



# Illinois Sustainable Technology Center

A division of the Institute of  
Natural Resource Sustainability

[www.istc.illinois.edu](http://www.istc.illinois.edu)

2008 ANNUAL REPORT

# OVERVIEW

It's a new day for us with a different name, a different leadership, and a renewed commitment to our values. The Waste Management & Research Center is now known as the Illinois Sustainable Technology Center (ISTC). The new name better represents the goals and direction of the organization.

The name change is part of even larger changes at ISTC. After more than 20 successful years as a state government agency, the Center became part of the University of Illinois on July 1, 2008. It joined the other scientific surveys (Illinois State Water Survey, Illinois State Geological Survey, and Illinois Natural History Survey) in moving out of the Illinois Department of Natural Resources. The four organizations are now part of the Institute of Natural Resource Sustainability at the University of Illinois.

"We are excited about the move to the University of Illinois," said ISTC Interim Director Gary Miller. "The research, knowledge, and educational goals of the scientific surveys will be greatly enhanced by the strong research and academic excellence of the University of Illinois."

The ISTC staff remains committed to providing real world solutions to real world problems - solutions that bridge the gap between the natural resources and the human ones. Sustainability examines how to make human economic systems last longer and have less impact on ecological systems, and particularly relates to concern over major global problems such as climate change. By putting "Sustainable Technology" in our name, ISTC is showing its commitment to providing the ideas and systems to reduce environmental impacts and enhance the bottom line.

ISTC will continue to offer direct technical assistance from specialists, energy and pollution prevention assessments, a sophisticated analytical laboratory, research funding to explore a wide range of environmental issues, and information on environmental and pollution prevention issues. In addition, ISTC will continue to serve as the coordinating agency for regional and national programs including the Great Lakes Regional Pollution Prevention Roundtable and the Printers' National Environmental Assistance Center.

Our agency has been providing assistance to Illinois businesses and the public since 1985. Institutions both large and small are realizing that the environment and economic health are not competitors but are actually a great partnership. Recognition of this relationship is the key to success in the coming decades. Through ISTC's efforts, Illinois businesses, agencies and citizens can become more efficient and competitive. Improving the economic climate while protecting natural resources makes Illinois a better place to live, a role that ISTC has taken on since its beginning. The Center will continue to find new ways to educate young and old alike about how science and nature can work together.

ISTC will continue to maintain offices on the University of Illinois campus in Urbana-Champaign, and in Oak Brook, Peoria, and Brighton.



# TABLE OF CONTENTS

Governing Officials	3
Interim Director's Message	4
Where our Funding Comes From	5
Biofuels	6
Center Director Retires	7
Clean Air Counts	8
The Cutting Edge Partnership	10
Ethanol Plant H <sub>2</sub> O Use	11
Illinois River Project	12
Interim Director Heads NPPR	13
ISTC Seminars	14
Green Training Sessions	17
2007 Governor's P2 Awards	18
Leaching of Lead from Concrete	22
Library and Clearinghouse	23
P2Rx and GLRPPR	24
Patents	26
Perchlorate Study	27
PPCPs	28
PNEAC	29
Staff Publications and Presentations	30
Tar Removal Project	31
Technical Assistance	32
Research	34
What's Your Footprint?	39

# GOVERNING OFFICIALS

## STATE OF ILLINOIS

Rod Blagojevich, Governor

## DEPARTMENT OF NATURAL RESOURCES

Sam Flood, Acting Director

Leslie Sgro, Deputy Director

## BOARD OF NATURAL RESOURCES AND CONSERVATION

Until July 1, 2008, the Illinois state scientific surveys, which included the Waste Management and Research Center (now the Illinois Sustainable Technology Center), were governed by the Board of Natural Resources and Conservation. The BNRC has been an eight-member board appointed by the Governor and chaired by the Director of the Department of Natural Resources. It includes scientists, engineers, and representatives of the President of the University of Illinois and the President of Southern Illinois University.

## DESIGNATED CHAIRMAN

Leslie Sgro, Deputy Director

Illinois Department of Natural Resources (IDNR)

## MEMBERS

Representing University of Illinois

Dr. Charles (Chip) Zukoski

Office of Vice Chancellor for Research

University of Illinois

Plant Biologist

Dr. John Ebinger, Professor Emeritus

Department of Biological Sciences

Eastern Illinois University

Representing Southern Illinois University

Dr. Christopher C. Kohler

Director of SIU Fisheries and Illinois Aquaculture Center

Southern Illinois University

Animal Biologist

Dr. John Rogner, Field Supervisor

US Fish and Wildlife Service – Barrington

Geologist

Dr. David L. Gross

Senior Geologist Emeritus

Illinois State Geological Survey

Chemist

Ms. Ada C. Nielsen

BP America - Naperville

Sid Marder

Illinois State Chamber of Commerce - Springfield

LIAISON

Damon Stotts,

Acting Director, Office

of Scientific Research

and Analysis IDNR

Engineer

Ms. P. Kay Whitlock, P.E.

Vice President of Christopher B. Burke Engineering, LTD - Rosemont



**Illinois  
Department of  
Natural  
Resources**

# INTERIM DIRECTOR'S MESSAGE

These days everything in our nation and the world seems to be about change. Over the past year the Center experienced historical changes and the beginning of some great new challenges and opportunities. Yet, some things remain the same.

As you will see in this report, the retirement of George Vander Velde as our Director of 10 years was both significant and personal. He provided inspiring leadership, networking, sound advice, and vision to the staff at our Center and everyone else that knew him. George impacted us in numerous ways; most significantly in helping to launch the technical assistance approach we use called Accelerated Diffusion of Pollution Prevention Technologies (ADOP2T). Using this approach to help businesses and others eliminate waste and be more efficient, our effectiveness and success has more than doubled. George lead efforts in many other ways including working with the City of Chicago and other government agencies to create an ecotoxicology protocol for the Lake Calumet area on the south side of Chicago which is a model for rehabilitating distressed areas. This is a blueprint for interagency cooperation for years to come.



**Gary Miller, Interim Director**

In May I was named Interim Director by the Board of Natural Resources and Conservation. I am very honored to be given this responsibility, especially during this unprecedented transition. At the end of June, legislation was passed and signed by Governor Blagojevich to change our name from the Waste Management and Research Center to the Illinois Sustainable Technology Center. This new name more accurately represents our efforts to develop and deploy technologies that help businesses, communities, and citizens conserve resources and be more productive. This includes the work highlighted in this report on water purification, bioenergy from various industrial wastes, restoring habitats, developing brownfield sites and providing timely information resources.

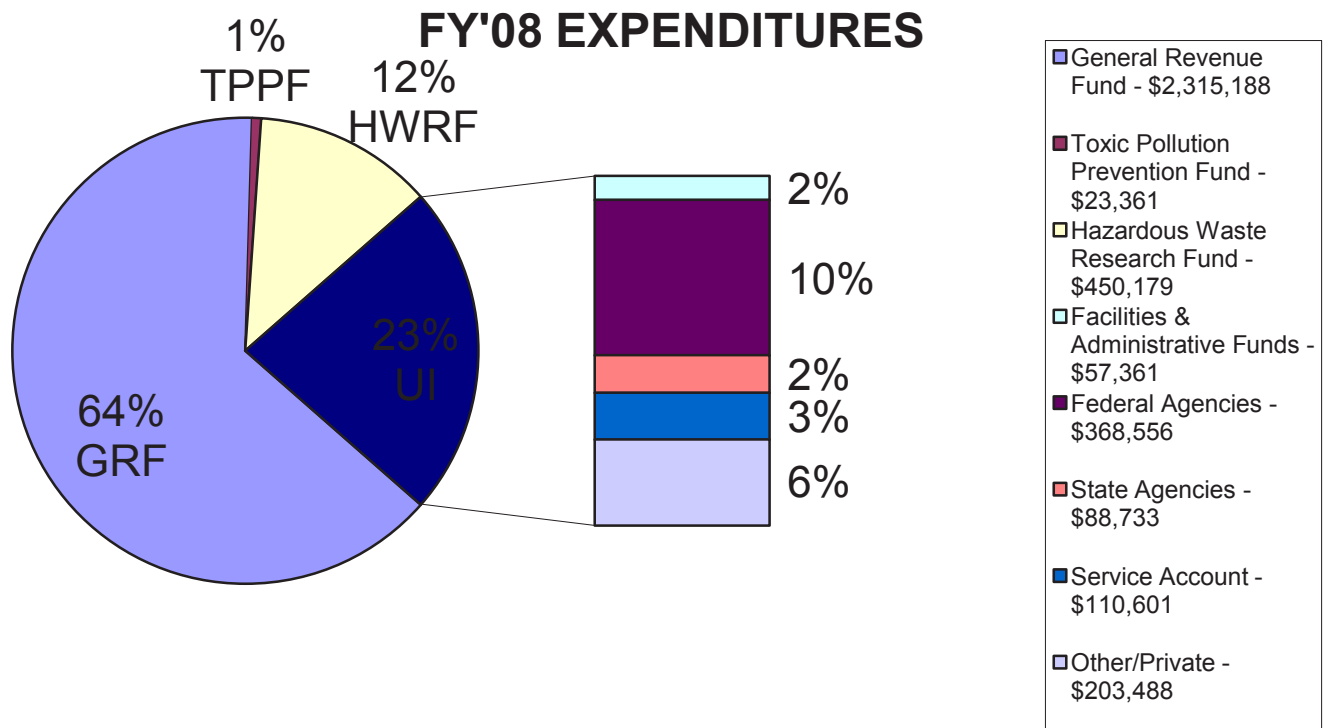
This legislation also transferred us along with the scientific surveys under the Board of Trustees of the University of Illinois in a new Institute of Natural Resource Sustainability. We have always been affiliated with the University and headquartered in a University building. This closer relationship with the University affords many opportunities for developing sustainable solutions and stronger partnerships.

In 1985 I joined the Center and have seen growth from a staff of five in rental space near the University campus to an annual budget of about \$3 million a year, a technically strong staff, offices in strategic parts of the state, and a research laboratory with advanced analytical capabilities plus pilot scale engineering technologies. This provides a strong foundation to address the many challenges we face. Our legislative mandates have not changed. We will still provide businesses and citizens with sustainable solutions, compliance assistance, sound science on emerging contaminants and testing of alternative technologies.

