

Institute for Environmental Science and Policy

Inside

<i>Letter from the Director</i>	2
<i>Current Research</i>	3
<i>Workplace Research: Nurtan Esmen</i>	3
<i>Transportation Research: Jane Lin</i>	4
<i>Groundwater Research: Kathryn Nagy</i>	5
<i>Faculty Achievements</i>	6
<i>Upcoming Events</i>	6

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ILLINOIS BOARD OF HIGHER EDUCATION GRANTS PERMANENT STATUS TO IESP

In December 2007, IESP received its final required approval to be designated a permanent institute at UIC. That approval came from the Illinois Board of Higher Education (IBHE), and followed a series of preliminary approvals from committees and boards at both UIC and at the state level. Since its start-up in 2001, IESP had interim status as a unit at UIC.

IESP's written request for permanent approval stated that the Institute's mission is based on the concept that solutions to modern environmental problems facing society are increasingly regional and global in scope, and require collaborative expertise from many areas. It noted that the economic growth and productivity of the State are directly dependent on the health and well-being of its citizens and sustainability of its ecological systems.

The document describes how the Institute, through its programs, addresses multiple policy areas of



The Illinois Commitment, which is intended to guide institutions of higher education in ensuring continued responsiveness and relevance to the needs of

the State. It also noted that IESP's mission is congruent with the strategic goals of UIC as expressed in the UIC 2010 Strategic Thinking report – specifically, the goals of outstanding education, cross-disciplinary scholarship, the Great Cities Commitment, attractive work environment, and visibility.

The document submitted to IBHE described new initiatives of the Institute, including research on urban environmental sustainability and environmental impacts of nanotechnology, and greater interaction with UIC's medical complex.

With this terrific news capping an already productive 2007, IESP can now plan for its future with an additional sense of certainty and knowledge that its important contributions will continue and expand.

Mission Statement

The mission of The Institute for Environmental Science and Policy (IESP) at the University of Illinois at Chicago is to advance multidisciplinary research and scholarship within the environmental and health sciences, engineering, economics, urban planning and the social sciences among UIC's faculty and students, to prepare the next generation of environmental scientists and decision makers, and to transmit workable solutions for environmental problems to the public sector.

FROM THE DIRECTOR



Thomas L. Theis, Director, IESP

“Environmental research and related activities also need to address real-world problems and generate real-world solutions.”

- Thomas Theis

In just the past few years, awareness of environmental issues, among all groups, has increased substantially, as has the understanding that solutions to environmental problems are complex and intertwined with the many functions of our society. Sustainability has become a common, if not fully understood, concept in virtually all areas of inquiry, from science and engineering, to business and commerce, to planning and policy, to philosophy and ethics. But as has always been the case, decisions on what to do about our problems must still be made, and actions are called for. Last year IESP, along with several other campus organizations, urged then Chancellor Sylvia Manning to initiate a process whereby the UIC community would take up the many-faceted issues associated with the creation of a sustainable campus. The committee spent many hours assembling a series of ideas and best practices that, taken collectively, will form the basis of further actions. The complete report is available on the IESP website, www.iesp.uic.edu.

The core of the sustainability paradigm is concerned with the equitable allocation of resources among present *and future* generations. This is a tall order, given the uncertainties involved, and the loftiness of the stakes. In a university, our principle product, and resource, is knowledge, which we help to create through our scholarship, impart through our classes and laboratories, transfer through practice, and archive through our libraries. The Campus Sustainability Task Force was acutely aware of the need to integrate its work across the various functions of UIC, including our pedagogical work. IESP is presently coordinating the process of engaging the UIC community of scholars in advancing this need

through a series of “Town Hall” style meetings, the first of which will take place, fittingly, on Earth Day (April 22). In future newsletters we will report on the results of these meetings.

This newsletter also summarizes our recent activities in the areas of research, training and engagement. Of special note is the granting of permanent status to IESP by the Illinois Board of Higher Education in December 2007. We look forward to continuing to thrive, and expand our efforts, in the years ahead. I hope you enjoy this snapshot of IESP’s activities, and I welcome your comments and suggestions.

