



# Vanderbilt Center for Environmental Management Studies

[www.vanderbilt.edu/vcems](http://www.vanderbilt.edu/vcems)

Spring 2006

*Earth Day 2005*

## VCEMS Hosts Symposium on Individual and Household Environmental Behavior

Speakers from the academic, government, nonprofit, and business worlds concluded that after more than 30 years of regulations targeted largely at corporations, individual behavior is now a major source of pollution. The symposium on Individual and Household Environmental Behavior, held last Earth Day at Vanderbilt, was co-sponsored by VCEMS and the Environmental Law Institute (ELI).

Individual environmental behaviors include backyard barrel burning, which is the largest current source of dioxin emissions. Similarly, individual activities such as driving cars and light duty trucks, and residential electrical and product use release almost a third of all ozone precursors. Although cars are at least 70-90 percent cleaner than they used to be, this is offset to some extent by more people now driving more miles.

While the environmental consequences of one person's behavior may be inconsequential, in the aggregate individual behavior negatively affects environmental quality. So how do you change behavior collectively?

The speakers examined the use of legal sanctions and economic incentives, including taxes and subsidies. Since these are often unpopular solutions, several speakers suggested that personal and social norms may provide at least part of the answer. "During an energy crisis, people will engage in conservation behavior on a short term basis, when it is relatively simple. But if the behavior is inconvenient or sustained, it probably won't work," said Ann Carlson, professor of law at UCLA.



Paul Stern, Michael Vandenberg, Linda Breggin and Leslie Carothers at the symposium.

Stephen Hetcher and Michael Vandenberg, Vanderbilt professors of law, suggested that norms that employ a sense of guilt or duty to act may be one answer. "For example, kids now wear bike helmets, and that is not a law. But people over time saw other people wearing helmets and thought that was a smart idea. Maybe we could incorporate that kind of learning into environmental matters," Hetcher said.

John Sheerin, retail environmental manager at Bridgestone Firestone Retail and Commercial Operations, and Art Gibson, vice president of Environmental, Health, and Safety with The Home Depot, talked about how their companies are trying to be good environmental citizens. "Companies that have such positive reputations not only do the right thing but typically have higher sales, consistent performance, customer loyalty, higher quality employees, and better publicity," Gibson said. Other speakers included Leslie Carothers (President of ELI) Paul Stern (National Research Council), and Prof. Daniel Farber (UC Berkeley School of Law) ■

OWEN GRADUATE SCHOOL OF MANAGEMENT \* LAW SCHOOL \* SCHOOL OF ENGINEERING

## Modeling Volcanic Plume Dispersion at Yucca Mountain

by Leah Spradley

One of the scenarios being evaluated for the potential High Level Waste repository at Yucca Mountain, Nevada is the intrusion of a basaltic dike into the disposal area, with subsequent venting of the magma at the surface. In this scenario, nuclear waste contained in the magma might be dispersed in a volcanic plume and subsequently deposited on the ground. People could then be exposed either to the ash deposited at their location directly, or by redistribution of ash falling elsewhere .

In the past, the Nuclear Regulatory Commission (NRC) has analyzed this scenario with models that assume a steady, unidirectional wind field blowing due south, toward the assumed location of the maximally exposed individual; i.e., the RMEI location. More recently, NRC has applied a similar model (known as TEPHRA) that takes into account the actual direction of the wind from a weather station near Yucca Mountain. This allows for a more realistic pattern of possible ash deposition in places other than the RMEI location, which is necessary to take into account redistribution of the ash by wind and water.

In an attempt to improve on plume dispersion calculations, NRC is experimenting with the HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) model developed by the National Oceanic and Atmospheric Administration to forecast potential contaminant plumes. The meteorological inputs to this model are based on input from many nearby and distant weather stations. Inputs to HYSPLIT are three-dimensional, time-dependent and also include many descriptors of the current meteorological conditions such as precipitation and humidity. Representing VCEMS, I was asked to assist NRC with this effort.