We are dedicated to our responsibilities as change agents and the opportunities at hand to make our economy, environment and world a better place to work and live. Our plan is to lead by example first in our own activities along with strong partnerships. We look forward to the future with renewed commitment.

# WHERE OUR FUNDING COMES FROM

The programs of the Waste Management & Research Center (now ISTC) were funded last year through a variety of sources. The largest source was General Revenue Funds from the state of Illinois. However, WMRC also received funding from federal sources, other state sources, and private funds. The chart below shows the percentage of funding received in each category during Fiscal Year '08.



## TEACHING HOW TO USE WASTE STREAMS AS FUEL

Recently, all types of groups are getting involved in biofuels. The future of biofuels is far reaching and it affects many types of organizations.

Scientists at the Illinois Sustainable Technology Center (ISTC) are working on a unique niche for the biofuels world. ISTC is exploring ways to produce biodiesel from waste streams; that way valuable crops will not have to be diverted to produce biofuels.

For several years, ISTC has been producing biodiesel from waste cooking oil. The 100% pure biodiesel (containing no petroleum) produced is being used to fuel a standard diesel Ford 250 pickup truck. ISTC researchers have been evaluating the performance of the biodiesel under various weather and driving conditions and seeking innovations in the process of biofuel production. Generally speaking, biodiesel is a fuel for use in diesel engines made from renewable organic resources, such as vegetable oils and animal fats, which are domestically available. Biodiesel burns cleaner than traditional petroleum diesel fuel and is biodegradable, making it an interesting alternative fuel option in terms of both environmental protection and U.S. energy independence.



And ISTC is taking the lessons of biofuels to the next generation through classes at schools across the state. The overall objective of this project is to have Illinois schools successfully participate in an alternative fuels project pertaining to biodiesel. The objective is to examine environmental impacts, economic, and technical aspects related to producing biodiesel from waste and utilizing biodiesel as an alternate fuel source. ISTC experts help the schools set up a biodiesel production facility and the students make biodiesel that can be used in the school buses or other equipment. Along with the training on biofuel production, ISTC has a retired teacher who gives students lessons on the business aspects of the biofuel industry.

Nine schools, 26 teachers and 372 students, have participated in the project this past year. A total of 465 gallons or 3,534 lbs. of waste oil have been converted to this point. Also, the schools reduced CO<sub>2</sub> emissions by more than 9,600 pounds and saved more than two million Btu's.

ISTC staff members also have been developing techniques for extracting the oil from distiller's grains left over from ethanol production. This has included some large scale pilot testing at the Viobin Company in Monticello. Future plans call for ISTC to expand its role as a leader in biofuel information. The Center will work with scientists from the other scientific surveys, other University of Illinois professors, and experts from agriculture and business to develop a multi-day conference. This conference, to be held on the U of I campus, will examine the entire biofuels system instead of looking at only one aspect of biofuels like most workshops.

# CENTER DIRECTOR RETIRES



Dr. George Vander Velde retired as the Director of the Waste Management and Research Center in the spring. Dr. Vander Velde was responsible for the leadership of the organization for 10 years.

One of his final projects before retiring was to help bring our agency into the University of Illinois where we became the Illinois Sustainable Technology Center.

“George’s primary skill is that he created a climate and atmosphere where others could function and advance the state-of-the-art in their respective areas,” says Gary Miller, ISTC Interim Director. “This was obvious in how he managed the staff at WMRC and in his work with others in state government, the private sector, the military, and university administrators. George had the vision for our agency and the State of Illinois to understand the challenges and opportunities we face—the new millennium, changing

world conditions, an economic downturn, rising energy costs, and globalization of industry—and to craft a sustainability approach to address them.”

Miller says that his predecessor greatly strengthened relationships between local governments and state government. He was a key element in getting all stakeholders to work together to develop the project in the Lake Calumet area that was recognized by the White House Conference on Cooperative Conservation in 2005. Vander Velde also worked with the many agencies involved in the Green Government Coordinating Council to implement a strategy for sustainability planning and reporting, and co-chaired the Region 5 Sustainability Network with the Department of Defense.

Prior to joining state government, Vander Velde had a wide range of prior experience in research, environmental, and waste management fields. He worked as an environmental consultant in areas such as environmental technology evaluations, brownfield development, and has served as an expert in environmental cases. Prior positions include Vice President at Golder Associates, a worldwide consulting engineering firm, VP of Science and Technology at Chemical Waste Management, Inc. and at Waste Management Inc. He also had worked as VP of the Environmental Testing and Certification Corp. and as Manager of Technical Services at OH Materials Corp., a national emergency response and remediation firm. He has served on a number of science advisory committees for research institutions such as the SEPUP program at the Lawrence Hall of Science, UC Berkeley, the IBM Corporation, the CenCITT program at Michigan Tech. Dr. Vander Velde is a graduate of Hope College in Chemistry and earned a Ph.D. from the University of Houston, Texas in the Biophysical Sciences.

“On a personal note,” says Miller, “George’s approach is always other people first. He is one of the most caring people in terms of interest in the welfare of others. We’ll miss him.”



# CLEAN AIR COUNTS

The Illinois Sustainable Technology Center has for several years, guided the Clean Air Counts program, a northeastern Illinois regional initiative to reduce ozone-causing emissions, thereby improving air quality and enabling economic development. It is a collaborative effort between the Metropolitan Mayors Caucus, City of Chicago, U.S. Environmental Protection Agency Region 5, and Illinois Environmental Protection Agency.

During the past year, ISTC has worked to implement standard pollution prevention strategies and technologies in paint manufacturing facilities and large industrial paint users that had joined Clean Air Counts in order to reduce volatile organic compound (VOC) emissions. The implemented pollution prevention strategies were quantified and resulted in permanent reductions of VOCs in the Chicago area. The second objective was to model emerging ozone reduction strategies for leaf blowers and vehicle idling that could be implemented on a municipal level in future years.

The Clean Air Counts project this year also:

- Developed a fact sheet titled "Air Pollution Emission Reductions through Energy Efficiency at the Illinois Army National Guard (ILARNG) Facilities." The ILARNG reported the annual energy savings and emission reductions from two boiler upgrades that resulted in lower natural gas usage and reductions in air pollution.
- Compiled a fact sheet on the International Truck and Engine Corporation spray coating upgrade for its engines. This improvement reduced paint usage, emissions, and paint sludge.
- Conducted an energy efficiency audit for City of Wood Dale's city hall, police station, city services building, and wastewater treatment plants. Wood Dale is a CAC Communities Group member.
- Assisted Fox Valley Park District with a lighting retrofit. Seventy percent of the lighting upgrades have been completed. The remaining facilities will be completed by January, 2009.
- Worked with Ace Hardware Paint Division to implement a compressed air leak detection and repair program, install more energy efficient lighting, and reduce heating costs in the winter.
- Completed the Leaf Blower and Anti-Idling policy.

## Background

In 2004, the Illinois Sustainable Technology Center was asked to seek commitments from paint manufacturers that emit VOCs in the Chicago region to implement standard pollution prevention (P2) strategies and technologies to reduce emissions. ISTC focused on outreach to the paint manufacturing sector in the project area with the goal of recruiting 10 companies to join CAC, work with ISTC, and reduce emissions. In return for their commitment, companies would receive technical assistance such as pilot scale technology testing or pollution prevention assessments from ISTC. At the suggestion of the paint manufacturers, the initiative was subsequently expanded to include recruitment of high volume paint users. In total, 15 facilities have joined the CAC initiative.

# CLEAN AIR COUNTS

The participating companies have reported the following savings because of these CAC efforts:

- Ozone Precursor Reductions—116,390 pounds per year
- Hazardous Air Pollutant Reductions—106,060 pounds per year
- Electricity Savings—167,540 kWh per year
- Natural Gas Savings—25,763therms per year
- Hazardous Waste Reduction—39,364 gallons per year
- Savings—\$402,123 per year

# THE CUTTING EDGE PARTNERSHIP

The Illinois Sustainable Technology Center (ISTC) recently was selected as a recipient of a national award from the National Pollution Prevention Roundtable (NPPR) for its **Cutting Edge Partnership** project. The award was presented in the NPPR headquarters in Washington.

The **Cutting Edge Partnership** program was developed to help industries extend the life of their metal working fluids (MWF) to save money and help the environment. The program also helped companies save energy and retain jobs in the United States. The **Cutting Edge Partnership** focuses on bringing together a variety of expertise in machining, formulations, recycling, product management, environmental health, and safety to help companies address the uncertainties in adopting new technologies. The **Cutting Edge Partnership** provides an innovative method to help companies focus on reducing these uncertainties and proving the anticipated benefits of the technologies being considered. In this program:

- Technical assistance was driven by individual facility need. The partnership provided a forum through which needs of end-users were addressed through collaborations with chemical suppliers and vendors, consultants, and academia.
- Integrated multiple pathway approaches were used as the framework to reduce the environmental footprint of MWF. A core group of chemical suppliers, vendors, and consultants who subscribe to this philosophy was assembled. Potential solutions, identified in response to the issues raised by the manufacturers, were screened based on the principles of green engineering.
- Technology testing was carried out at mentor sites.
- Following a successful technology implementation, other industry participants were allowed access to mentor sites to witness first-hand details of project conception, implementation, and applicability.

A case study of what the **Cutting Edge Partnership** provided is the success at the Hitachi Nukabe Automotive, Inc. (HNAI) facility in Effingham, IL. The company operates a precision machining and assembly facility that produces automotive parts for many of the major automotive companies. ISTC worked with the company to develop and pilot a metal working fluid purification system to reduce the amount of MWF used, to negotiate a program with a tooling supplier to reduce costs and improve processes and to contract with a chemical company to provide a cost effective chemical management service. Over a three year period, HNAI saved hundred of thousands of dollars, reduced the use of chemicals, and reduced energy use. The company also stopped hundreds of thousands of pounds of pollutants from being released into the environment.

