



## CE-CERT Names a New Deputy Director

Mr. Dennis Fitz has been appointed as CE-CERT's Deputy Director, replacing the retired Andy McCue. He graduated with Master's degrees in both Chemistry and Applied Sciences from the University of California, Riverside, both under the direction of Professor James N. Pitts Jr., then the director of the Air Pollution Research Center (APRC). After graduation Mr. Fitz was a Research Specialist at APRC for nine years prior to becoming the manager of CE-CERT's Atmospheric Processes Group in 1993. At APRC he developed the outdoor Teflon smog chamber facility and was responsible for developing and maintaining air quality measurement techniques. His group at CE-CERT conducts research to determine the fate of air pollutants after they are emitted into the atmosphere using measurements and modeling. The primary focus is to determine the reactivity of air pollutants to form ozone and particulate matter. As Deputy Director one of his main initial challenges is to centralize document preparation and archiving.



## 2008-09 CE-CERT Scholarship Winners Announced

Ten CE-CERT students won scholarships for the 2008-2009 academic year. Dylan Switzer was named the winner of the Jim Guthrie Research award in recognition of his work on formation of aerosol from amines from animal feeding operations while under the supervision of Dr. David Cocker. Dylan, a sophomore, will receive \$500 toward his educational expenses.

CE-CERT awarded the 2008-2009 Ford Motor Company Undergraduate Scholarship to Edi Rocha. Edi is a senior in Computer Science & Engineering and is designing a solar electric vehicle under the direction of Dr. Matthew Barth.

The Esther Hays Graduate fellowship - with an award of \$5,000 - was given to Varalakshmi Jayaram, an outstanding second year graduate student. Varalakshmi works in the Emissions and Fuel Research Group.

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# CE-CERT Students Win Scholastic Awards

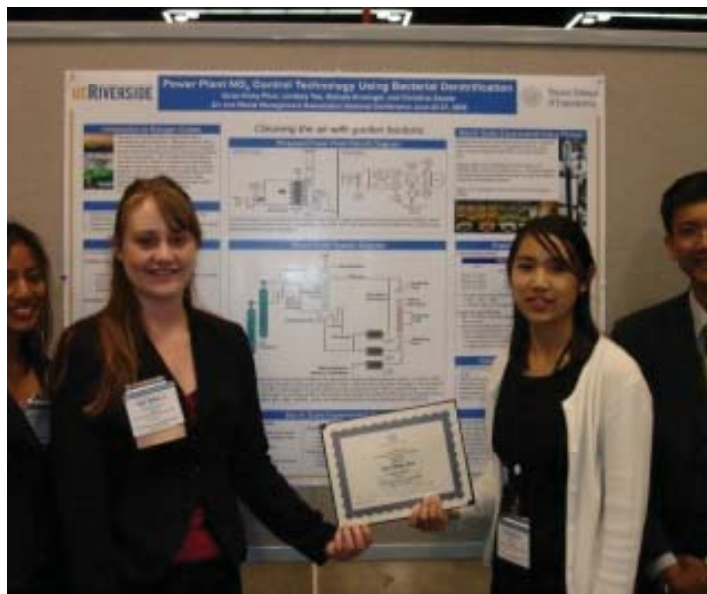
Quentin G.J. Malloy, a fifth year Ph.D. graduate student and Bethany Warren, a recent Ph.D. graduate were awarded \$1,000 scholarships from the Air and Waste Management (A&WMA) West Coast Chapter to compete in the paper/poster competition at the national A&WMA conference in Portland, Oregon in June.