Thomas L.. Theis,
Director



Current Research

New Faculty Cluster

A key strategy to build environmental collaborative research success at UIC has been through the Faculty Research Cluster Program. Grants provide seed funding to a faculty research team to jointly explore a research theme or a portfolio of research projects that will over time develop into a full research proposal for external funding. Current faculty clusters include:

Greenhouse Gas Emissions from Wastewater Treatment Plants and Engineered Wetlands. Faculty from Earth and Environmental Sciences and Biological Sciences have partnered with The Wetlands Initiative and Metropolitan Water Reclamation District of Greater Chicago to research GHG emissions from wastewater treatment processes and engineered wetlands. They are focusing on global atmospheric methane and nitrous oxide, atmospheric concentrations of which have increased significantly – and they have greater global warming potential than CO₂. Several locations in Illinois are serving as excellent laboratories for the studies.

New Research Initiatives

Urban Environmental Sustainability. This initiative aims to establish the academic infrastructure to explore innovative solutions to urban environmental problems stemming from the consumption of materials and energy, and to expand the concept of life cycle thinking throughout the various disciplines at UIC with a view of enriching the already strong focus of UIC on great cities.

Environmental Impacts of Nanotechnology. Sectors where nanoproducts or nanomanufacturing (in the 1-100 nm-size range) are being used today include ceramics, membranes, coatings, composites, skincare products, biotechnology, semiconductors, and thin films. This area is growing rapidly, with new applications and products expected to be developed in the near term. However, nanomanufacturing methods may create toxicity, and their effects on both health and the environment need to be better understood.

Nurtan Esmen: Understanding and Protecting the Working Environment

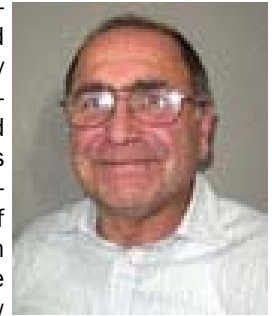
Cobalt is a chemical used worldwide in the manufacture of many metal products. Cobalt with tungsten carbide is considered by the International Agency for Research on Cancer (IARC) to be probably carcinogenic to humans (Group 2A). Lung cancer is the primary concern. However, according to IESP and Environmental and Occupational Health Sciences Professor Nurtan Esmen, the evidence in that regard is limited, and many companies, workers and governments would like to put this issue to rest. That's where Esmen and his colleagues come in.

Esmen and his colleague Dr. Gary Marsh of the University of Pittsburgh's Graduate School of Public Health are currently studying the effects of occupational exposure to jet engine manufacturing materials. They have completed similar studies on formaldehyde, smelter operations, arsenic and man-made mineral fibers, among others. The International Tungsten Industry Association, based in Belgium, turned to them to conduct a study of cobalt, which is used as a binder in tungsten carbide manufacturing. Tungsten carbide is a hard metal with major worldwide industrial uses, including use in the manufacture of cutting tools, saws and blades, in addition to military applications.

Esmen and Marsh are in the initial phase of the study, identifying which factories in which countries have sufficient information for purposes of the study. While up to 18 countries are being considered for inclusion, they need to possess good mortality records, cancer registries and related information and databases in order to be eligible subjects in these types of studies.

The main study, which is expected to last for four to five years, will start this coming fall. For that, Esmen, Marsh and colleagues will examine factories and their proc-

esses, look at records, take measurements, collect cause-specific mortality records for the entire cohort and "interview workers – in many languages," says Esmen. Fortunately, graduate students and some international colleagues who will be involved in the project come from a variety of countries and can converse in a number of languages. The study "will go back quite a few years – to the 1950s, or even earlier, since the industry goes back to the end of the 19th century, and an early start date to provide sufficient passage of time for cancer latency is important," says Esmen.