A chief goal of this project is to develop systems that companies can share with other businesses. A primary barrier to implementation of innovative pollution prevention (P2) technologies is a lack of technical resources to conduct a sufficient pilot test of the technology to overcome issues of complexity and compatibility. The project provides the mentoring company and a successful track record of a program to a company interested in beginning such a process. The program has been successful in attracting a variety of other companies.

In the companies that participated in the research program over the past three years, ISTC has recorded a total savings of 300,600 pounds of MWF saved from disposal annually. There also is an annual savings of more than 1.4 million gallons of water. This results in a financial savings of \$160,000 per year. ISTC also calculated some of the savings to all of the companies that participated in the Cutting Edge Partnership to some degree. There was a total projected savings on electricity of more than 8.3 million Kilowatt hours, for a savings of \$530,000. There also was a projected reduction of more than 7.5 million pounds of CO<sub>2</sub> emissions.

Jeffrey Burke, Executive Director of the National Pollution Prevention Roundtable, said the 2008 recipients of the Most Valuable Pollution Prevention (MVP2) award such as ISTC demonstrated that reducing pollution and protecting the environment can also save on the bottom line. The prestigious awards are given out to both programs and individuals.

# ETHANOL PLANT H<sub>2</sub>O USE

## REDUCING WATER USE IN ETHANOL PLANTS

The once heralded rush to build ethanol plants has been slowed, in part, by concerns about how much water the plants use in their process. But do they have to use so much water?

As part of a project funded by the Illinois Department of Commerce and Economic Opportunity, ISTC scientists studied how dry grind ethanol plants use water in their manufacturing processes and identified opportunities for water conservation. The project team recommended three options that can be implemented in new and existing plants with few changes to existing practices. Those options are:

1. Reduce cooling water use through water conservation;
2. Reusing water through blowdown recovery;
3. Using alternative water sources, i.e. municipal effluent.

The report recommends the state identify wastewater treatment plants with the greatest potential for alternative water sources for industrial use. This would be based on flow as well as community and industry interest. It also recommends that publically owned treatment works (POTW) should be ranked with the most potential based on proximity to ethanol plants, preliminary water quality data, and need for infrastructure. Research also needs to be done to characterize effluent quality, with particular consideration to suitability for cooling tower use. Finally, the report recommends a thorough cost/benefit analysis be conducted of using such alternative sources for each identified opportunity.

The final report, a literature review entitled Options for Reducing Fresh Water Consumption in Ethanol Plants, has been submitted to DCEO.

# ILLINOIS RIVER PROJECT

## TURNING UNWANTED SEDIMENT INTO ENVIRONMENTAL IMPROVEMENTS

It seems like a simple concept; taking a material away from where it is not wanted and putting it into an area where it is desired. But when you are talking about river sediment; the idea takes barges, new dredging techniques, and the cooperation of dozens of federal, state, and local organizations.

For several years, the Illinois Sustainable Technology Center has been at the vanguard of an effort to remove soil that has been clogging the Illinois River, and take it to places where it can restore the environment. The Illinois River project spearheaded by ISTC Associate Director John Marlin this year won the Outstanding Planning Achievement Award from the Illinois River Basin Restoration Comprehensive Study Team. The Illinois River project was recognized for its innovation and collaboration to formulate a restoration plan in a system, and from a watershed prospective. It also was honored for its holistic approach on water resources problems, and its collaborative interagency approach. The project previously has been given both regional and national awards by the Mississippi Valley Division and the headquarters offices of the U.S. Army Corps of Engineers.



The Illinois River provides commerce, recreation, and environmental habitat for a major portion of the state of Illinois. However, the River has been filling with sediment for the past century to the point that few areas outside the main channel are more than two feet deep. The result is a significant decrease in recreational use and fish and wildlife populations. This project has been developing ways to remove sediment from the Illinois River in a cost effective and safe manner. Study teams have investigated dredging and transport techniques, the quality of the sediment, and a variety of potential uses. The removed sediment has been used to restore habitats such as islands and may prove suitable for use as landscaping soil, especially at strip mines and abandoned industrial sites near navigation channels.



The largest part of the project so far saw barges full of Illinois River sediment shipped to Chicago where it was reclaimed as rich topsoil for a new Chicago park, providing healthier habitat for wildlife and new green vistas for urban residents. The project also has taken soil to an area near Pekin to restore habitats. And this past year, similar work has been done on the Mississippi River near New Boston, IL.

These restoration efforts have attracted international attention. Marlin has been contacted about the project by officials in Louisiana and China. Louisiana officials are considering using Illinois sediment to restore wetlands along the Gulf of Mexico. And Chinese officials are examining how the dredging, transportation, and environmental methods developed by the Illinois project can be used in their country.

# INTERIM DIRECTOR HEADS NPPR

Gary Miller, Interim Director of the Illinois Sustainable Technology Center, has been serving this year as the Chairman of the Board of Directors for the National Pollution Prevention Roundtable. The National Pollution Prevention Roundtable (NPPR) is the largest membership organization in the United States devoted solely to Pollution Prevention (P2). The Roundtable provides a national forum for promoting the development, implementation, and evaluation of efforts to avoid, eliminate, or reduce pollution at the source. NPPR's members are comprised of the country's preeminent P2 experts from regional resource centers, state and local government programs, small business assistance networks, non-profit groups, industry associations, and federal agencies.



Dr. Miller had served as the Assistant Director of the ISTC since 1985. Since 1996 he has also been Director of the Printers' National Environmental Assistance Center, which is one of 15 national Compliance Assistance Centers funded by the U.S. Environmental Protection Agency. Some of Dr. Miller's main accomplishments are directing the ISTC's involvement in the Greater Chicago Pollution Prevention Alliance, Clean Air Counts program in the Chicago area, Illinois/USEPA Waste Reduction Innovative Technology Evaluation Program, serving on the Illinois Great Printers Project steering committee, developing information resources on pollution prevention, and consulting on environmental issues for various businesses. He is also subject Editor for the Journal of Cleaner Production.

Prior to joining ISTC, Dr. Miller was Assistant Professor of Civil Engineering and Environmental Science at the University of Oklahoma. From 1979 to 1985 he was also Assistant Co-Director of the National Center for Groundwater Research at the University of Oklahoma. Miller received an undergraduate degree in biology from Oral Roberts University, an M.S. degree in Environmental Science and a Ph.D. in Engineering both from the University of Oklahoma. He is the co-author of four books on energy, environmental policy, and groundwater protection; has published over 40 other papers and reports; and has made numerous presentations to businesses, professional organizations, and university classes.

Others serving as NPPR officers are: Greg Copley from the University of Kentucky as Vice Chair, Robert Jackson from the Michigan Department of Environmental Quality as Secretary, and Michael DiGiore of the New Jersey Department of Environmental Protection as Treasurer.

## “SUSTAINABILITY” AND MORE AT ISTC SEMINARS

During the past year, ISTC held a year-long series of sixteen seminars presented by researchers, policy makers, and corporate executives on various topics related to Sustainability, Energy, and the Environment. The aim of the seminar series was to highlight efforts on sustainability on the UIUC campus and in industries and businesses in the state. The seminars were broadcast live on the ISTC Web site and are also archived on the Web site at [www.istc.illinois.edu/about/sustainability\\_seminars.cfm#previous](http://www.istc.illinois.edu/about/sustainability_seminars.cfm#previous).

**Sustainability Seminar Series** presentations included:

- **“Sustainability on UIUC Campus”**—Dr. William Sullivan, Director of the Environmental Council and Associate Professor in UI Dept. of Landscape Architecture, gave an overview of sustainability research and teaching at the University of Illinois.
- **“Advances in Dry Grind Ethanol Production Processes”**—Dr. Vijay Singh, Associate Professor in the UI Department of Agriculture & Biological Engineering, discussed his ethanol research and the development of a corn-milling process that increases the amount of ethanol produced per batch as well as the value of the co-products resulting from the process.
- **“Sustainability within Illinois State Government”**—Marc Miller, senior policy advisor for the office of Lt. Governor Pat Quinn, presented an overview of the sustainability efforts within state government and discussed a variety of initiatives being undertaken by the state related to the reduction of greenhouse gas emissions, and conservation of energy and water resources.
- **“Sustainability, Energy, and the Energy/Water Nexus”**—Don Fournier, chair of the UIUC Building Research Council, explained why our current energy path is not sustainable and discussed the need to explore various renewable energy systems and increased energy-efficiency in the built environment. He also discussed the relationship between energy usage and water supply and postulated that water may be the limiting factor in continued growth and development.
- **“The Calumet Region of Chicago: Nature, Industry, and Community”**—Nicole Kamins, Program Director of the Chicago Department of the Environment, discussed the efforts by various groups to protect coastal wetlands in one of the nation’s most industrialized areas. She serves as the lead for a team that is working to restore and protect Hegewisch Marsh, a remnant coastal wetland in south Chicago.
- **“Sustainability and the Mahomet Aquifer”**—Al Wehrmann, Director of the Center for Groundwater Sciences at the Illinois State Water Survey, explained the formation of the aquifer and discussed the current water use and the future demands for water from the aquifer.
- **“Emerging Contaminants in the Environment”**—Jennifer Davis, an environmental toxicologist with the Department of Environmental Health at the Illinois Department of Public Health, talked about various “old” contaminants returning as a different hazard as our understanding and technology enable

us to realize lower levels of these than previously thought can impact human health. Davis discussed continuing clean-up efforts and pollution prevention strategies for these chemicals and addressed the new concern about pharmaceutical contamination of water and the research work in that area.

