The world is changing at an ever-increasing rate. But there also are things that always remain the same. One of the most important of these is protecting the environment. And if you’re running a business, another one is not wasting your money.

The Waste Management and Research Center has been providing assistance to Illinois businesses and the public since 1985. WMRC is a non-regulatory service organization affiliated with the University of Illinois and is a division of the Illinois Department of Natural Resources. WMRC has staff located in Champaign, Oak Brook, Peoria, Springfield, and Brighton.

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 WMRC’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 WMRC 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.

WMRC’s staff is committed to providing real world solutions for real world problems.

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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
The BNRC is the governing body for the Illinois state scientific surveys, which includes the Waste Management and Research Center. The BNRC is 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

Representing Southern Illinois University
Dr. Christopher C. Kohler
Director of SIU Fisheries and Illinois Aquaculture Center
Southern Illinois University

Chemist
Ms. Ada C. Nielsen
BP America - Naperville

Engineer
Ms. P. Kay Whitlock, P.E.
Vice President of Christopher B. Burke Engineering, LTD - Rosemont

Plant Biologist
Dr. John Ebinger, Professor Emeritus
Department of Biological Sciences
Eastern 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

LIAISON
Damon Stotts,
Acting Director, Office of Scientific Research and Analysis IDNR
Sustaining our way of living

Everyone wants future generations to enjoy the same benefits of living in Illinois that we have enjoyed. So we need to develop ways to preserve the environment and conserve energy while expanding the economy. That’s what the Illinois Waste Management & Research Center is all about – sustainable solutions.

The nation can no longer live with the notion that what is good for the economy is bad for business. Economic growth and scientific advancement should be coupled with the needs of the environment. At WMRC, we are striving to develop sustainable solutions that will provide a future of exciting opportunities while preserving an environmental legacy for generations to come.

WMRC has helped hundreds of businesses find a better way to operate. We can show how preventing pollution reduces harm to the environment and is economically viable.

This is the Information Age, and information is a key element of what we do at WMRC. Our building has a special Library with information about a variety of environmental and scientific issues. WMRC hosts several regional and national information programs that through web sites, trainings, meetings and other tools provide knowledge to technical assistance providers, businesses, and the general public.

From the research we fund to the final manufacturing processes we help improve, WMRC is always seeking a better way to do a job. To make Illinois and the world a better place, those solutions have to be able to sustain growth, sustain the economy, sustain our natural resources and sustain the environment. Our actions today can create an even better future – that is the vision that keeps WMRC working for the people of Illinois.
The programs of Waste Management & Research Center are funded through a variety of sources. The largest source is General Revenue Funds from the state of Illinois. However, WMRC also receives funding from the University of Illinois, federal sources, other state sources, and private funds. The chart below shows the percentage of funding WMRC received in each category during Fiscal Year '07.
Gary Miller, Assistant Director of the Waste Management & Research Center, won a national award for his work with the national Environmental Summit. Miller was presented with the “Spirit of the Summit” award during the 2007 national summit held in New Orleans.

The award was presented to Miller for his contributions in advancing the theme and goals of the Summit through his contributions on the job and his work in the community. The theme for the 2007 Summit was Local Actions, Global Results.

Miller’s selection was based on four criteria.

1. Leadership and Vision: His position taken to address the theme and the role of the individual to inspire others.

2. Transferability: The applicability of his efforts to other situations and the degree to which the individual has fostered the opportunity to transfer.

3. Collaboration: The degree to which his effort brought together relevant parties.

4. Accountability: The degree to which his effort demonstrates its impact on the community and communicates its impact to relevant parties.

Miller serves on the Board of the National Pollution Prevention Roundtable, one of the sponsoring agencies for the Environmental Summit. He also is active in a variety of organizations with the State of Illinois, the University of Illinois, regional pollution prevention associations, and national compliance assistance centers.
Scientists throughout the world are developing new fuel sources to ease the demand on fossil fuels. Experts at the Waste Management and Research Center (WMRC) have been developing a special niche in alternative fuels: producing biodiesel from waste streams. WMRC experts are working with the University of Illinois, food product manufacturers, public schools, and food services to create biodiesel.

Illinois Lt. Governor Pat Quinn this year praised the biodiesel program at WMRC as one of the ways America can reduce its dependence on foreign oil. Quinn visited the University of Illinois to highlight how WMRC uses waste cooking oil from a student dining hall to power its biodiesel truck. Joining Quinn at a news conference were University of Illinois President Joseph White and Chancellor Richard Herman. Quinn says efforts such as WMRC’s will lead the way to a better future for Illinois.

“We don’t want to rely on foreign potentates to fuel our vehicles,” said Quinn. “Here at WMRC, the researchers have demonstrated that it’s possible to run a standard pick-up truck on 100% biodiesel fuel. This innovative technology makes it possible for us to find new sources of alternative fuels that can substantially reduce our dependence on imported petroleum. This vegetarian pick-up truck proves we can help the environment and increase our national security by running ordinary vehicles on homegrown fuels.”