The work focused on running simulations on the deposition of ash predicted by the TEPHRA model and the HYSPLIT model, and then comparing the results. Both models make identical assumptions about the size and intensity of the initial volcanic column, and assume that all ash is released from a point source at the top of that column. The ambient meteorology that disperses the subsequent volcanic plume is assumed to be unaffected by the heat or

momentum of the initial volcanic column; the only processes causing the transport of the ash are the result of the ambient meteorological conditions.

The simulation results show the total deposition of ash at the RMEI as well as other pertinent locations. Results from the two models were compared on the basis of total ash deposited in the capture areas and average ash surface deposition.

The results of the HYSPLIT runs gave less total mass deposited. Similarly, the average deposition over the capture area was somewhat smaller for HYSPLIT. However, deposition at the assumed RMEI location was somewhat larger than the TEPHRA results. Because of the preliminary nature of this work, these differences are not fully understood at this time. It is not yet possible to confirm that the inputs to the models were similar enough to merit a fair comparison, nor that the conceptual models for the two approaches were similar.

TEPHRA and previous NRC analyses did not include the possibility of wet deposition. Therefore, an experiment was performed to estimate the importance of wet deposition. Under dry conditions the smaller diameter particles did not settle significantly before being blown out of the modeled area. However under wet conditions, nearly all of the fine ash was deposited into the modeled area, demonstrating the significant effect of rainfall on total deposition.

Future work on this project will attempt to determine if there are systematic differences in the conceptual models used in HYSPLIT and TEPHRA. Improvements to the HYSPLIT approach may include the introduction of a model to account for near-field effects of the vertical volcanic column, and the incorporation of spent fuel into the deposited ash. ■



## Green Marketing and Green Product Leadership by Jeff Gowdy

Going through the interview process, as I near the completion of my MBA, I am often asked the question, what is environmental sustainability?" The best way for me to answer this is to provide examples of what I worked on this summer at GreenOrder, a sustainability strategy and marketing firm ([www.greenorder.com](http://www.greenorder.com)).



The biggest chunk of my time this summer was assisting with GE's launch of ecomagination. Our first task at GreenOrder was to evaluate all of GE's products (from airplane engines to household appliances to wind turbines...) to determine which products could be promoted as "environmental leaders" in their respective industries. The most common metric used to determine this "leadership" was in green house gas emissions. This analysis found that 17 of GE's current products could safely be promoted as environmental leaders. These products were then massively advertised in print, on television, and on GE's website [ge.ecomagination.com](http://ge.ecomagination.com) under the marketing banner: ecomagination.

The launch garnered quite a large response. The GreenOrder website received an increase in emails from interested job seekers. Others in the eco/green/environmental world of business in NYC were quite interested in discussing the launch at conferences, meetings, and happy hours. Newspaper and magazine articles noted, quoted, and even led with the story. In early August, Forbes dedicated its cover page to a smiling mug of GE CEO Jeff Immelt with the tagline "GE Goes Green."

But has GE gone green? GE, the corporate felon that has been convicted dozens of times (just visit [www.cleanupge.org](http://www.cleanupge.org) to see the details), is now Green simply because they launched a marketing campaign? Well, no. And yes...kind of.

Ecomagination is simply a marketing campaign right now. But it is also a longer term, multi-billion dollar growth strategy for GE - to improve many of their products' environmental attributes in order to provide cleaner, more fuel efficient products and technologies to their customers. Why would GE do this? With tighter environmental regulations globally, rising energy costs, green house gas caps, and increased consumer education and demand for cleaner products...there is an emerging market for products that provide cost savings, through environmental improvements, for business customers.