- **“Megadisasters: Natural vs. Stealth”**—Dr. Susan Kieffer, a professor of Geology and Physics from the UI Center for Advanced Studies, described the impact of human activities on the earth and how the waste from these activities is leading to “stealth disasters”, such as contamination and loss of soils and freshwater; pollution of oceans and the atmosphere; and ecosystem destruction.
- **“The Business of Sustainable Development”**—John Disharoon, Director of Sustainable Development at Caterpillar, Inc., provided a business perspective on the challenges and opportunities of various sustainability issues. Caterpillar is on the cutting edge of many sustainability initiatives in their operations worldwide.
- **“Feasibility of Composting Organic Residuals Generated at the University of Illinois”**—Dr. Leslie Cooperband, UI Dept. of Human and Community Development, discussed the feasibility study she conducted at the Urbana-Champaign campus. She evaluated potential sites for composting, compost recipes, appropriate composting technologies, and potential markets for compost.
- **“Land Use and Sustainability”**—Dr. Brian Deal, Assistant Professor of Urban and Regional Planning at the U of I, presented ideas about engaging a community to effectively address sustainable land use questions. He described modeling with LEAM (Land Use Evolution Impact Assessment Model) to assess the impact of land use decisions on water usage and energy usage and its value for making land use and planning choices for communities.
- **“Multi-Objective Decision Model for Urban Water Use: Planning for a Regional Water Reuse Ordinance”**—Dr. Paul Anderson of the Department of Civil, Architectural, and Environmental Engineering at Illinois Institute of Technology, discussed the evaluation of technological, economic, societal, and environmental incentives and barriers to wastewater reuse.
- **“Sustainability as a Business Imperative: Baxter’s Approach”**—Jenni Cawein, Manager of Environmental, Health, and Safety at Baxter International, Inc., gave Baxter’s perspective on the issue of sustainability practices as part of business plans and how it is a good economic decision, as well as one that is important for environmental and social responsibility.
- **“Sustainability – Practical Approaches for Business and Universities”**—Bill Blackburn of William Blackburn Consulting, Inc. described the complexities, challenges, and benefits of sustainability and discussed his ideas on how organizations of all sizes can reach or exceed economic, social, and environmental excellence.
- **“Energy Use History and Management Initiatives at the UIUC Campus”**—Terry Ruprecht, Director of Energy Management at UIUC, explained the energy scenario at the Urbana-Champaign campus.



Ruprecht discussed how much energy is used, where the energy goes, and efforts underway to better control both consumption and costs.

- **“How Sustainable is Organic Agriculture?”**—Dan Anderson of UIUC Dept. of Natural Resources and Environmental Sciences discussed the organic food industry and recent research that provides evidence that organic food is healthier and that organic farming is often as productive as conventional farming. His presentation explored how sustainable organic and natural farming methods are for farmer, consumers, and the environment.

## **“Green” Workshop**

ISTC staff last spring participated in a workshop “CommonCents—Practical Strategies for a “Greener” Business” at SIU–Edwardsville. The workshop was organized jointly by Dr. Susan Morgan and Jianpeng (Jim) Zhou of SIU–E and ISTC. It was part of Dr. Morgan’s research grant which is funded by ISTC. The grant is to work on the development of an environmental networking system in southern Illinois and to help develop more relationships between ISTC and industries and agencies in southern Illinois. ISTC staff members Tim Lindsey, Todd Rusk, Dan Marsch, and Mike Springman gave presentations on energy and water conservation and waste reduction at the workshop. Another workshop is planned for the fall to continue this effort.

## **Research Seminar**

Dr. Michael Plewa of UIUC–ACES gave a presentation at ISTC entitled “Comparative Mammalian Cell Cytotoxicity of Metalworking Fluids and MWF Components.” This talk was based on the research project being conducted by Dr. Plewa, along with Dr. N. Rajagopalan, and Dr. E.D. Wagner on “Greening Metalworking Fluids using Multicriteria Methodologies” that ISTC has funded the past two years. They are analyzing the chronic cytotoxicity of MWFs using an in vitro mammalian cell assay. In general, they have found there is an overall cytotoxicity rank order of MWF classes. The CHO cell cytotoxicity data are highly correlated with published in vivo pulmonary toxicology data. The researchers will be continuing this study through next spring.

# GREEN TRAINING SESSIONS

## **ISTC STAFF TEACHES COMMUNITY ABOUT GREEN BUSINESS**

In May 2008, ISTC staff presented a green business information session in collaboration with the Parkland College Business Development Center. The session was attended by 60 people from local manufacturing, government agencies, and non-profit organizations. The session included a rationale for why companies should consider the environment when doing business, offered examples of pollution prevention and resource efficiency opportunities, and provided pointers to more information resources. Participants filled out a survey at the end of the session to identify topics about which they wanted to learn more. Based on these surveys, ISTC staff will develop and teach workshops on industrial energy efficiency, industrial pollution prevention, and basic green business/greening the office through the Business Development Center in Fall 2008.

The success of this workshop lead ISTC to expand the effort to other community colleges throughout Illinois. The workshops to be offered this upcoming year will help participants learn how to improve the bottom line through sustainable practices in their office and home. ISTC experts will discuss what it means to be green, how a medium to small-sized organization can reduce material and energy waste, and how going green cuts costs. Participants also will receive a listing of available resources to help go green.

# 2007 GOVERNOR'S P2 AWARDS



The Illinois Sustainable Technology Center (ISTC) this past year honored 22 Illinois companies and organizations for their significant achievements in protecting the environment and boosting the economy. The Governor's Pollution Prevention Awards and the Illinois Sustainable Technology Awards were presented in Glen Ellyn during a luncheon. This was the 21st consecutive year the awards were presented by ISTC (formerly WMRC).

The Pollution Prevention (P2) projects recognized through the Governor's Pollution Prevention Awards program produced millions of dollars in savings in material and disposal costs. The award winners prevented hundreds of tons of waste materials from being released into the environment and saved millions of gallons of wastewater from being sent to treatment facilities. The Illinois Sustainable Technology Award recognizes a novel technology or process that leads to significant waste reduction, waste elimination, or environmental impact.

Many of the companies honored are ones that ISTC works with regularly to find pollution prevention opportunities. The ISTC technical experts review all of the applications for the award. The ISTC experts also perform site visits for finalists. In addition, the finalists are reviewed by the Illinois EPA for compliance issues.

The award winners are listed below.

## GOVERNOR'S POLLUTION PREVENTION AWARD WINNERS

**Abbott** in North Chicago implemented projects to reduce fresh water usage, which saved more than 3 million gallons per year. Isopropyl alcohol is now segregated for reuse instead of going to a water treatment facility. Abbott also developed a process change that will reduce use of hazardous solvents up to 60%.

**Akzo Nobel Non-Stick Coatings** in Des Plaines has a goal to remove all hazardous air pollutants from its coatings. This year all of these solvents were removed from 20 coatings products, cutting emissions more than one ton. An additional reduction of 3/4 of a ton in hazardous emissions is expected in the upcoming year.

**All-Brite Anodizing Co.** in Northlake developed methods to extend the life of its Nickel Seal bath, converted to continuous pretreatment of its acid recycling, and developed a filter system to recycle the tank acid. This saves the small company over \$12,000 per year.

**Amerikal Products Corporation** in Waukegan developed a biodegradable blanket and roller wash for offset printers. This product offers a viable alternative to petroleum based washes, which dramatically reduces or eliminates harmful chemicals while offsetting millions of gallons of petroleum each year. Additionally, Amerikal developed a single step fountain solution to run without alcohol.

# 2007 GOVERNOR'S P2 AWARDS

**Cadbury Adams** in Rockford developed a non-contact system to provide cooling water to process equipment. Using this system in the three chiller cooling towers means discharge to the sanitary district has been reduced by more than 8 million gallons at a savings of \$13 million dollars.

**Caterpillar Inc. Hydraulics and Hydraulic Systems** in Joliet implemented a flame sprayed coating for its truck suspension system, replacing a chroming process. As a result of this change, the plan will reduce hazardous waste by 700,000 pounds annually and save 14 million gallons of water. It also will save the company an estimated \$280,000 per year. This project is the culmination of more than five years work to develop and implement an environmentally friendly alternative to hard chrome plating.

**Caterpillar Inc. Cast Metals Organization (CMO)** in Mapleton had a team that looked at the regulation requiring scrap to be free of Hazardous Air Pollutants. The team developed a program that informed the Foundry about the scrap suppliers' ability to provide acceptable product. Mapleton worked with the American Foundry Society to help produce a rule that would not only meet strict quality requirements, but would allow foundries to continue to recycle certain types of scrap and maintain a competitive cost structure.

**Caterpillar Inc. Mossville Engine Center (MEC)** in Mossville formed a team to look at used oil re-use and recycle processes that forced MEC to send large amounts of used oil off-site for recycling, instead of reclaiming it for re-use on-site. Based on the team's recommendations, the facility developed two system updates, installed a newer, more effective dehydrator, and an underground pipeline. The resulting benefits included a total savings of \$816,851 for the year and a reduction of about 208,000 gallons of oil.

**Cintas Corporation** in Rockford is an industrial laundry facility, which completed projects aimed at improving wastewater discharge compliance, reducing the amount of water used and discharged, and reducing the amount of energy used. Cintas installed a new clarifier and equalization tank for wastewater pretreatment, a wastewater heat re-claimer, a boiler stack economizer, and more efficient washers and dryers. The new process allowed Cintas to reduce freshwater usage by 25%, reduce the volume of wastewater discharged by 29%, and reduce natural gas consumption by over 28%.

**Consolidated Printing** in Chicago replaced its petroleum-based press and blanket washes with more environmentally responsible cleaners made from bean and seed esters. Consolidated reduced its volatile organic carbon emissions by 600 lbs, and increased the life of its press rollers, which saved \$7,500 per year. Consolidated also converted to an electronic ordering and approval system to reduce the printing of hard paper proofs for their clients, and purchased a digital press for smaller orders, which has reduced paper and ink wastes.

**Crest Industries** of New Lenox manufactures industrial paints and coatings. Crest implemented several projects including installing separate lines of unpigmented and pigmented products. Previously, during a batch changeover, up to 100 gallons of solvent were used to clean the filling equipment. Now, with the dedicated line, only 20 to 30 gallons of solvent are required. Crest reduced its hazardous waste generation by over 13,000 gallons per year, reduced its annual cleaning solvent purchases by \$43,000, and saved \$6,000 in disposal costs.

# 2007 GOVERNOR'S P2 AWARDS

**Electronic Interconnect Inc. (EI)** in Elk Grove Village is a Printed Circuit Board manufacturer. EI initiated several projects to decrease its chemical consumption and waste generation by a range of 10 to 45% for eight major chemicals. The liquid hazardous waste generated was reduced by 40% in a period of two years, which is almost 40,000 gallons per year. EI also substituted less hazardous chemicals in other processes and eliminated the in-house consumption of lead containing materials.

