CE-CERT over the years.

# Goliff Joins Atmospheric Processes Group To Participate in PACES Project, Phase II

Wendy Goliff has joined the Atmospheric Processes Group to work primarily with Bill Carter in developing and evaluating atmospheric chemistry mechanistic models based on smog chamber simulations. Her expertise will also be utilized in ambient field measurement studies.

Wendy earned her Ph.D. at UC Irvine in Chemistry from Professor Sherwood Rowland and then spent 10 years as a Research Professor at the Desert Research Institute (DRI) of the University of Nevada.

Goliff's research focuses on sampling and analysis of volatile organic carbon (VOC) in the atmosphere and gas phase photo-chemical mechanism development. While at DRI Goliff collaborated with Dr. Barbara Zielinska in collecting air samples using both canisters and Tenax adsorption tubes. These samples were then analyzed by gas chromatography with detection by flame ionization, and mass spectrometry.

She also collaborated with Dr. William Stockwell to further develop a VOC reaction scheme for the Regional Atmospheric Chemistry Mechanism, Version 2 (RACM2) in which the mechanisms for biologically emitted VOC and aromatic hydrocarbons were improved.

CE-CERT researchers have developed a chromatographic system which can measure a common volatile organic compound (VOC) used in paints. VOCs from many sources contribute significantly to the formation of ground-level ozone, the primary constituent of smog.

Texanol® is typically the most abundant VOC used in water-based architectural coatings. This compound has no other commercial use. While measurements have been made for indoor applications to determine indoor concentrations and in flow-through chambers to measure the emission rate as a function of time, there have been few reported attempts to measure Texanol® in ambient air.



*Dr. Wendy Goliff*

As part of Phase I of the Paints and Architectural Coatings Environmental Study (PACES), researchers at CE-CERT have developed a chromatographic system for measuring Texanol® in ambient air. Texanol® was observed in all nine samples collected during Phase I, with the concentrations ranging from 5 to 70 ppt.

With the ability to measure Texanol® at low concentrations, it is important to conduct further measurements of Texanol® in ambient air to determine its impact on ozone (smog) formation. As part of Phase II of the project, three monitoring locations are being sampled during the following year: one just downwind of the Los Angeles urban center (Pico Rivera), one near Azusa in the middle of the Southern California Air Basin (SoCAB) and one on the eastern side of the SoCAB (CE-CERT facility in Riverside).



## MEL Feted for 10 Years of Pioneering Emissions Measurement

Researchers, students and faculty paused on the afternoon of Sept. 29 to celebrate 10 years of achievement for one of the Center's most visible tools for measuring combustion emissions.

Reza Abbaschian, Dean of the Bourns College of Engineering, and Matt Barth, Director of the Center for Environmental Research and Technology (CE-CERT) joined many of the people past and present who have contributed to the success of the "Mobile On-Road Heavy Duty Emissions Laboratory."

The unassuming 53-foot tractor trailer truck, affectionately known at CE-CERT as MEL (Mobile Emissions Laboratory), can often be seen moving along California highways. But the truck is not carrying produce (the use for which it was originally designed); it is a state-of-the-art laboratory actively sampling emissions from vehicles in their natural habitat – on the roads.

"This laboratory is used by the EPA to set national standards – that was never anticipated in the beginning," said Wayne Miller, Manager of the Emissions and Fuels Group. Miller credited then-Center Director Joseph Norbeck for the vision of how it would fill the gap on diesel emissions data. Kent Johnson, Principal Development Engineer successfully implemented MEL with Don Pacocha operating the systems.

Today it conducts in-use emissions of many vehicles including trucks, locomotives and port equipment associated with commercial transport. It can also measure the chemical and physical properties of emissions. MEL has played a key role in testing advanced emission control technologies. Most recently it has catalogued the emission char-

acteristics of a wide range of bio-fuel formulations.

Heavy duty diesel engines are manufactured to exacting standards to certify that emission standards are met. But they meet those standards in controlled test conditions, said Dennis Fitz, CE-CERT Deputy Director. MEL is equipped to determine emission performance in real world conditions.

Built at a cost of more than \$1 million with support from the U.S. Environmental Protection Agency, MEL has been responsible for about \$10 million in research at the Center, sponsored by both industry and government to perform a wide variety of previously unavailable testing. "It has a lot of the uses we didn't even imagine in the beginning," Miller said. "Our thinking initially was very narrow." Addressing the many students attending the celebration, Miller said, "Always keep your visions broad as you do your research and explore things of importance to science and society. That's how your ideas will grow larger than even you thought they were."