WMRC Director George Vander Velde said that Quinn and his staff were instrumental in the Center’s efforts to obtain a pick-up truck for the research project. The “vegetarian” vehicle is a standard diesel Ford pick-up truck.

Tim Lindsey, manager of the Pollution Prevention program at WMRC, explained how the used kitchen oil is salvaged from the residence hall. The used oil is pumped from a waste oil container at the kitchen loading dock and taken to the WMRC building on campus where it is converted to biodiesel. Biodiesel is produced through a chemical process that involves the separation of glycerin from fatty acids and binding of those acids to alcohol molecules. Any vegetable oil may be used.

What makes this project unique is that it uses waste oil. While what is commonly referred to and sold as biodiesel is actually a blend of pure biodiesel and petroleum diesel (B20, or 20% biodiesel, 80% petroleum diesel, for example), the WMRC truck is fueled by 100% biodiesel. Biodiesel offers similar power and lower emissions as compared to petroleum diesel and is biodegradable, making it an environmentally friendly fuel that can reduce dependence on foreign oil.
WMRC works with Illinois industries, businesses, and citizens to reduce waste and prevent pollution—thus the interest in both the used cooking oil waste stream and the cleaner burning, renewable fuels like biodiesel. WMRC researchers are exploring the use of other industrial wastes and byproducts in the production of biodiesel to assist businesses and organizations in turning what might otherwise be seen as a disposal burden into a valuable commodity.

WMRC wants to get the information they have acquired out to the masses. Hence, they have been working with businesses and schools to educate them on the many opportunities available to create their own sources of fuel. WMRC technical assistance providers worked with U of I students on the U of I dining hall biodiesel program. They have also worked with several high schools this year to produce biodiesel from cooking oil generated by the school cafeterias. WMRC staff demonstrates the principal of biodiesel and give students a hand-on lesson in production of the fuel that can be used by school buses. Technical assistance providers also partnered with Parkland College and Earth Partners on a four-day workshop for teachers entitled, “Using Reading, Math, and Science to Teach About Biofuels, Energy, and Land Use.” Tim Lindsey presented the workshop and participating teachers also had the opportunity to see WMRC’s biodiesel truck.

WMRC’s Joe Pickowitz and Debra Jacobson this year also initiated a project with McDonald’s Corporation. The biodiesel fuel that WMRC created from waste oil was used in the McDonald’s Headquarters employee shuttle buses with great success. The McDonald’s headquarters is in Oak Brook near the Chicago area office of WMRC. There are plans to expand this project with McDonald’s in the future, perhaps using waste cooking oil from McDonald’s restaurants.

A report was produced for the WMRC web site called “Small Scale Biodiesel Production” that gives an overview of the Biodiesel production process on a small-scale basis. For more information about WMRC’s biodiesel program, visit http://www.wmrc.uiuc.edu/main_sections/tech_assist/biodiesel.cfm. Or contact Dr. Tim Lindsey.
After years of development, an Ecotoxicology Protocol document was signed this year to aid in the development of an area of Chicago.

Waste Management and Research Center (WMRC) has been active in a variety of projects concerning the Calumet Area in recent years. WMRC’s Marv Piwoni and George Vander Velde attended the official signing ceremony for the Calumet Area Ecotoxicology Protocol document, a consensus document defining acceptable residual contamination levels in soil, water and sediments for Calumet wetlands restoration projects.

The Calumet area in Chicago is a site of former landfills and abandoned industrial facilities. WMRC has sponsored research in the area, provided technical assistance to businesses, developed clean fill and sediment options, and partnered with the City of Chicago Department of Environment on a number of projects. WMRC’s work in the Calumet area also involved the establishment of an Ecotoxicological Roundtable.

With appropriate pomp, the attending dignitaries representing the City of Chicago, US and IEPA, UNITED STATES Fish & Wildlife Service, Illinois Department of Natural Resources, and the Chicago Park and Cook County Forest Preserve Districts signed the document. Chicago Mayor Richard Daley bestowed praise on those who helped develop the document that led to this signing.

Chicago Mayor Richard Daley

IDNR Deputy Director Leslie Sgro
WMRC has partnered with the Illinois EPA Office of Pollution Prevention on a project focusing on reducing the environmental impact or “footprint” of metal working fluids (MWF) at industrial firms in central and southern Illinois.

Over the last two decades, the machine tool industry has achieved higher machining rates and productivity. These gains have resulted in large part from the improved formulation and application of MWF. There is a growing trend towards high velocity machining, which will place even greater demands on MWFs.