**Farmland Foods** in Monmouth installed two hog coolers onsite, which were complemented with a large trim blender and electrical switchgear. This resulted in reductions in water, CO<sub>2</sub>, and energy use in the meat cooling process. Water usage was cut by 34 million gallons per year, CO<sub>2</sub> use was reduced by 2.7 million lbs, and energy use dropped by 5.2 million kWh. The projects collectively reduce greenhouse gas emissions by at least 9.7 million lbs annually, and saves the company over \$8 million per year. Other significant benefits include a reduction in product shrinkage and improvements in labor savings.

**GE Healthcare** in Arlington Heights is a manufacturer of radiopharmaceuticals that are used in various imaging techniques. GE Healthcare implemented a waste reduction project to reduce the amount of Low Level Waste generated in manufacturing areas. By providing employees with the ability to segregate waste at the point of generation, an annual volume reduction of approximately 34% was realized. An estimated annual savings of \$39,000 in disposal and labor costs was realized by this project.



**HN Automotive Inc (HNAI)** in Effingham initiated a Tooling Management Program, which saw a tooling costs decrease of over 30%, a savings of more than \$300,000. It also installed a machine to compress metal chips from machining operations into cylindrical pucks that are sent back to the foundry to make new castings. HNAI upgraded the compressed air system, reducing annual energy usage by 350,000 kWh, a savings of over \$20,000 per year. A membrane filtration system was installed to remove water from liquid wastes, which reduced water use over 100,000 gallons per year and saved more than \$30,000.

**Horigan Urban Forest Products, Inc.** in Glenview is committed to recycling trees from the urban forest. Previously, most trees that were removed from the Chicago area were chipped for mulch or cut for firewood. Horigan now turns trees cut down on residential, commercial, or public property into kiln-dried lumber for use by homeowners or artisans. By using trees from local sources, Horigan reduces the number of trees removed from the forest, reduces the amount of fuel consumption for transporting lumber, and reduces the amount of carbon released into the atmosphere by sequestering carbon as hardwood lumber.

**International Truck and Engine** in Melrose Park developed a new coating for the spray coating process for the new engines it manufactures. The prior engines needed to be completely spray-painted. The new coating is water-based, contributing to a reduction of hazardous emissions. Additionally, this coating covers an average of 23 engines per gallon; the old blue coat paint covered only four engines per gallon. The change resulted in annual reductions of paint use by 82%, hazardous emissions by 83%, and paint sludge waste by 12.5%. The facility's efforts have resulted in an annual savings of \$115,000.

# 2007 GOVERNOR'S P2 AWARDS

**Koppers Inc.** in Stickney implemented pollution prevention projects that reduced its hazardous waste generation by 70%, natural gas usage by 129,000 therms per year, and electricity consumption by 1.96 million kWhr per year. The projects saved \$2.2 million per year. Koppers added exhausters to its process and a vapor ejector system. The exhausters separate phthalic anhydride from a byproducts stream and returns it to the refining process, which increased product yield and reduced hazardous waste. Koppers also implemented a system that minimized the compressed air feed during low production. The reduced airflow has led to a decrease in energy consumption, a reduction in emissions, and an increase in product yield.

**Nalco Company** in Bedford Park is a specialty chemical company. The plant made improvements to recover more product from its manufacturing process and decrease the use of steam. These changes saved millions of pounds of products, reduced several tons of air emissions, and reduced the overall gas usage at the plant. The overall savings from these projects totaled over \$600,000. Nalco also provides idled buildings to various governmental and local agencies for use in training drills, benefiting emergency response teams and hospitals.

**New Holland Apartments** in Danville is a five-story brick structure that was renovated in a way that combines historic restoration, affordable housing, and green design and technologies. The Holland was an abandoned building awaiting demolition until Crosspoint Human Services purchased it and restored it. A Geothermal unit was installed to provide energy efficient cooling and heating that is individual apartment controlled. Thermal windows and Energy Star rated appliances were installed to save energy. Period brick was reclaimed from nearby demolitions to replace architectural features long ago removed by former owners.

## ILLINOIS SUSTAINABLE TECHNOLOGY AWARD WINNERS

For the first time, two companies were honored with the Illinois Sustainable Technology Award. Reviewers felt both companies deserved recognition for their technical innovations.

**Colbert Packaging Corp.** in Lake Forest developed BlisterGuard and EnviroGuard, which replace the traditional plastic clamshell commonly used for retail display. Both products are pilfer resistant, use more environmentally friendly material, provide ample space for manufacturers' product branding and are easily recyclable by consumers. These products reduce or eliminate petroleum-based plastics and are printed using soy-based inks.

**Crown Cork & Seal Beverage Division** in Kankakee improved its spray machines to operate reliably at much lower pressures. A new system also monitors the spray to ensure proper application of the interior can coating. The system has allowed the plant to reduce interior coatings per can and save \$250,000. Hazardous emissions have been reduced by 22.5 tons.

# LEACHING OF LEAD FROM CONCRETE

## DETERMINATION OF RAINFALL LEACHING OF LEAD FROM CONCRETE DEMOLITION MATERIALS

The lead content of waste demolition concrete is often a concern to project managers and environmental regulators. Waste reduction policies give an incentive to limit putting demolition debris into landfills, but some material recycling scenarios can involve environmental exposure to crushed concrete.



ISTC worked with the U.S. Army's Construction Engineering and Research Laboratory (CERL) on a project to determine the amount of lead in concrete demolition material, and to also determine the amount of lead that could be leached by rain from the same materials. The concrete from the study came from buildings that had originally been painted with lead based paint. The objective of the project was to determine if the residual lead in the crushed demolition concrete is relatively immobile in the concrete or would be carried into the surrounding environment when exposed to rainfall.



CERL personnel sampled the demolition materials from the site and delivered the concrete to ISTC for lead analysis. Initially the materials were chemically digested and analyzed for total lead via microwave digestion using nitric acid, hydrogen peroxide, and hydrofluoric acids to dissolve the samples. Next, an extraction experiment was designed to mimic the environmental performance of using crushed concrete as a paving material for parking lots. Lab containers were packed to a six inch depth with the demolition material to simulate a parking lot made of the demolition material. The containers were filled with the equivalent of two years of rainfall, and lead content and pH were measured. The buffering capacity of the concrete was also examined as all of the liquid left, consisting of the dissolved matter and the solvent used, had a final pH of about 11. This is important, as lead is not very soluble under basic pH conditions.

The experiment showed that for the expected levels of lead, very little of the heavy metal was extracted from the concrete. The experiment also showed that after exposure to two years of simulated rainfall, the pH of the simulated rainfall changed from 4.5 to about 11 following exposure to the concrete.

# LIBRARY AND CLEARINGHOUSE

The Library and Clearinghouse at the Illinois Sustainable Technology Center specializes in the science of waste management, which makes it a unique national resource. The Library's print collection includes industry case studies and information on pollution prevention practices, environmental education, green business, sustainable development, environmental and analytical chemistry, alternative fuels, renewable energy, and household hazardous waste. The Library's holdings include thousands of books, articles, maps, reports, and periodicals.



The Library's staff continues to add holdings to OCLC, a national shared bibliographic database, making the collection available for loan to libraries throughout the country. The Library's periodical holdings have been in OCLC since the 1990s. The Library continues to participate in AskAway Illinois, the statewide online reference service sponsored by the Illinois State Library. AskAway Illinois is part of OCLC's QuestionPoint virtual reference cooperative, which provides 24/7 reference assistance from librarians all over the world.

Last year, the ISTC Library staff responded to over 300 information requests from clients. In addition, library staff added 521 books and videos, 7 serials, and 1,880 articles to the library's collection. The Library staff also continued to add records for Web sites and online documents to the library's catalog.

Suzhen Chen, a student from the UIUC Graduate School of Library and Information Science (GSLIS), completed a cataloging independent study at the Library during the spring 2008 semester. She added a wide variety of items to the collection, including videos and technical reports.

Laura Barnes, ISTC's Librarian, presented a poster at the Health Science Librarians of Illinois Conference in Urbana, IL on the topic of pollution prevention in the health care industry. As part of the presentation, she created a bibliography entitled "Selected Resources for Pollution Prevention in the Health Care Industry." The bibliography is available at [www.istc.illinois.edu/info/library\\_docs/TN/tn08-092.pdf](http://www.istc.illinois.edu/info/library_docs/TN/tn08-092.pdf). Slides for the poster session are available at [www.istc.illinois.edu/info/library\\_docs/TN/healthcarep2slides.pdf](http://www.istc.illinois.edu/info/library_docs/TN/healthcarep2slides.pdf). Links to the Library's complete collection of reference guides are available at [www.istc.illinois.edu/info/library\\_reference\\_guides.cfm](http://www.istc.illinois.edu/info/library_reference_guides.cfm). Ms. Barnes also conducted environmental story times each week for fourth grade classes at Dr. Howard Elementary School in Champaign.

ISTC Library staff continues to maintain Environmental News Bits ([lib.wmrc.uiuc.edu/enb](http://lib.wmrc.uiuc.edu/enb)), a blog to update Center staff on environmental news and emerging issues. In FY 2008, 2862 items were posted to the blog and it had 542,862 visits.

The Clearinghouse consists of reports from research projects funded by the Center, pollution prevention fact sheets and brochures, and other environmental information from around the world. The Clearinghouse distributed 114 hard-copy publications last year on topics ranging from household hazardous waste to mercury and pollution prevention in schools. This number is lower than previous years because the Center moved to electronic-only distribution of its research reports in FY 2005. During FY 2008, ISTC reports and fact sheets were viewed 35,652 times on the Web site.



# P2Rx AND GLRPPR

The Pollution Prevention Resource Exchange (P2Rx™; [www.p2rx.org](http://www.p2rx.org)) is a consortium of eight regional pollution prevention information centers, funded in part by the U.S. EPA. These centers provide pollution prevention information, networking opportunities, and other services to states, local governments, and technical assistance providers in their region. U.S. EPA has awarded ISTC funding to support P2Rx.