Kent Johnson, offered additional statistics of the MEL's 10-year run. In that time 24,000 analytical samples have been collected during 7,500 tests and 5,000 calibrations. Five Ph.D.s were earned and many scientific papers and reports have their source in the mobile lab.

"This is a happy occasion for the campus, our college and CE-CERT as a whole," said Dean Abbaschian. "It just shows what teamwork can do. There are the ideas, and then there is the entire team that takes the ideas and turns them into reality. You should be proud of what you have accomplished."

# PILOT

Continued from Page 1

The ‘CE-CERT Process’ of steam hydrogasification was recently evaluated by the National Energy Technology Laboratory of the U.S. Department of Energy. Compared to all other mainstream gasification technologies, the CE-CERT Process was found to be 12 percent more efficient, with 18 percent lower capital costs.

Other partners in the project include the City of Riverside and Viresco Energy LLC of Riverside.

Among the advantages of the ‘CE-CERT Process’ is that it can use mixed fuel stocks, includ-

ing yard wastes, agricultural by products, waste wood, municipal wastes and sewage sludge, most of which currently end up in landfills. The state of California has committed to reduce petroleum use by the equivalent of 2.4 billion gallons per year by 2017. California already uses approximately 1 billion gallons of ethanol and 4 million gallons of biodiesel but more than 95 percent is imported from out of state.

The UCR project will help answer the engineering and economic questions of how efficiently steam hydrogasification can transform waste materials into renewable transportation fuels.

Current estimates are that California produces 83 million dry tons of biomass wastes per year, including agricultural and forestry wastes and wastewater treatment biomass that must be disposed of. Some 32.1 million dry tons of this biowaste is estimated to be practically available for fuel production.

## Biofuels Symposium Held at CE-CERT

CE-CERT hosted a UCR Biofuels Symposium March 12 which gathered some of the engineering faculty and as well as plant scientists at UCR.

The symposium's primary focus was highlighting UCR's research with 20 minute presentations from different faculty members. In addition, there were a few speakers representing industry.

The lunchtime keynote speaker was Joseph M. Cleary from National Renewable Energy Laboratory (NREL).



*Lab helper Laurie Graham and Engineer Mike Todd lead the charge up “The Rock” before a staff meeting and pot-luck. The climb becomes more difficult as you move around to the right.*

## Research Contracts Awards Total \$2.1M for Fourth Quarter of 2008, First Quarter of 2009

CE-CERT researchers were awarded \$2 million in new contracts during the past two quarters. Dr. Charles Wyman of the Sustainable Energy Systems Research Group was awarded over \$800,000 from Oakridge National Laboratory and Mascoma Corporation to further his research in pretreatment of biomass to enhance the efficiency of

producing ethanol used as a fuel additive.

Dr. Wayne Miller, the manager of the Emissions and Fuels Research Group, was awarded \$400,000 from the California Air Resources Board to test emissions from Port and Marine engines in addition to emissions from the main engines of ocean-going ships.



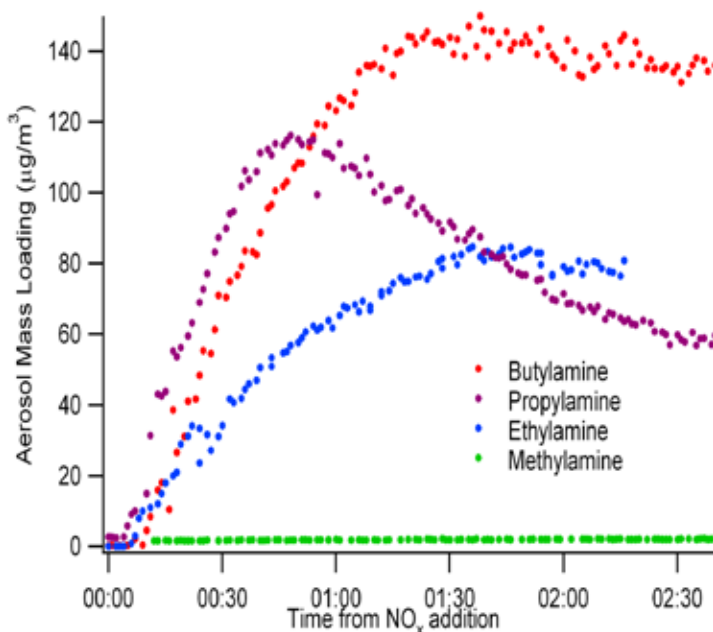
# CE-CERT's Smog Chamber Probes Aerosol Formation Processes from Gaseous Precursors