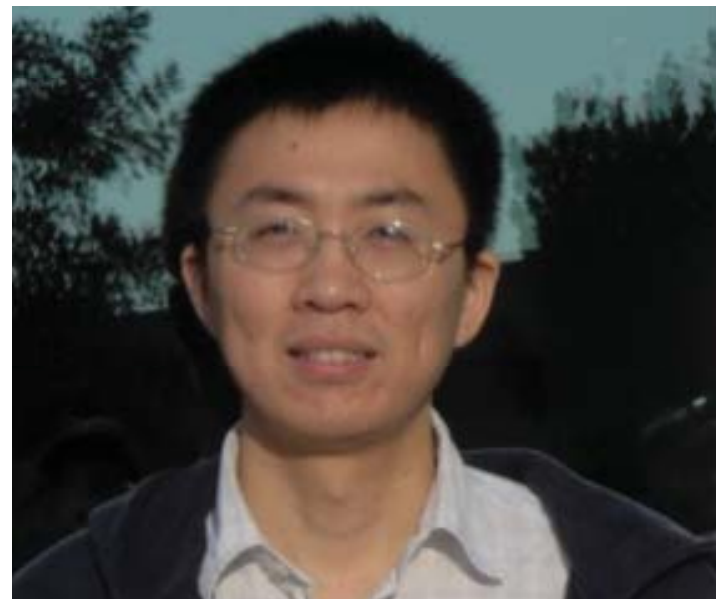
Harshit Agrawal, a third year graduate student at CE-CERT received a fellowship from MAN Diesel allowing him to work at their facility in Denmark for three months beginning August 25, 2008. MAN Diesel is the world's leading provider of large-bore diesel engines for marine and power plant applications which fits perfectly with Harshit's primary research focus, which is "Evaluation of Impacts of Marine Port Sources on Regional Air Quality".



Former undergraduate researchers Lindsey D. Yee and Christina Zapata also competed in the paper/poster competition with their research group (including Nichola Kinsinger, Quoc-Hung Phanand) and received first place in the undergraduate research category (\$800) for their project titled "Power Plant NOx Control Using Bacterial Denitrification".



Weihua Zhu was awarded a competitive internship award at ESRI, Inc. during the summer 2008, where he studied advanced geographic information systems navigation techniques.





# CE-CERT Researchers Win UCR Awards



David Cocker, a researcher at CE-CERT and a Chemical and Environmental Engineering associate professor, was chosen to receive the 2008 Outstanding Young Alumnus Award at the annual Alumni Awards of Distinction Banquet on May 17. After graduating with a double major in 1996, Cocker completed graduate studies at Caltech with John Seinfeld, a leading expert in the field of aerosol research. He received the prestigious NSF CAREER award in 2005, given to early-career academics that show great promise of becoming leaders in their fields. He is already recognized as an expert on aerosol formation in the atmosphere. Aside from performing research at the College of Engineering-Center for Environmental Research and Technology (CE-CERT) in the state-of-the-art atmospheric processes chamber, and in the Emissions and Fuels Research Laboratory, he holds teaching duties in the Chemical and Environmental Engineering department. At CE-CERT, he works alongside his wife Kathalena who he met in undergraduate classes at UCR. They have two young daughters, Allison and Caroline.



Dr. Wayne Miller, the manager of the Emissions and Fuels Research Group was announced as the recipient of the Distinguished Research-Instruction Collaboration Award (Non-Senate) for 2007-08.

Dr. Miller joined CE-CERT in December 2000 after a distinguished career with Sun Oil Co. and UNOCAL. Dr. Miller brings more than 25 years of experience in technology planning, chemical engineering processes, new product development/commercialization, business development and multi-national relationships. Dr. Miller's research interests range from the current characterization of emissions of mobile and stationary sources and their impacts on the public health to earlier research on technology management as it relates to the development of new products and the subsequent protection of the intellectual property. His current research on emissions from mobile and stationary sources has involved a multitude of mobile sources including: automobiles, trucks, buses, locomotives, military diesel equipment, construction equipment, aircraft, ground support equipment, harbor craft, cargo handling equipment and ocean going vessels. Dr. Miller holds a Ph.D. in Chemical Engineering from the California Institute of Technology and a B.S. in Chemical Engineering from Worcester Polytechnic Institute. Additionally, he has had training at the Harvard Business School and Wharton School Forum on emerging technology and emerging markets. Among this honor, Dr. Miller has earned others such as EPA's 2007 Climate Change Award for the Joint Strike Fighter (JSF) Project (team member), Honorary Judge for the Secretary of Defense Environmental Awards (2003-2004-2005-2006 and 2007) and U.S. Air Force's Arnold Engineering Development Center for its Annual Technical Achievement Award (2006).