ISTC coordinates the Great Lakes Regional Pollution Prevention Roundtable (GLRPPR; [www.glrppr.org](http://www.glrppr.org)). GLRPPR serves not only the states in U.S. EPA Region 5, but New York, Pennsylvania, and the Province of Ontario, Canada as well. Through its participation in P2Rx, the Roundtable is able to expand the services and products provided to the entire Great Lakes Region as well as provide quality and cost-effective national products.

## New Online Resources

During the past year, GLRPPR completed two new “P2 in Schools” Topic Hubs. Sustainable School Design (Construction and Retrofitting) provides communities with resources that support pollution prevention and guide them through the process of constructing new high performance/green schools or retrofitting pre-existing schools. Energy Efficient Schools and Students (E2S2) offers a central resource for disseminating energy efficiency and alternative energy curricula and strategies to schools and teachers. A complete list of Topic Hubs developed by GLRPPR and other P2Rx Centers is available at [www.glrppr.org/hubs/](http://www.glrppr.org/hubs/).

The GLRPPR Blog ([www.glrppr.org/blog/](http://www.glrppr.org/blog/)) continued this year as a way to provide information and communication opportunities to members beyond the typical listserv, conference, or newsletter. The blog provides readers the chance to comment on stories and provide further information and insights, thus fostering networking in a way not possible through a standard newsletter. The blog has added Scott Butner from Batelle Pacific Northwest Laboratory and Rick Yoder from the P2RIC organization in Region 7 as guest bloggers. GLRPPR has also incorporated the “site of the month” into the blog (it’s a monthly blog post now instead of a separate section of the GLRPPR home page).

GLRPPR now has RSS feeds available for all of the GLRPPR Sector Resources. Participants can now subscribe to the sector and subject categories that interest them and receive updates in a news aggregator (e.g. Google Reader, Bloglines, etc.) when something new is added to those categories. The Sector Resource RSS feeds will allow someone to keep up with the latest information added to the GLRPPR Web site related to their subjects of interest. The areas being monitored include resources, upcoming events, funding opportunities, and archived Help Desk questions and answers related to a sector or subject. To subscribe to Sector Resource RSS feeds, visit the Sector Resources section of the GLRPPR site.



# P2Rx AND GLRPPR

GLRPPR also has added a sector resource called "P2 Measurement & Calculators." It provides a way to calculate the environmental impact of some everyday items and has ways to determine an organizations carbon footprint. It's available at [www.glrppr.org/contacts/gltopicub.cfm?sectorid=143](http://www.glrppr.org/contacts/gltopicub.cfm?sectorid=143).

## Other activities

GLRPPR participated this year in a quality review of the P2Rx national network and the individual centers. The evaluation was performed by Abt Associates Inc., under contract to the US EPA. ABT worked with all eight center directors and surveyed customers by telephone and online. The purpose of the evaluation was to:

- 1) Assess the effectiveness of the program in promoting the adoption of P2 opportunities
- 2) Identify opportunities for creating a more effective interface with customers
- 3) Identify current efficiencies in information collection and dissemination as well as future opportunities for improving efficiency.
- 4) Determine how P2Rx activities can be linked to long-term environmental outcomes

A copy of the ABT report is available online at

[www.p2rx.org/AdminInfo/2008\\_survey\\_results/FINAL%20PPIN%20Evaluation%20Report\\_August8.pdf](http://www.p2rx.org/AdminInfo/2008_survey_results/FINAL%20PPIN%20Evaluation%20Report_August8.pdf)

## Annual Conference

The Region 5 and 7 joint Pollution Prevention conference was held in Omaha in the spring. One of the things that made this conference unique was that it was held in meeting rooms at the Omaha Zoo. During the breaks participants were free to explore that world class zoo and learn about environmental sustainability strategies.

The Omaha event began with a day-long training on Lean and Clean, including Green Suppliers, energy issues, and the connection to Environmental Management Systems. The first day of the conference offered a variety of topics including five reasons businesses go green, the state of the ethanol industry, and Green Chemistry. In the afternoon there were speakers on the Waste to Profit network, carbon credits, measuring climate change, and reports on issues from officials with the EPA and the National Pollution Prevention Roundtable. The second day offered report outs from the states in Region 5 & 7, a discussion of some new CARE grant programs, information about the Midwest Product Stewardship Council, and a discussion of P2 Intern programs.

Fifty people attended at least part of the event. Presentations from the Great Lakes/Great Plains P2 Conference are available online at: [www.p2ric.org/Roundtable/2008SpringAgenda.cfm](http://www.p2ric.org/Roundtable/2008SpringAgenda.cfm).

## PATENTS ISSUED TO ISTC STAFF

Several Illinois Sustainable Technology Center staff members were issued patents this year.

Kishore Rajagopalan and Todd Rusk of ISTC, as well as to Rob Sanford from Civil and Environmental Engineering, received a patent for *“Methods and Systems for Membrane Testing.”* This is the second patent this group has received on different aspects of the same technology. The patent is based on the use of paramagnetic particles to probe membrane integrity, i.e., to determine if defects—such as pinholes—exist in the membrane. The patent improves current membrane integrity detection procedures through utilization of the magnetic properties of the test particles as a “handle” to increase both particle concentration and specificity prior to detection. You can read the patent at the link below:

**[www.google.com/patents?id=\\_wOpAAAAEBAJ&dq=7,357,859](http://www.google.com/patents?id=_wOpAAAAEBAJ&dq=7,357,859)**.

A patent was issued to Tim Lindsey and Joe Pickowitz of ISTC, as well as Steve Rundell of Chemical Management Systems. The patent is for *“Method and Apparatus for Purifying Mixtures of Oil and Water.”* The group developed an apparatus and method for separating oil and particulate contaminants from pump-driven aqueous fluid contaminated with emulsified oils, free oils, particulate matter, suspended solids, and other contaminants. The contaminated fluids are introduced into a container having a horizontal bottom portion and a weir plate dividing the container into an upper clean fluid compartment and a lower separation compartment. An aperture for the outflow of clean fluid from the upper clean fluid compartment sized relative to the pumping rate of the pump drives the aqueous fluid to ensure a residence time of the contaminated fluid in the lower separation compartment of at least about 0.4 minutes, coalescing media comprising a plurality of abutting polypropylene spheres located in the lower separation compartment. A drain receptacle collects the contaminated fluid and delivers the contaminated fluid across the weir plate to the lower separation compartment. Details on this system can be found on the Web at:

**[www.google.com/patents?id=e9-fAAAAEBAJ&dq=7303085](http://www.google.com/patents?id=e9-fAAAAEBAJ&dq=7303085)**.

# PERCHLORATE STUDY

## ASSESSING A POSSIBLE DANGER IN ILLINOIS H<sub>2</sub>O

Perchlorate has been shown to be a health hazard to humans, particularly women of childbearing age and children. This inorganic salt has been detected ubiquitously in surface and groundwater in 22 states. Is it a danger in Illinois water? That is what a study by the Illinois Sustainable Technology Center Laboratory staff is attempting to determine.

Testing in animals has shown that perchlorate can disrupt thyroid function by interfering with the uptake of iodine. Because of this, the U.S. EPA has adopted a reference dose for perchlorate of 24.5 parts per billion (ppb). Some states have proposed a much lower level than that; Illinois EPA is proposing a 4.9 ppb standard.

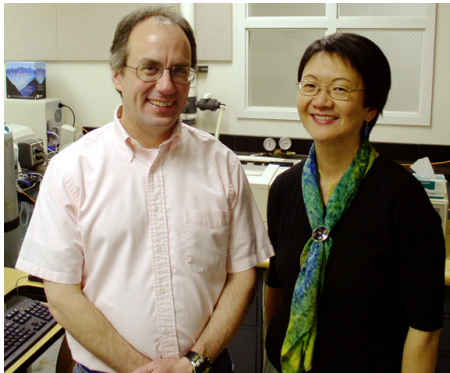
Perchlorate is most commonly found in places where its salts were used as an oxidizer in rocket propellants, missiles, fireworks, blasting agents, and highway flares. Therefore, the ISTC project involved collecting water samples from within one mile of potential source areas. The nine sites chosen across the state were former federal military facilities and places where fireworks were manufactured.

The project results showed that perchlorate was not detected above two ppb at any of the sites. At a former Army depot site, the perchlorate level was found to be slightly higher, but still below the proposed level for Illinois..

# PPCPs

There is increasing worry about medicine in the water system. How much is there and does it pose a problem to humans? Staff members from ISTC are researching the issue.

ISTC recently hosted a symposium on pharmaceuticals and personal care products (PPCPs) in the Illinois environment. The symposium was by invitation only, and it brought together a wide range of individuals with interest in this topic for discussion of past and current work, as well as the future research needs in this area. Approximately 30 researchers from different Illinois universities and organizations; regulators from various agencies such as IL Dept. of Health, IL EPA, and U.S. EPA; and engineers and representatives from pharmaceutical companies and water utilities gathered for the meeting. The presentations from the seminar are archived on the ISTC Web site at:



[www.istc.illinois.edu/special\\_projects/ppcp-env/](http://www.istc.illinois.edu/special_projects/ppcp-env/).

Teresa Chow and Monte Wilcoxon of the ISTC Laboratory staff this year developed analytical methods for PPCPs based on the new USEPA guidelines. ISTC can analyze 18 compounds by two methods using both positive and negative ion modes. Chow presented her data at the PPCP Symposium.

Pharmaceuticals and Personal Care Products can include:

- Prescription and over-the counter drugs
- Hormones and vitamins
- Veterinary drugs, especially antibiotics and steroids
- Antibacterial soaps and detergents
- Fragrances, Cosmetics

The PPCPs can come from a variety of sources including human activity, residues from hospitals and nursing homes, veterinary drug use (especially antibiotics and steroids), and livestock waste. There can be some residues from pharmaceutical manufacturing, but these are usually well defined and controlled.

From 1999-2000, the U.S. Geological Survey tested 139 streams in 30 states and found that 80% of the water samples contained residues of PPCP's. Studies in places as different as the Potomac River and the Great Lakes Water Institute in Milwaukee have shown PPCP's are affecting the development of fish.

Chow says more research is needed in the area of PPCP's in the water. There are currently monitoring studies in the Chicago and Bloomington areas. She suggests at point source studies also need to be done near hospitals or nursing homes to see if they impact the wastewater sent to treatment plants. She says the analytical methods at facilities such as ISTC are being upgraded all the time, which will help determine the extent of the problem and give direction on what corrective actions should be taken.