Profitable solutions with a focus on environmental improvements - that's what I call a good step towards environmental sustainability. ■

VANDERBILT CENTER  
FOR  
ENVIRONMENTAL  
MANAGEMENT  
STUDIES



401 21ST AVENUE SOUTH  
NASHVILLE, TENNESSEE 37203  
PHONE: 615-322-8004  
EMAIL: [VCEMS@VANDERBILT.EDU](mailto:VCEMS@VANDERBILT.EDU)  
[WWW.VANDERBILT.EDU/VCEMS](http://WWW.VANDERBILT.EDU/VCEMS)

MARK D. ABKOWITZ, DIRECTOR, VCEMS  
VANDERBILT SCHOOL OF ENGINEERING

MARK A. COHEN, DIRECTOR, VCEMS  
OWEN GRADUATE SCHOOL OF  
MANAGEMENT

ATULYA TANKHA,  
PROGRAM DIRECTOR, VCEMS

---

VCEMS is a Vanderbilt University initiative jointly led by the Graduate School, the School of Engineering, the Law School, the Owen Graduate School of Management. Center activities are interdisciplinary and focus on environmental management, engineering, law and policy.

The Center is funded by corporate sponsors and by outside research grants. These funds are used to support curriculum development, student scholarships, research, executive seminars, leadership summits, and Center marketing and administration. Research grants for specific projects are sought from various sponsors, including foundations, government agencies, and corporations.

In compliance with federal law, including the provisions of Title IX of the Educational Amendments of 1972 and Sections 503 and 504 of the Rehabilitation Act of 1973, Vanderbilt University does not discriminate on the basis of race, sex, religion, color, national or ethnic origin, age, disability, or military service in its administration of education policies, programs, or activities; its admissions policies; scholarship and loan programs; athletic or other University-administered programs; or employment. Inquiries or complaints should be directed to the Opportunity Development Office, Baker Building, Box 1809 Station B, Nashville, Tennessee 37235 (telephone 615-322-4705; fax 615-421-6871).

# Environmental Courses

## CE 290. Reliability and Risk Case Studies

### Using the Past to Plan for a Safer and More Secure Future

by Mark Abkowitz

We live in a complex world, one where life has assumed a frenetic pace and society is demanding greater accountability in terms of safety and security. These circumstances have pushed issues related to system reliability and risk into greater prominence. Much can be learned about reliability and risk by looking retrospectively at historical events that have occurred, taking the lessons learned and applying them in the current environment.

This is what spawned the development of a new course, Reliability and Risk Case Studies, offered by the Department of Civil Engineering, but open for enrollment to any Vanderbilt upperclassman or graduate student. The course consists of a review of selected case studies involving successes and failures in managing reliability and risk. Cases are drawn from natural disasters (Northridge earthquake, Mount St. Helens eruption and Hurricane Georges), industrial accidents (Bhopal, Chernobyl, Exxon Valdez), aviation accidents (United Airlines 232, Challenger/Columbia), intentional acts (Aum Shinrikyo, Oklahoma City bombing, USS Cole) and other disastrous events.

Each case is discussed and debated on the extent to which factors of design, production, operations, organizational culture, human factors and exogenous events contributed to event occurrence and the severity of the consequences. Event consequences are analyzed in terms of

public health and safety, environmental impacts, community and business disruption, and the implications on regulation, legal liability and business code of conduct. Mitigation strategies are evaluated based on achievable goals, technical and political feasibility, and economic impact.

While much of the course focus is on “what went wrong”, some cases exemplify “what went right”, demonstrating to students that good risk management practice makes a difference. Among the lessons learned are:

- Risk is in everything and is everywhere.
- Human factors are the root cause of most failures.
- Safety culture in any environment is the key – when people care how safe things are, we all benefit.
- Proper Prior Planning Prevents Poor Performance.
- All too often, it takes a major disaster before appropriate safety regulations are enacted.
- A totally reliable and risk-free world is impossible to achieve; consequently, we must learn to tolerate certain risks in our lives.