# CE-CERT Researchers Evaluate Emissions From Animal Feeding Operations

Animal feeding operations produce a significant amount of air pollutant emissions. Ammonia and related organic amines are some of the most important of these emissions since they reacts with nitric and sulfuric acids produced in polluted atmospheres to create fine particles. Health effects studies have shown that fine particulate matter is a major contributor to premature deaths. CE-CERT researchers have developed methods to both measure ammonia emissions from these open sources and to evaluate the importance of organic amines using smog simulation chambers.

Ammonia emission measurements have been conducted using both the traditional spectroscopic measurements of ammonia downwind of these operations and active and passive flux diffusion denuder samplers developed by CE-CERT researchers. Shown below are these diffusion denuder samplers set up downwind of a dairy operation at heights of 1 and 2 meters above the ground. With an array of these samplers the emissions from an entire dairy can be estimated.

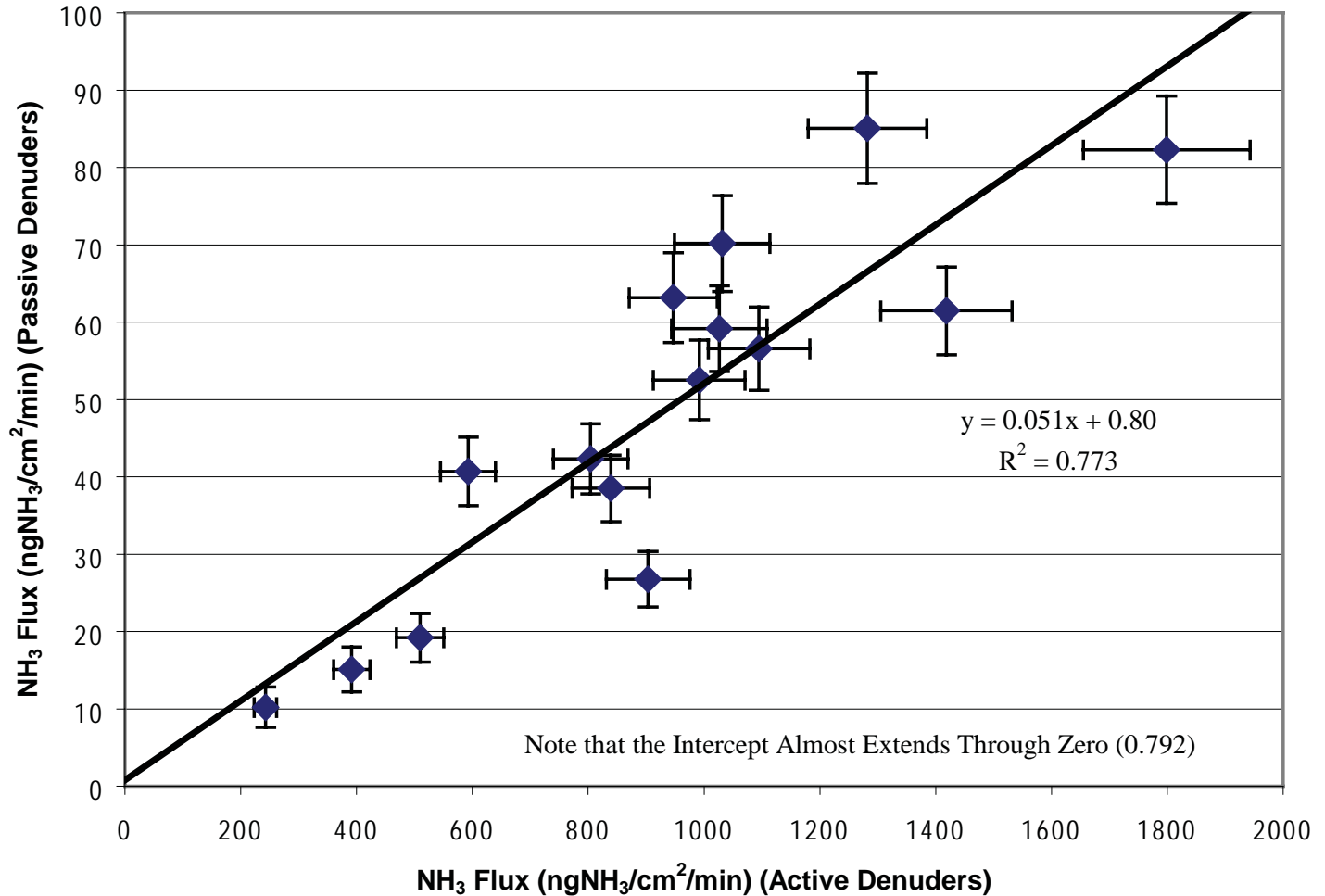


Advantages of the passive flux samplers are that no power is required and collocated measurements of wind speed and direction are not necessary. These devices are also much easier to locate on a tower so that the vertical extent of the emission plume can be

determined. The photograph below shows these samplers located at various heights up to 20 meters.