# PNEAC

The Printers' National Environmental Assistance Center (PNEAC) is one of the national compliance assistance centers established by U.S. EPA Office of Enforcement and Compliance Assurance. The Illinois Sustainable Technology Center has received funding from the U.S. EPA to coordinate PNEAC since 1995. PNEAC maintains services to industry and government agency staff including:



- online, direct technical and compliance assistance to printers;
- a comprehensive Web site that provides environmental compliance, safety, and technical resources specific to the commercial printing industry.

PNEAC is developing a resource to assist industry to comply with EPA's storm water regulations. This interactive online tutorial explains the stormwater permitting and reporting requirements as they apply to manufacturing and other industries. It explains the requirements of the pollution prevention plan, self-inspections, and details which states have authority to implement these regulations. This tool is a resource for all industries, not just printers. It will be an important resource because all entities subject to these regulations must submit documentation to their state or U.S. EPA to be in compliance with the regulations regardless of whether a permit is required.

Fact sheets and case studies are perennially a key resource provided on the PNEAC Web site. Over the past year two additional fact sheets were developed. Check them out at [www.pneac.org](http://www.pneac.org).

The Vendor and Supplier Directory is routinely updated. A renewed effort to expand and maintain this area has been launched. Trade journals and buyers guides are routinely reviewed for new vendors. New vendors are added to the PNEAC directory. As part of this effort new vendors are contacted to inform them about their listing in the PNEAC directory and they are invited to sponsor the PNEAC Web site.

PNEAC served as a co-sponsor of the Printers National Environmental Health & Safety Conference held in Indianapolis, Indiana in March 2008. PNEAC has co-sponsored the program for thirteen years. The second annual "PNEAC Publication of the Year" award was presented at this conference. Three publications were honored, including "Green Converting" Paper, Film & Foil Converter—September 2007 (Book/Collection: National Publication Category), "Shades of Green" Georgia Printer—October 2007 (Book/Collection: Regional Publication), and "Green 101" Labels & Labeling April/May 2007 (Article).

# STAFF PUBLICATIONS AND PRESENTATIONS

Informing the public about the many interesting and important projects at the Illinois Sustainable Technology Center (ISTC) is an on-going commitment. ISTC staff members had a number of publications and poster presentations during the year.

## PUBLICATIONS

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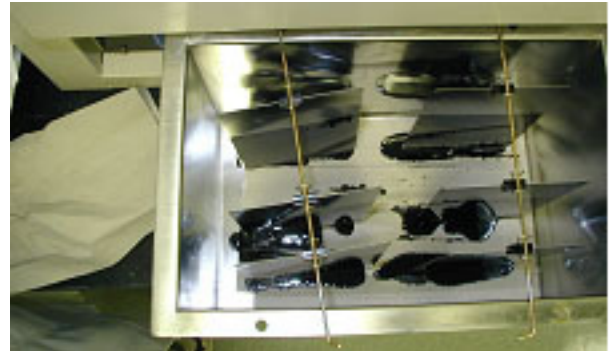
## PRESENTATIONS

Nancy Holm and Brent Panno represented ISTC at the poster/display sessions of the Environmental Horizon Conference at the Illini Union. Panno exhibited a poster on work by the ISTC lab on four different research projects highlighting the analytical capabilities of the lab. Holm modified the general ISTC display to also include examples of several of the current research projects we are funding through the research grant program. Gary Miller and Tim Lindsey also participated in presentations at the conference.

# TAR REMOVAL PROJECT

## EVALUATION OF SOLVENTS FOR ASPHALT REMOVAL

During those hot Illinois summer days, accumulation of road asphalt on vehicles can be a problem. Diesel fuel has commonly been used to remove the deposit, but other solvents also are being investigated for this cleanup. Under a project for the U.S. Army's Construction Engineering and Research Laboratory, the Illinois Sustainable Technology Center laboratories tested three alternate cleaners for their efficiency in removing asphalt from the surface of metal.



The first phase of the project was a literature review to determine what cleaners have been studied and how the studies were set up and carried out. The information gathered in the literature review led to the development of a protocol to measure the efficiency of the solvents on removing the asphalt from metal surfaces. After the protocol was developed, the actual testing of the solvents took place.

The asphalt used in these experiments was a standard commercially available material labeled CRS-2. Four alternative solvents were chosen for the project. The project used stainless steel test strips with identical dimensions. Asphalt was coated on the test strips by immersing them to a depth of about four inches. The strips were hung in a 60° oven for 24 hours and the excess CRS-2 was allowed to drain from the test strips. At the end of the drying period, the strips were cooled to room temperature and weighed. The strips were immersed in the test solvents so that the entire asphalt coated areas were exposed to the solvent. The strips were withdrawn from the solution after 60 seconds and drained for 2 minutes. This was repeated two more times for a total of three solvent rinses. Following this the strips were washed in water. The strips were allowed to dry at room temperature for 2 hours and desiccated overnight.

This study revealed that at least two categories of solvent blends can remove asphalt off metal. Of the solvents tested, Axarel 32, appears to combine both functionality and desirable environmental characteristics. ISTC recommended that follow up studies be conducted to evaluate these solvents in the overall framework of economics, environment, and health.



# TECHNICAL ASSISTANCE

Illinois Sustainable Technology Center (ISTC) technical assistance engineers possess a unique mix of experience and training that enables them to investigate and solve a variety of business problems. Our experts can help businesses and organizations reduce all types of solid waste as well as toxic releases into the air or water.

ISTC engineers work as change agents to help customers identify and implement practices that improve efficiency. Services typically begin with a free assessment to develop strategies and set priorities for addressing issues. ISTC staff assist companies to develop and implement processes that are more environmentally friendly and less wasteful. They work closely with customers to help them identify opportunities to improve efficiency by improving raw material utilization, reducing waste and minimizing energy usage.

Services offered by the technical assistance experts at ISTC include:

- Waste Minimization Opportunity Assessments
- Energy efficiency Assessments
- Project Implementation
- Water purification and conservation methods
- Environmental Management Systems
- Testing of alternative technologies

## CHICAGO INDUSTRIAL REBUILD PROGRAM

ISTC partnered with ComEd to provide energy, waste reduction, and process improvement assessments to manufacturers in the Chicago area. ISTC's technical assistance engineers worked with several food-processing companies in Chicago this past year to assist them with improving waste management practices and implementing energy efficiency technologies.

## GREEN CONSTRUCTION AND DEVELOPMENT

The Pollution Prevention program's Green Construction and Design Program assists citizens, developers, and contractors with recycling and reuse options for construction activities. Through a Solid Waste Management Grant from the USEPA, ISTC has developed a project to implement a sustainable building program within the state of Illinois.

The project provides information and technical assistance on green building concepts as well as ideas about construction and demolition (C&D) waste management and recycling. The program also forms partnerships

# TECHNICAL ASSISTANCE

with other 'change agents' to implement these practices. During the two-year grant period, ISTC will host three seminars on these topics, identify recycling markets for C&D debris, and form partnerships with two Illinois builders to perform green building and recycling demonstration projects.

## WASTE TO PROFIT

Established in October 2006, the goal of the Chicago Waste to Profit Network is to promote business collaboration to find new ways of transforming business waste into profitable and innovative uses. Member companies in the network are helping to improve not only their business operations, but also the quality of life in the Chicago area. The City of Chicago is bringing this program to Chicago area businesses through a partnership with the United States Business Council for Sustainable Development (USBCSD) and the Chicago Manufacturing Center (CMC). The Chicago network also has a partnership with the National Industrial Symbiosis Programme (NISP) in the United Kingdom. ISTC is acting as a technical partner to assist with the development of the overall program. ISTC works directly with businesses and with the City of Chicago departments to assess activities and identify opportunities for by-product exchange, new technology needs, and waste reduction or efficiency opportunities.



**CHICAGO  
WASTE TO PROFIT NETWORK**

ISTC staff has helped identify synergies and coach companies to explore and test potentially valuable synergies. In addition, ISTC has identified and recruited new members into the network based on gaps in services or complimentary processes that can utilize byproducts among the existing network.

The goal is to continue to grow the Chicago Waste to Profit Network as a long-term program to serve Chicago businesses and promote economic development for the region. As the network grows, it will seek to add member companies from every major industry sector in the Chicago region.

The Illinois Sustainable Technology Center (ISTC) supports research projects that explore solutions for vital issues impacting the environment and public health. The researchers work in areas such as the development of innovative pollution prevention technologies; improvement of efficiency and reduction of waste in business and industries; studies of emerging environmental contaminants; promotion of wastewater reuse; and formulation of biodiesel and alternative fuels. The results of the various research projects provide valuable information to the scientific and regulatory community in Illinois and throughout the nation.

FY2008 was an unusual year in that no new research projects were funded since ISTC had insufficient new funds available to justify a full research proposal solicitation. Several ongoing research projects were completed in FY2008 and a number of projects continued through the year. A new solicitation was conducted for new projects to begin in FY2009. All of these projects are described below.

## **RESEARCH PROJECTS COMPLETED IN FY2008:**

### ***Whole-cell Biocatalysts for Producing Biodiesel from Waste Fats***

This research project by Guang Jin and her colleague Tom Bierma, Department of Health Sciences at Illinois State University, focused on whether the micro-organisms that produce four popular lipases used in biodiesel synthesis can catalyze transesterification of yellow grease high in free fatty acids (FFA). The ability to use whole organisms in place of either alkali or purified enzyme catalysts could allow low-cost transesterification of high-FFA waste fats.

### ***Risks to Insectivorous Birds in the Calumet Region from Transfer of Contaminants from Sediments to Emergent Aquatic Insects***

David Soucek, Jeff Levensgood, Sue Gallo, and Walter Hill of the Illinois Natural History Survey, along with Gary Bordson of ISTC and Jon Talbott (formerly of ISTC), studied the transfer of PCBs, PBDEs, and metals from sediments to insectivorous birds (using tree swallows as a model). The study was done via emergent aquatic insects in various wetlands in the Lake Calumet region. They quantified the risks to the birds by examining the health and productivity of the tree swallow population. The researchers found that a variety of inorganic and organic contaminants were accumulated by nestlings, but concentrations of nearly all contaminants were at the lower end of the range of values reported in the literature. They reported one of the first known finds of PBDEs concentrations in tree swallow nestlings. They concluded that tree swallows at these sites do not appear at risk from contaminant exposure via emergent insects.