Upon completion of the course, students have acknowledged a new perspective on the significance of reliability and risk in providing a safe and secure environment, and recognize the elements that require reliability and risk management attention in order to ensure successful outcomes. ■

## Alumni News . . . . . On to Greener Pastures

Long time VCEMS student Kristen Shepherd completed her PhD in Environmental Management in May, 2005. We are excited to announce that Kristen is staying on at Vanderbilt University. She was hired by Vanderbilt Environmental Health and Safety to coordinate the University's environmental, health, and safety management system and to manage the campus sustainability initiative. ■



# Research Focus . . . . PhD Students

**Derek Bryant** Each year over 30,000 oil or chemical spills are reported in the United States. Sound planning and response to these spills are critical to safeguarding human health and environmental resources. In order to assist individuals overseeing the planning for and mitigation of chemical spills, Derek is working with Dr. Mark Abkowitz to create a software application that will facilitate informed decision-making. This screening-level tool calculates threats from land-based spills to human and environmental receptors. Threats are calculated using a risk model that accounts for the characteristics of the spilled chemical as well as local environmental factors. The system is supported by a database containing information on hundreds of organic chemicals as well as environmental data that will ultimately include the entire United States. As such, the model calls for only minimal input from the user, which reduces data requirements and allows for quicker risk assessments. System outputs include color-coded risk maps that are produced using geographical information systems technology. These maps allow decision-makers with little chemical or environmental expertise to quickly and easily gauge the magnitude of threats presented by potential or actual spills. Data used in risk calculations are also available to the user to provide information critical to spill mitigation and to serve as a starting point for more in-depth risk analyses. Examples of potential uses for the system include the planning of hazardous chemical transportation routes, allocation of resources for homeland security, location of new industrial sites, and management of spill responses. ■

**Ann Olsen** Ann is conducting research on diffusion of the U.S. Green Building Council's LEED™ (Leadership in Energy and Environmental Design) Rating System. Rapid growth in use of the certification system for new commercial construction and major renovations since its introduction in 2000 is observed in the numbers of buildings certified under LEED™ and even larger numbers registered with the USGBC for possible certification upon completion. Additional measures of diffusion of LEED™ include the numbers of LEED™ Accredited Professionals and the numbers of organizational members of the USGBC. Ann's research examines early clustering of adoption of LEED™ in certain states and metropolitan areas of the U.S. and the subsequent process of diffusion. Ann has been active with the local chapter of the USGBC and was recently selected to serve as one of two delegates to the new USGBC Southeast Regional Council.

Ann received a small grant from the Office of the Provost to involve freshmen in the design of communications programs and signage to highlight LEED™ features of a new dining hall on campus. Vanderbilt Campus Planning and Construction (CPC) will seek LEED™ Certification for this dining facility and new residences comprising the freshmen Commons on the Peabody campus. The grant project also involves Associate Professors Sanjiv Gokhale (Civil & Environmental Engineering [CEE]) and Paul Speer (Human and Organization Development [HOD]), CPC architect and project manager Keith Loiseau, AIA, members of SPEAR (Students Promoting Environmental Awareness and Recycling), and undergraduates enrolled in HOD 2690, a new course exploring Corporate Social Responsibility. Ann is co-facilitating the course along with Associate Professors Speer and Joe Cunningham and two undergraduates, Leah Morgan and Stacy Tolos, who conceived and championed this new offering. Ann also assists Jim Clarke, CEE Professor of the Practice, in his freshman course, Technology and the Environment, by presenting a well-received class session about Sustainable Building. ■

**Marcella Recher** Marci is conducting research into how a firm's organizational characteristics influence facility environmental compliance with applicable environmental laws. In Spring 2005, Marci was awarded a Dissertation Enhancement Grant, which allowed her to go to several state environmental protection agencies to collect data for her doctoral research. Currently, she has completed her data collection and is working on generating results and interpreting analysis. ■

Visit our website! You'll find information on degree programs, details on upcoming and recent activities, downloadable versions of VCEMS research publications and newsletters, and much more!!! [www.vanderbilt.edu/vcems](http://www.vanderbilt.edu/vcems)

# Faculty Notes for 2005



## MARK D. ABKOWITZ, PH.D. Professor of Civil Engineering

**VCEMS** Director Dr. Mark Abkowitz continued to serve as a member of the Nuclear Waste Technical Review Board and as a member of the National Academy of Sciences, Transportation Research Board Committee on Hazardous Materials

Abkowitz appeared on Fox News, CNBC and other media outlets to discuss whether and how to rebuild the City of New Orleans. He also appeared on National Public Radio to discuss the risks associated with rail shipments of hazardous materials.