A comparison of the active and passive samplers was conducted. The flux from the active samplers was calculated by multiplying by the average wind speed and the flux from the passive samplers was determined from the dimensions of the same holder. The figure on the following page shows a plot of the results. A good correlation was shown. As expected, the passive sampler flux was about 20 times lower since the wind speed is significantly reduced by passing through the tube that holds the sampling substrate. The passive flux diffusion denuder developed by CE-CERT researchers was shown to be an accurate and economical approach to measuring these fugitive ammonia emissions.



## Probe Developed to Measure Ammonia Slip in Boilers using Ammonia Injection for NO<sub>x</sub> Control

More stringent control mandates for nitrogen oxide (NO<sub>x</sub>) has resulted in the broad based deployment of post combustion control systems, such as selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR). A growing segment of low NO<sub>x</sub> emitting boilers, or older, smaller capacity boilers, are being retrofitted with SNCR technology. Since the NO<sub>x</sub> control mandates are typically represented by emission tonnage caps, increased NO<sub>x</sub> reductions are often desirable and can be achieved early in the catalyst life cycle through increased reagent injection, with a concomitant increase in the amount of unreacted ammonia, or slip.

Continuous measurements of the NH<sub>3</sub> concentration downstream of the reaction zone are required to minimize NH<sub>3</sub> slip so as to avoid air heater fouling for those boilers firing a medium or higher sulfur coal. There are also a number of negative consequences associated with excessive NH<sub>3</sub> slip:

1. If it is the result of incomplete mixing, unreacted NO<sub>x</sub> will be emitted in excess of the permitted amount;
2. Even if the titration is complete, NH<sub>3</sub> will be emitted. This is not only a waste of reactant but causes its own emission problems;

3. In the case of fuels with appreciable sulfur content the excess  $\text{NH}_3$  slip leads to the formation of ammonium sulfate and ammonia bisulfate, solids which can seriously foul up tubing and produce a visible plume from the stacks. The fouling can result in plant shut-down for appreciable periods of time at a considerable cost;

4. Ammonia reaction with acidic coal ash can render it unsaleable to the cement industry. Disposal of ammoniated fly ash in land fills can also lead to  $\text{NH}_3$  pollution of ground water.

Non-extractive, optical methods can provide accurate real-time measurements of  $\text{NO}_x$  with low maintenance. UCR with Electric Power Research Institute (EPRI) support has been investigating optical methods specifically using tunable diode laser (TDL) spectroscopy for these measurements. One of the hurdles to overcome was the interference and fouling from the high concentration of particulate matter within the exhaust stream. Recently UCR and EPRI have developed a portable probe to overcome this problem and have interfaced it with a TDL instrument to make  $\text{NH}_3$  measurements.

Measurements were recently conducted at the TVA Johnsonville Plant in New Johnsonville, TN using this probe. Figure 1 shows the probe being installed. Figure 2 shows the data from three complete traverses, each running approximately 1.5 hours in duration. Note there is significant stratification to the walls, although there was very little slip in the center of the ducts. This showed that further optimization of the  $\text{NH}_3$  injection would be beneficial.

The development of these measurement techniques by CE-CERT researchers will help optimize the consumption of ammonia by these sources.