### ***Database Development for Comparative Analysis of the Performance of Metalworking Fluids in Machining Operations***

Shiv Kapoor and his colleagues at the University of Illinois at Urbana-Champaign developed a database that will aid industrial users in the selection of metalworking fluids (MWFs) that are economical and minimize environmental impact. The researchers evaluated ten MWFs for a variety of parameters and the results of

the tests were formulated into a product performance matrix which can be used to choose fluids based on specific performance qualifications.

### ***Expanded CMS Pilot Projects in Small and Medium Sized Enterprises (SMEs)***

Tom Bierma, Department of Health Sciences at Illinois State University, built on earlier efforts to introduce the chemical management system (CMS) model into small and medium sized enterprises (SMEs) in Illinois. The CMS model has been implemented at two SMEs in central Illinois and the companies saw substantial savings in material and energy costs during the first two years of implementation. The longer-term value of this approach is to improve the competitiveness of Illinois industries to ensure their financial viability into the future.

### ***Correlations of Agrochemical Residues in Drinking Water and Birth Defects in Illinois***

Manoj Mohanty, Southern Illinois University-Carbondale, coordinated a study investigating the relationship between conception rates, birth defects, and other adverse pregnancy outcomes and the concentration of agrochemical-based contaminants in Illinois drinking water supplies. The study specifically examined atrazine, nitrate, and nitrite, as well as two disinfectant byproducts—total trihalomethanes and haloacetic acids. This project was a collaborative effort with several other agencies, including the U.S. Geological Survey—specifically David DuPre and Terri Arnold, and the Illinois Department of Health. Results indicated that atrazine, total trihalomethanes, and haloacetic acids were found to be the most critical contaminants, whose effects were statistically significant for all categories of adverse birth outcomes. Additional work on the interpretation of the data is being conducted.

### ***Hydrologic and Hydraulic Modeling for the Restoration of the Calumet Marshes: Assessment of Runoff Scenarios***

Yanqing Lian and George Roadcap of the Illinois State Water Survey, and Ximing Cai, University of Illinois at Urbana-Champaign, constructed hydrologic and hydraulic models for the Calumet region in South Chicago. These models will be used by the Chicago Department of Environment and others as a basis for determining the best water management strategies for the Lake Calumet Cluster Site and the adjacent marshes and ponds that it potentially impacts.

### ***Isoflavones in the Environment: A Pilot Study***

Researchers Jeff Levensgood, Illinois Natural History Survey, and Teresa Chow, ISTC, conducted a preliminary investigation of selected phytoestrogens in small, highly-cultivated agricultural areas and drainage in central Illinois. They analyzed samples for a suite of 13 phytoestrogens, including 12 isoflavones and coumestrol. Seven of the phytoestrogens were detected in low concentrations in water, and eight were observed at higher concentrations in sediment samples than in the water. Their results show spatial and seasonal patterns to the presence of these compounds, which could be driven by rainfall, seasonal land-use, and plant growth patterns. Also the patterns indicate that there are multiple sources of these phytoestrogens in the agricultural environment.

## **RESEARCH PROJECTS ONGOING IN FY2008:**

### ***Mercury Concentrations in Wetlands associated with Coal-fired Power Plants in Illinois***

This project undertaken by Richard Halbrook and his colleagues at the Cooperative Wildlife Research Laboratory at SIU-C is examining preliminary data and protocols for evaluating the current mercury status in wetlands surrounding coal-fired electrical generating plants in southern Illinois. They are examining mercury concentrations in tadpoles and sediments in over 40 ponds located above and below coal-fired power plants. They will also provide a mechanism for monitoring and evaluating the efficacy of efforts to reduce mercury emissions in such environments.

### ***Fate Analysis of Polybrominated Ethers in Anaerobic Digester Sludge***

Karl Rockne and associates at UI-Chicago are investigating whether BDE-209, the deca-brominated form, can be debrominated to more toxic and bioavailable congeners in wastewater treatment plants. Data will be used to predict BDE dynamics under various digester conditions using a model developed as part of this project, providing the information necessary to conduct risk analyses for the continued use of BDE-209.

### ***Overcoming Barriers to P2 and Recycling for Construction Waste***

The goal of this project being conducted by Richard Boser and Tom Bierma of Illinois State University, along with Mohamed El-Gafy of Michigan State University, is to accelerate the adoption of waste minimization and pollution prevention (P2) practices by Illinois home builders. They have organized two pilot studies—one in Normal and one in Chicago—to promote the use of best management practices for the minimization and reuse of waste materials. They identified and examined major barriers such as cost, training, building site size, allegiance to waste hauler, and availability of recycling sites to adoption of these practices.

### ***Topsoil Modification during Suburbanization: Impact on Demands for Municipal Water***

Robert Darmody, Department of Natural Resources and Environmental Science at UIUC, has been investigating the impact on water usage of various construction practices. The study is focusing on new construction in northeastern Illinois and central Illinois and will address topsoil removal, soil compaction, and associated practices on water percolation rates, and the ultimate impact on water use for lawn and garden watering. This research will help to redefine construction practices that will minimize post-construction water usage and help with water shortages.

### ***Greening Metalworking Fluids Purchasing Using Multicriteria Methodologies***

Michael Plewa and Elizabeth Wagner, UIUC-ACES, and Kishore Rajagopalan, ISTC, are developing methodologies that will help industrial users make intelligent choices in purchasing metalworking fluids (MWFs). The information gathered will include evaluations of the functional behavior of the MWFs in various industrial processes and the toxicity and associated health and safety aspects of the various fluids.

## ***Developing the Basis for Creating Environmental Networking Organizations in Downstate Illinois***

This project coordinated by Susan Morgan and Jianpeng Zhou, Department of Civil Engineering, Southern Illinois University-Edwardsville, is evaluating the potential for the development of environmental networking organizations in the metro-east region of St. Louis to elevate the awareness and increase the use of ISTC services by local industries. The project will identify potentially interested parties, define the needs of industry, explore the feasibility and usefulness of creating networking organizations in these two counties in western Illinois, and develop a networking organization model. Two workshops jointly sponsored with ISTC have been held.

## ***Identification of the sources and temporal patterns of sediment-associated toxicity in the Illinois River***

Michael Lydy and colleagues at Southern Illinois University-Carbondale are examining toxicity in Illinois River sediments and pore-waters due to sediment-associated ammonia. They also are examining other potential sources of benthic toxicity such as metals, organochlorine pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). These organic compounds and metals have been previously measured in Illinois River sediments, but their current contribution to toxicity is not known. Information gathered in this study will be used to better inform about the sediment dredging and beneficial use activities in the river.

## ***Perchlorates in the Illinois Environment***

This study by Rita Dolan and associates at Greenwood Environmental Consulting, Inc. is investigating the level of perchlorates at various sites in Illinois to determine if there is a contamination issue in Illinois drinking water supplies. Currently, there is insufficient data to demonstrate whether there is a perchlorate risk in Illinois water supplies.

## **NEW PROJECTS AWARDED FUNDING FOR FY09:**

In early June, funding decisions for proposals submitted for the FY2009 research solicitation were made. Due to budget limitations, only a small number of the projects received funding. Those were:

- ***Ecotoxicology of Antimicrobial Pharmaceutical and Personal Care Products in Illinois Rivers and Streams*** by Dr. John Kelly and Dr. Emma Rosi-Marshall of Loyola University-Chicago, and Teresa Chow of ISTC
- ***In-vitro Selection of DNA Aptamers for the Detection of Endotoxins*** by Dr Yi Lu of UIUC
- ***Monitoring and Documenting Performance of Stormwater Best Management Practices*** by the Center for Neighborhood Technology under direction of Bill Eyring and Steve Wise
- ***Seed Project: Total and Methyl Mercury Export from Tile-Drained Fields of Central Illinois: A Comparison of Conventional Free-Flowing Systems and Systems with Subsurface Denitrifying***

# RESEARCH

**Bacteria** by Dr. Bob Hudson of NRES and Dr. Richard Cooke of Agriculture & Biological Engineering at UIUC

- **Seed Project: Examining potential emerging contaminants in the Great Lakes area: analytical methods development and measurement of concentrations in Great Lakes fish** by Dr. Jeff Levengood of INHS and Gary Bordson of ISTC
- **Seed Project: Optimized Antioxidants for Biodiesel and Biodiesel Petroleum Diesel Mixtures** by Dr. Rick Larson of UIUC (Dr. Wei Zheng of ISTC will be collaborating on parts of this research with Dr. Larson).

# WHAT'S YOUR FOOTPRINT?

The term “carbon footprint” is becoming a part of the American culture. A carbon footprint illustrates an organization’s or individual’s contribution to global climate change and provides insight on potential exposure to future regulations. The Illinois Sustainable Technology Center (ISTC) takes a comprehensive approach to calculating carbon footprints from both industrial and commercial operations. ISTC’s carbon footprint studies include contributions from the usage of fossil fuels and electricity, as well as other sources of greenhouse gas emissions.

ISTC staff members decided that we should examine our own house first and performed a carbon footprint analysis of our headquarters building. Those findings are being reviewed and discussed with officials at the University of Illinois, which owns the building.

ISTC can take what it has learned about carbon footprintings and bring the expertise to businesses and organizations of all sizes. ISTC can help:

1. Analyze facility operations to identify sources of greenhouse gas emissions.
2. Quantify the company’s baseline level of greenhouse gas emissions.
3. Identify opportunities to reduce emissions.
4. Provide assistance in the implementation of greenhouse gas emission reduction strategies. ISTC works with clients to develop strategies to reduce carbon and other greenhouse gas emissions through energy efficiency, the use of renewable energy, and other innovative strategies.

For further information about how ISTC can help an organization with its carbon footprint, contact Todd Rusk at [toddr@istc.illinois.edu](mailto:toddr@istc.illinois.edu).





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ILLINOIS

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