If the new epidemiological research does confirm the carcinogenicity to workers of cobalt exposure, the impact on the industry could be severe. Esmen says that IARC would probably then designate cobalt in conjunction with hard metal use as a known human carcinogen (Group 1). If so, many countries may ban its use or may require its replacement with a safer material. Unfortunately, such a material or process will have to be developed as an "off the shelf solution" does not exist.

How does this study fit into Esmen's work as a whole? "In general, I apply math and engineering principles to occupational health, whether it is epidemiology, experimental design and analysis, modeling or the physics of aerosols," he explains. As this study progresses, it should lead to results that are as important in the field of environmental health with real-world implications for industry and workers.

Lin's Research Connects Transportation and the Environment

Cars, trucks, buses and other vehicles are a major contributor to poor air quality and other environmental concerns, and a recent national study showed that Chicago's traffic congestion is getting worse. So developing and evaluating technologies and policies that can reduce congestion and lessen the emission of harmful compounds from vehicles are critical parts of improving the environment. Jie "Jane" Lin, Assistant Professor of Civil & Materials Engineering and of IESP, and affiliate of UIC's Urban Transportation Center, is exploring various facets of these issues through timely projects that have important real-world applications.

One of her projects focuses on Chicago Transit Authority buses, which have all been equipped with GPS systems that provide real-time travel information – "a rich data set," Lin says. This information can be provided to customers and can help the CTA track its performance. The GPS systems also allow CTA buses to be used as "probes" to predict traffic conditions – information that can potentially be provided online to anyone, including other drivers. Additionally, researchers can use the information on speed, acceleration and deceleration of buses to estimate emissions, which could then be used to take actions to reduce congestion and vehicle emissions. Lin says that feedback on a paper that she and a graduate student have written on this "is that using bus probes in this way is quite promising."

A transportation issue that one tends to hear less about is freight, a broad term that includes all modes of transporting goods. Lin has developed a model that, taking into account factors like how goods are moved, different development scenarios, and effects of various regulations, can predict the amount of truck traffic on highways and their emissions. A policy analysis can then explore ways of reducing emissions. Lin and a graduate student are now expanding the truck model to rail, for which estimating emissions "is a complicated problem," says Lin. "It depends on the kind of commodity," as well as distance and the cost and size of the shipment. The lack of publicly available adequate freight data makes the estimation even more challenging.

A project Lin is exploring that has especially significant ramifications for policy is an evaluation of Congestion Mitigation and Air Quality analyses. Under the federal Clean Air Act Amendments, municipalities that are not or previously were not in attainment with air quality standards must submit these studies to EPA when they are considering undertaking an activity, such as building a road, in order to show that the proposed activity will not worsen air quality. Lin is in discussions with a local planning organization about carrying out a study of how these analyses are conducted and how effective they are. She would do this by examining air quality impacts both prior to and after the road building or other transportation-related activity is carried out – which is currently not required as part of the reports.

And on a broad level, Lin organized and facilitated the Particulate Matter (PM) Peer Exchange Meeting that was held in October 2007 and sponsored by the Illinois Department of Transportation and Illinois Center for Transportation. The objectives of the event were to convene state transportation staff from the seven Midwestern states and staff of the Metropolitan Planning Organizations, U.S. EPA, Illinois EPA and other agencies in a small setting to exchange ideas and experiences about PM "hot spot analysis," including challenges in practice, research needs, and practical guidelines. PM hot spot analysis refers to new EPA regula-



Jane Lin, Assistant Professor

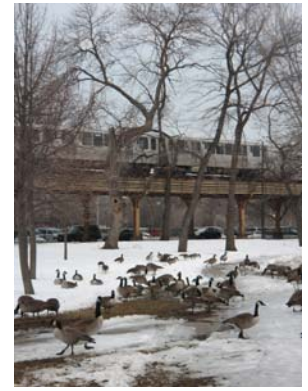
tions in March 2006 for performing PM_{2.5} and PM₁₀ Hot-Spot Analyses and Transportation Conformity Determinations for transportation projects located in areas that do not or previously did not meet the National Ambient Air Quality Standards for PM_{2.5} and PM₁₀, i.e., EPA designated non-attainment and maintenance areas. Non-attainment areas for PM_{2.5} (ultra fine particles with a diameter of 2.5 micrometers or less, inhalation of which have been found to be associated with numerous health effects) include the Chicago metropolitan area.