by Quentin Malloy

Professor David Cocker's research group has recently completed several studies using CE-CERT's atmospheric simulation chamber. These include aerosol formation from agricultural emissions, simulated aging of secondary organic aerosol (SOA), and the photo-oxidation of diesel exhaust. In addition to these laboratory studies, Cocker's group has studied the chemical and physical properties of smoke from biomass burning.

Along with researchers from Utah State University, Professor Cocker and graduate students Quentin Malloy and Li Qi recently published two papers detailing the formation of SOA from several commonly emitted VOCs from agricultural operations. This research is the first of its kind to identify aerosol formation from night-time chemistry involving these compounds.

In addition to the agricultural VOC experiments, graduate student Li Qi has recently focused



Time traces of aerosol formation from a series of experiments conducted at the CE-CERT environmental chamber.



Meng Cao (left) and Weihua Zhu of Electrical Engineering and Quentin Malloy (center) of Chemical and Environmental Engineering all earned their Ph.D.s in 2008-2009. Cao has headed up north to UC Berkeley to be a Postdoctoral Scholar. Zhu began his career as a Postdoctoral Scholar at CE-CERT under Matthew Barth. Malloy traveled east to Rice University in Houston, Texas for a Postdoctoral Scholar appointment doing research in Heterogeneous Chemistry. Congratulations to them all. CE-CERT wishes them the best of luck!

much of her time on tackling the issue of aerosol aging. Her work has utilized the atmospheric chamber's unique size advantage which allows for long-term experiments to be conducted. Her results will be useful in understanding the ability of SOA to participate in cloud formation processes as well as furthering our understanding of the toxicity and optical properties of these aerosols.

Another area where Dr. Cocker's group has been active is in the field of biomass burning and its physiochemical properties. He recently had the opportunity to conduct a large scale field project in collaboration with researchers from several other universities and federal agencies exploring this issue. His group deployed much of their instrumentation to a fire lab located at the University of Montana. Here they conducted a month long program, collecting data on both gas-phase and particle phase chemical composition. Results from this testing will be invaluable to state agencies and other researchers when attempting to assess the impacts of forest fires and local biomass burning on air quality.

# Durbin to Compare Diesel Emissions from California, Federal Fuel Formulations

The goal of Tom Durbin's new \$1 million program is to better understand and quantify the benefits of continued use of CARB diesel fuel in the State.

This program will compare CARB diesel fuels with Federal diesel fuels over a range of vehicle/engine technologies. The primary testing will be conducted using both engine and chassis dynamometer testing at CE-CERT.

It is initially planned that a total of three fuels will be tested, including a blend designed to represent an average CARB diesel fuel and two Federal diesel fuels, on at least three heavy-duty engines and a fleet of vehicles.

Both the engines and the vehicles will include a range of technologies that are representative of California's in-use fleet. In support of this program, CE-CERT will be constructing a new heavy-duty chassis dynamometer facility for the testing of heavy-duty vehicles under different driving conditions.



Tom Durbin

## Students Present at AAAR Conference

Professor David R. Cocker and CE-CERT graduate students attended the American Association for Aerosol Research International Aerosol Conference in St. Paul, MN to present and observe research findings.

Doctoral student Bethany Warren gave a well-attended 20-minute presentation titled "Secondary organic aerosol formation and chemical speciation for the cyclohexene-ozone system in the presence of water vapor and inorganic salts."

Graduate students Quentin Malloy and Ajay Chaudhary each presented posters, "Secondary organic aerosol formation from the photo-oxidation of m, o, and p-xylene," and "Effects of real-world driving conditions on gaseous and particulate emissions in-use heavy duty diesel trucks," respectively.

Additionally, graduate student Abhilash Nigam presented two well-received posters titled PM Emission Measurements from "Back-up generators: Method V vs. ISO 8178," and "Effect of fuel sulfur content and control technology on PM emissions from ships' auxiliary engines."

A recent CE-CERT collaborator, Ph.D. student Mikko Lemmetty from Finland, also gave a 20-minute presentation, "The effect of different dilution-cooling conditions on nucleation on diesel exhaust."