Dr. Abkowitz's recent publications include "An Integrated Risk Communication System for the Transport of Hazardous Materials", appearing in *Packaging, Transport, Storage & Security of Radioactive Material* (with John Minor), and "Predicting Storm-Induced Beach Erosion in Caribbean Small Islands", appearing in *Coastal Management* (with Edsel Daniel)

Dr. Abkowitz received funding from the Tennessee Department of Transportation and the U.S. Army Corps of Engineers to conduct research related to intelligent transportation systems and applications of advanced information technologies. He also served as a consultant to the BNSF Railroad, Federal Motor Carrier Safety Administration and the Japanese Ministry of Transport on hazardous materials transportation safety and security risk management. ■

Transportation.

Over the past year, Professor Abkowitz presented papers on "Factors to Consider in Assessing Transportation Risk" at the Best Practices in Radioactive, Mixed & Hazardous Waste Transportation conference in Phoenix, AZ and "Hazardous Materials Serious Truck Crash Analysis" at the 2005 International Truck & Bus Safety and Security Symposium in Alexandria, VA. He also visited nuclear waste facilities in Spain and the Waste Isolation Pilot Plant in Carlsbad, NM, as well as traveling to the islands of Montserrat and St. Kitts to discuss the development of national environmental management information systems.

During the aftermath of Hurricane Katrina, Dr.



## MICHAEL P. VANDENBERGH, J.D. Associate Professor of Law

**VCEMS** faculty member Michael Vandenberg's work focuses on the environmentally significant behavior of corporations and individuals. He published his most recent paper on corporate behavior, entitled *The Private Life of Public Law*, in the Columbia

*Without Social Norms: How Personal Norms Can Protect the Environment*, and presentation with two colleagues of a talk entitled *Air Quality Survey Revisited: Results from 2004 and 2003-2004 Combined* to the Vanderbilt Interdisciplinary Social Psychology Seminar in September. In addition, Professor Vandenberg worked with Professor Mark Cohen and Linda Breggin of the Environmental Law Institute to co-sponsor the symposium entitled "The Next Environmental Frontier: Individual and Household Environmental Behavior." Professor Vandenberg's paper from the symposium, *The Individual as Polluter*, has been published along with the other symposium papers in a recent issue of the Environmental Law Reporter. Professor Vandenberg's ongoing research includes several empirical studies with Professor Cohen and other social scientists on the effects of norms and beliefs on the environmental decision-making of firm managers and private individuals. ■

Law Review. He also presented the paper at law school workshops at Vanderbilt, the University of California – Berkeley, Florida State, Georgetown, and the Harvard Kennedy School of Government. The paper examines the influence on corporate environmental behavior that arises from the environmental terms in agreements entered into by private firms, such as credit agreements, real estate leases, merger and acquisition agreements, and good neighbor agreements. Professor Vandenberg's work on individual environmental behavior included publication in the Northwestern University Law Review of an article entitled *Order*



## MARK A. COHEN, PH.D.

### Justin Potter Professor of American Competitive Enterprise

**VCEMS** Director Dr. Mark Cohen continued his activities related to sustainability reporting. As a member of the Stakeholder Council of the Global Reporting Initiative ([www.globalreporting.org](http://www.globalreporting.org)), he is a member of its Management Team and Chair of the Educational Institutions Working Group. The GRI sets global standards for firms that report on the social and environmental impact of their organizations. Professor Cohen also served as a member of the U.S. EPA Science Advisory Board's "Illegal Competitive Advantage Economic Benefit Advisory Panel." In the Fall of 2005, this panel issued its report advising EPA on appropriate methodologies for calculating civil penalties for firms found in violation of environmental regulations.