How did transportation become Lin's passion? "It's so close to everyday life," she says. "Everyone can tell you a story about a travel experience. And transportation engineering is a relatively new area of civil engineering, so there is a lot to be done." She is indeed doing a lot.



Campus Sustainability Task Force

IESP has been very active of late in promoting environmental awareness and activity on campus. When former UIC Chancellor Sylvia Manning created a Campus Task Force on Sustainability to make recommendations on “greening” the campus, IESP became involved, with Tom Theis co-chairing the task force and Susan Kaplan identifying and pursuing related partnership and grant opportunities. As the administration considers the committee’s recommendations and makes decisions about implementation, IESP will continue to play a central role, especially in research, outreach and education.



Nagy’s Work Leads to Understanding of Hanford Leaks

Most of us have heard of the underground storage tanks in Hanford, Washington that leaked reprocessed nuclear fuel. Kathryn Nagy, Earth and Environmental Sciences and IESP Professor, is studying geochemical reactions that resulted from those and other leaks and trying to piece together what has taken place chemically in the ground. The U.S. Department of Energy (DOE) is in the process of emptying the tanks with the intention of consolidating the wastes for more permanent long-term storage, but in this case, Nagy’s work is leading to an understanding of the



Kathryn Nagy, Professor

potential for the contaminants to move towards the Columbia River.

Once the leaks occurred in Hanford – Oak Ridge, TN also has a large contaminated site – the DOE began investing a large amount of funding to understand how the waste has interacted with subsurface materials, such as minerals and groundwater. For ex-

ample, by what mechanisms do radionuclides and other compounds become immobilized in the ground? Because the leaking materials were unusual, high-pH fluids, there was virtually no information on what could have happened when they came into contact with the soil.

Nagy’s current project, working with Earth and Environmental Sciences colleague Neil Sturchio and Lynda Soderholm of Argonne National Laboratory, is focused on understanding what happens to uranium when it is in contact with dissolved silica. The work, funded by DOE’s Office of Biological and Environmental Research, will lead to an understanding of the mobility of uranium in subsurface areas at many DOE sites. Christophe Darnault of Civil and Materials Engineering at UIC is assisting with related applied experiments to explore the transport process itself.

“Very little is known about how uranium reacts with silica in the ground,” says Nagy, referring to both the Hanford and Oak Ridge sites. “The wastes at both sites ranged from acidic to basic – so we are studying the chemistry of uranium-silicate solutions and precipitates at low temperatures over a range of pH. This is exciting because even though uranium-silicate minerals are known, no one has looked at these reactions at

conditions expected at the surface of the Earth before and everything we are finding out is new.” In carrying out this work, Nagy and colleagues are working at the Advanced Photon Source synchrotron facility using a method called high-energy X-ray scattering, or “HEXS”, to characterize the structures that form in the solutions and precipitates.

Applying the study’s findings will mean being able to predict how uranium moves in groundwater. More broadly, the study will shed light on the fundamental behavior of these very tiny particles – which can be categorized as nanoparticles – and will therefore be applicable to other types of nanoparticle contaminants. One paper recently published refers to these tiny particles using the poetic-sounding term “synthons.”

What has been missing in the large amount of knowledge scientists have developed over the years on reactive transport modeling, which is applied to a broad array of problems involving fluid flow in porous systems such as the ground, “is a good way to predict how these tiny particles are formed or ‘nucleate’ and how they become mobilized or immobilized,” says Nagy. Her critical work is filling in some of these long-standing gaps.