Figure 1

Unit 1  $\text{NH}_3$  Slip Measurements (9/05/08-9/06/08) TVA New Johnsonville Unit 1

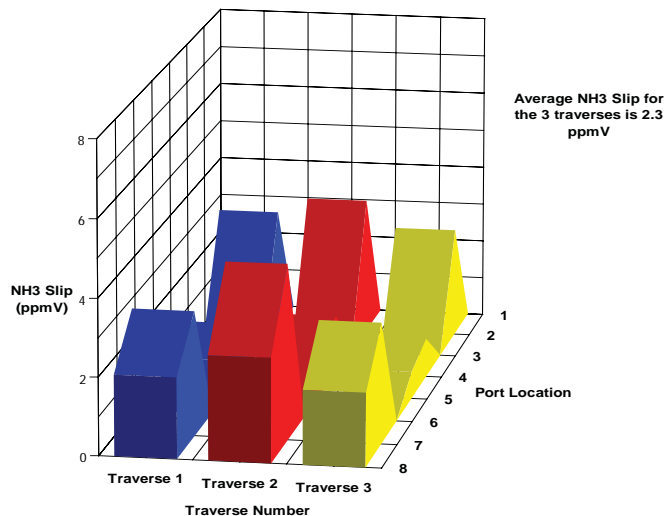


Figure 2

## Contracts Awards Reach \$1.4M for 2008 3rd Quarter

CE-CERT researchers were awarded \$1.4 million in new contracts during the 3rd quarter of 2008. The quarter's largest award went to Dr. Charles Wyman of the Sustainable Energy Systems Research Group. The \$491K award from the U.S. Department of Agriculture is being used to develop advanced continuous biomass hydrolysis and fermentation methods. Dr. Wyman also won \$200K from the Oakridge National Laboratory to characterize biomass pretreatment methods. Dr. Wayne Miller, the manager of the Emissions and Fuels Research Group was awarded \$255K from the Strategic Environmental Research Development Program (SERDP) to develop new tools for estimating and managing local/regional air quality impacts of prescribed burns. The other major award, \$206K, was to Dr. Chan Park from Viresco, Inc to perform design work for a hydrogasification pilot plant.



# CE-CERT Doctoral Graduate Lands a Job Down Under

A recent Ph.D. graduate, Dr. Bethany Warren, from the Atmospheric Processes Group is now employed at an Australian based environmental consulting firm, Pacific Air & Environment (PAE). Projects include development of emission inventories, specifically geared to global climate change as well as addressing the new California, Australia and international based green house gas regulations and trading systems. Other projects include plume dispersion modeling and the development of high resolution traffic emissions and fuel consumption modeling. PAE is one of Australia's most experienced air quality management firms and is internationally recognized as a leading authority in the specialized areas of emissions estimation, modeling and impact assessment. We are sure that Dr. Warren will be a great asset to the company and wish her the best.





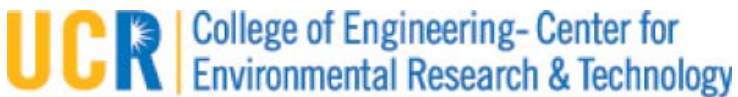
## WINNERS from p. 1

Another graduate student recognized for his outstanding performance was Yan Liu, a third year Ph.D. student in Chemical & Environmental Engineering who won the Pierson Graduate Fellowship with an award of \$5,000 to offset academic and/or research expenses. Working with Dr. Yushan Yan, Liu is developing materials that would allow microprocessors to be faster.

The Roberta Nichols Graduate Fellowship was awarded to Mike Vaona in the amount of 1,000 which can be used to offset educational expenses. This fellowship was named in the memory of Roberta Nichols, a great CE-CERT supporter who worked for the Ford Motor Company.

Four graduate fellowships from the UC Transportation Center were awarded. Jaclyn DeMartini, Julie Kang, Quentin Malloy, and Shunsuke Nakao each received \$20,000 to support their graduate research. Jaclyn is a first year Ph.D. student working for Dr. Charles Wyman. Her research involves

making ethanol from lignocellulose feedstocks, the inedible parts of plants. Julie Kang is a fourth year Ph.D. student in the Psychology Department. Her research applies cognitive psychology to transportation systems to improve driver safety and system efficiency. Quentin is a fourth year Ph.D. student in Chemical and Environmental Engineering. His research uses diesel emissions in smog simulation chambers so that he can determine the composition of the secondary organic aerosols that are produced. Shunsuke Nakao is a first year Ph.D. student in Chemical and Environmental Engineering. He studies the formation process of secondary organic aerosols in smog simulation chambers.



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