## Graduate Students Host 15th UC Transportation Center Conference

CE-CERT's graduate students held the 15th Annual University of California Transportation Center (UCTC) Student Conference Feb. 12-13 to welcome academia and professionals to share their research in the field of transportation. The goal was to encourage the participants from engineering, planning, and many other fields to interact with one another and to open up discussions on the fundamental problems in transportation.

See UCTC, p. 8



## Fifth Annual Exchange Joins CE-CERT, Chinese Engineering Students in Environmental Research

An environmental research summit between Chinese and UCR engineering students entered its fifth year on Monday, Sept. 28, when a delegation from Shanghai Jiao Tong University (SJTU) visited the Center for Environmental Research and Technology (CE-CERT).

The Chinese delegation was led by Associate Professor Lu Xingcai of SJTU's Research Center for Combustion and Environmental Technology.

The UCR and SJTU have been trading visits since 2005 to share environmental research results developed at the two research universities. The young researchers all shared an interest in new engineering solutions to dependence on foreign oil, pollutant emissions and greenhouse gases.

UCR students tended to look at pollution emissions from different sources and formulations of biofuels used in different classes of engines. Among the research presentations from UCR was one exploring the use of molten salts to store solar energy, and another explaining how reactor design alters the biofuels from cellulosic biomass.

Much of the SJTU students' research displayed an interest in modifying engine designs to obtain better efficiency and lower emissions. The

presentations included reducing diesel pollution using non-thermal plasma preoxidation, and producing hydrogen by the photocatalytic reforming of methanol.



*Students and faculty from Shanghai Jiao Tong University traveled to CE-CERT for the fifth research exchange between the two institutions.*

## Norbeck Extends Center's Ties to Thailand

The Thailand Institute of Scientific and Technological Research (TISTR) in collaboration with CE-CERT will conduct collaborative research in converting biomass to synthetic vehicle fuels, Prof. Joe Norbeck announced recently. The three-year collaboration aims at exchanging researchers, knowledge and technology transfer in the production of renewable synthetic transportation fuels from biomass.

This collaborative research aims to exchange researchers and knowledge on the research, and to further develop a novel hydrogasification technology for synthetic fuels production from biomass that was initially developed at UCR. The results of the collaboration will belong to both TISTR and UCR. Two TISTR researchers will come to UCR to conduct the research and UCR will send

researchers to implement its technology at TISTR.

The hydrogasification technology will be implemented at TISTR in the coming months. The decrease in a dependence on imported fuels and GHG gas emissions, the increase in the security of national energy and the development of Thailand's own green technologies are anticipated.



*Joe Norbeck at Thailand's TISTR*



# UCTC CONFERENCE

Continued from Page 6

On the opening night students and faculty from the UC campuses filled the CE-CERT training room to listen to a presentation by Mr. Wolfgang Hall, the Principal Consultant at ESRI (Environmental Systems Research Institute). Mr. Hall gave a lecture and a few demos on geographic information systems (GIS) with emphasis on transportation. The lecture generated a great deal of interest from both faculty and students and helped fuel the discussions afterward.

On the second day the conference took place at the new UC Riverside Commons and started with a plenary session given by faculty from the UC system and professionals from Caltrans. Following the plenary session, the faculty research session featured presentations by a number of faculty from UC Berkeley, UC Davis, UCLA, UC Irvine, and CSU San Bernardino. The luncheon speaker was UCR's Professor Charles Wyman who gave a presentation on "Powering sustainable

transportation by plants." After lunch, the students held a poster presentation with over 30 participants. The posters were judged by faculty. Julie Kang, UCR graduate student in the department of Psychology received the best poster award while second place went to Anh Vu, a UCR graduate student in Electrical Engineering

The student presentations came after the poster presentations, where students from the UC campuses and USC shared some of the research results that they gathered in transportation. During the dinner event, Professor Mohan Trivedi presented "Human centered, holistic systems for safer and smoother traffic" as a Mel Webber Memorial Annual Lecture. The conference received many positive responses thanks to the graduate students and the CE-CERT staff who put in the time to organize the conference and to the sponsors who funded the conference.

**UCR** | College of Engineering- Center for  
Environmental Research & Technology

1084 Columbia Ave.  
Riverside, CA 92507

Non-Profit Org. US Postage <b>PAID</b> Permit No. 131 Riverside, CA
---