Recent publications include: "Oil Pollution Prevention and Enforcement Measures and their Effectiveness: a Survey of Empirical Research from the U.S." in Proceedings of International Conference on Marine (Oil) Pollution: Legal Remedies in China, Europe and the US. Comparative Environmental Law & Policy Series (Eric Orts & Kurt Deketelaere eds.), "Individual and Household Environmental Behavior: What Does Economics Contribute to the Discussion?" *Environmental Law Reporter*. In addition, his April 2000 article on "Empirical Research on the Deterrent Effect of Environmental Monitoring and

Enforcement," earlier published in *Environmental Law Reporter* was reprinted in Making Law Work: Environmental Compliance & Sustainable Development, edited by Durwood Zaelke, Donald Kaniaru, and Eva Kruziková.

Professor Cohen recently completed a research paper with Owen Professor Nicolas Bollen ("Mutual Fund Attributes and Investor Behavior") which examines the investing behavior of socially responsible investors. This paper received Honorable Mention for the Moskowitz Prize for outstanding research in the field of socially responsible investing. Professor Cohen was interviewed and the paper was quoted in the Wall Street Journal (2005) and it has been mentioned on National Public Radio show "Morning Edition" and elsewhere.

In April 2005, Professor Cohen hosted a one-day symposium in Nashville on the role of individual behavior in environmental protection (along with Professor Mike Vandenberg of the Law School).

After spending two years in the Dean's office at Owen, Professor Cohen is very happy to be back on the research track and is starting up several new research projects – including projects on the role of individual norms and environmental behavior jointly with Professor Michael Vandenberg (Law School), Ken Wallston (School of Nursing), and Sally Simpson (University of Maryland). ■



## James H. Clarke, PH.D.

### Professor of the Practice of Civil and Environmental Engineering

**VCEMS** faculty member Jim Clarke, Professor of the Practice in the Department of Civil and Environmental Engineering, has been appointed to the Nuclear Regulatory Commission

(NRC) Advisory Committee on Nuclear Waste (ACNW). This group advises the Commission on many issues associated with the management of

radioactive waste, including the Yucca Mountain Project. Jim will serve as the lead member in the areas of Decommissioning of Nuclear Materials Sites under the NRC License Termination Rule and Risk-Informing Non-Reactor Regulatory Activities. During this past year, he chaired working group meetings for the ACNW on the proposed revisions to the NRC decommissioning guidance and on performance assessment approaches to the West Valley Demonstration

Continued on Page 8

## Continued from Page 7

Project decommissioning. The West Valley N.Y site was the location of the only commercial plant in the U.S. that reprocessed spent fuel.

Kevin Kostelnik completed his Ph.D. in Environmental Management under Jim's direction. His thesis title was "An Analysis of Institutional Responsibilities for the Long Term Management of Contamination Isolation Facilities". Kevin, Jim and their colleague, Dr. Jerry Harbour of the Idaho National Laboratory, have several conference presentations and journal articles on this and related topics.

Dr. Clarke continued his collaboration with Professor Gene Leboeuf (Department of Civil and Environmental Engineering) in the development of a mathematical model framework for contaminant transport across the ground water - surface water interface, through a grant from DuPont. This work is being submitted for publication as well.

Finally, Jim has also been appointed to the Executive Board of the American Nuclear Society Division of Environmental Science. ■

## Environmental Groups on Campus

Several student groups at Vanderbilt have been involved in the development and promotion of campus sustainability. SPEAR is an undergraduate student group focused on promoting recycling, raising awareness of environmental concerns and energy efficiency, and integrating environmental performance into the habits of the university community. Emerging Green Builders is for students and young professionals in middle TN, focused on integrating members into the green building movement. Net Impact is a group of MBA students committed to using the power of business to improve the world, primarily focused on environmental and social responsibility. Environmental Law Society is comprised of Law students interested in learning more about environmental law and possible environmental legal careers.

## Electronic copy of future newsletters?

Let us know if you would like to receive electronic copies of future newsletters.

**Phone: 615-322-8004**

**E-mail: [vcems@vanderbilt.edu](mailto:vcems@vanderbilt.edu)**

Vanderbilt University  
Vanderbilt Center for Environmental Management Studies  
401 21st Avenue South  
Nashville, TN 37203

**Non-Profit  
US Postage  
PAID  
Nashville TN  
Permit # 777**