Partnership with Peggy Notebaert Nature Museum

In IESP’s continuing partnership with the Notebaert Museum, IESP faculty have assisted in the development of new programming concepts for the museum based on life-cycle thinking. As part of the Nature, Math and Science Partnership program funded by the Illinois State Board of Education through the U.S. Department of Education’s Math and Science Partnership Initiative, IESP faculty are teaching graduate-level science and environmental courses to Chicago Public School teachers of grades 4 through 8 in disadvantaged areas. The goal is to assist them in moving towards “highly qualified” teaching status and/or endorsement in science.



Faculty Awards and Appointments

Cynthia Klein-Banai was named UIC's Interim Chancellor for Sustainability. She was also selected as a 2008 National Wildlife Federation Campus Ecology Fellow

Asgi Fazleabas, Professor of Physiology and Director, Center for Women's Health and Reproduction, Department of Obstetrics and Gynecology, has been awarded a University of Sydney Visiting Research professorship and was elected President of the Society for the Study of Reproduction.

Michael Iversen, Adjunct Assistant Professor of Urban Planning and Policy, has started the Urban Planning and Policy PhD Program at UIC.

Jane Lin, Assistant Professor of Civil and Materials Engineering and of IESP, has been appointed by the Transportation Research Board of the National Research Council as a member of its Transportation and Air Quality Committee. She has also been invited to join the editorial board of the transportation journal, *Transportation Research Part A: Policy and Practice* (Elsevier).

Andreas Linninger, Associate Professor of Chemical Engineering and Computer Science, has been named Organizer, Foundation Conference of Computer-Aided Process Design FOCAPD 2009 and 2007 Annual Meeting Elected Program Coordinator, Division 10A, American Institute of Chemical Engineers.

Kathryn Nagy, Professor of Earth and Environmental Sciences and of IESP, has been appointed to the U.S. Department of Energy's Basic Energy Sciences Advisory Committee.

Krishna Reddy, Professor of Civil & Materials Engineering, has received two awards: University of Illinois Scholar Award - 2007 and UIC Award for Excellence in Teaching - 2007

Karl Rockne, Associate Professor of Environmental Engineering, was awarded the College of Engineering Faculty Research Award from UIC's College of Engineering and the 2008 Teaching Recognition Program Award from the Council for Excellence in Teaching and Learning.

Brian Scott, Environmental Manufacturing Management alumnus, has a joint appointment with the economics and environmental studies departments at Washington College in Chestertown, Maryland.

Rosemary Sokas, Professor of Environmental and Occupational Health Sciences, has been awarded the American Public Health Association - Occupational Safety and Health Section Alice Hamilton Award for 2007. She is also a member of two National Academies of Science committees, one to establish an evaluation framework for NIOSH activities and the second to review the NIOSH Health Hazard Evaluation program.

Neil Sturchio, Professor of Earth and Environmental Sciences, was elected Secretary of The Geochemical Society, is on the editorial boards of *Chemical Geology*, *Geochemical Journal*, and *The International Journal of Environmental Forensics*, is a member of the Board of Governors of the Consortium for Advanced Radiation Sources, and coauthored a paper awarded an Editor's Choice award by *Environmental Science and Technology* as one of the best science papers published in 2007.

Town Hall Meeting: Environmental Research and Education at the University of Illinois at Chicago

Tuesday, April 22, 2008 at 12pm

Student Center East room 713

The Institute for Environmental Science and Policy is sponsoring a town hall meeting to explore opportunities for environmental research and education within the UIC community, including prospects that support the new campus sustainability initiative. All interested faculty, administrators, and students are invited to brainstorm new ideas for research and education as the next step in expanding environmental scholarship over the next decade.

Panel members:

Eric Gislason, Interim Chancellor

Russell Betts, Vice Provost for Planning and Programs

Peter Nelson, Interim Dean, College of Engineering

Eric Welch, Associate Professor, Public Administration

David Wise, Professor, Biological Sciences and IESP

Moderator:

Thomas Theis, Director, IESP

2008
External
Advisory
Board
Meeting:
September 17