It is estimated that two billion gallons of MWF is being disposed of each year nationally. This volume is spread across thousands of small facilities. MWF waste is typically discharged into wastewater systems where it causes high biochemical oxygen demand (BOD), and also contributes to wastewater processing problems, such as lower heavy metals precipitation and increased foaming and emulsification of oil. MWF effluent streams can be treated by chemical or ultra-filtration methods. However, these systems by themselves are not sufficient to meet sewer discharge limits, placing a strain on both water treatment capacity and water quality.

Significant concerns exist as to the potential health effects of MWF on machine tool employees. Several studies have established direct correlations between respiratory illnesses and endo-toxin exposure. MWF is reported to contribute as much as 16% of machining costs, including the cost of the fluid, maintenance, energy use, disposal and equipment-related costs. The value of raw materials lost in the MWF waste disposal can vary from $200 to $400 per 1,000 gallons. This constitutes a potential internal revenue stream that can be tapped to pay for modernization at machine tool plants.

In summary, MWFs are costly to manage, difficult to treat, impose a significant burden on the environment if inadequately treated, and present unique health and safety issues.

As a strategy to address these issues, the IEPA and WMRC have collaborated to form a partnership -- The Cutting Edge Partnership™ -- to promote pollution prevention (P2) practices within metal machining facilities utilizing MWF. The P2 practices include source reduction practices, design for the environment (DFE) principles, green purchasing, and innovative in-process recycling technologies whose goals include:

- Minimizing the MWF waste being sent to treatment facilities, landfills or sewers,
- Decreasing the release of aerosols emitted to the workspace air,
- Extending the useful life of MWFs via the in-situ removal of tramp oils and bacteria food sources,
- Testing innovative technologies and materials to reduce waste and eliminate air emissions.

Additionally, The Cutting Edge research team incorporates a holistic approach to identify facility-wide non-MWF-related opportunities in pollution prevention, resource utilization, energy efficiency, water conservation, and process optimization.

The operational structure is based on WMRC’s ADOP2T (Accelerated Diffusion Of Pollution Prevention Technologies Program) program. The ADOP2T program provides a framework to address the awareness, applicability and compatibility barriers in a concurrent manner, providing an effective mechanism for guiding and facilitating transfer of environmental technologies.
The Cutting Edge Partnership™ is committed to working toward state and federal goals to measure environmental outcomes. In the first year of the project, the partnership screened 1,200 companies, conducted telephone interviews with 30 companies, and performed pollution prevention site assessments at eight companies. The partnership selected four companies as the core of the project. The partnership demonstrated nine pollution prevention/energy efficiency (P2E2) technologies, performed 25 pilot projects with 92% of those pilots implemented, and recommended 104 P2E2 improvements with 53% of those implemented. The partnership also developed a facility qualification-screening tool, a Metal Working Fluid (MWF) questionnaire, a MWF project pathway, a MWF request for proposal, a weighted MWF decision matrix, and a DVD on MWF best practices and energy conservation measures.

WMRC conducted its pilot project at a company located in Mattoon. WMRC shared the outcomes of this pilot to reclaim spent synthetic Metal Work Fluid through the use of ultra filtration technology, with other experts. They included Wade Rohland, Director of Applications & Development Support for Northern Technologies International Corporation; Dr. Christine Neipert, Scientist for UTEK Corporation; Sean Reeder, Technology Transfer Officer, University of Illinois, Urbana-Champaign.

The charts below show results of the Cutting Edge project’s first year at participating companies.

Environmental Outcomes To Date FY 07:

<table>
<thead>
<tr>
<th>Company</th>
<th>Annual Gallons of MWF not Disposed</th>
<th>Annual Gallons of Water Saved</th>
<th>Annual Dollars Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>16,134</td>
<td>15,005</td>
<td>$18,311</td>
</tr>
<tr>
<td>Company B*</td>
<td>300</td>
<td>270</td>
<td>$750</td>
</tr>
<tr>
<td>Company B Extrapolated</td>
<td>36,000</td>
<td>32,400</td>
<td>$90,000</td>
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*These results are for a pilot project using ultra filtration technology on a single machining sump using synthetic MWF. Company B has approximately 120 similar sumps.

<table>
<thead>
<tr>
<th>Company</th>
<th>Projected Dollars Saved on Electricity</th>
<th>Projected KW Savings</th>
<th>Projected CO2 Emissions Reduction in pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>$48,392</td>
<td>638,817</td>
<td>1,149,870</td>
</tr>
<tr>
<td>Company B</td>
<td>$42,000</td>
<td>547,223</td>
<td>985,001</td>
</tr>
<tr>
<td>Company C</td>
<td>$55,393</td>
<td>1,146,563</td>
<td>2,063,813</td>
</tr>
<tr>
<td>Company D</td>
<td>$7,000</td>
<td>77,064</td>
<td>138,715</td>
</tr>
<tr>
<td>Company E</td>
<td>$112,000</td>
<td>1,455,817</td>
<td>2,620,470</td>
</tr>
<tr>
<td>Company F</td>
<td>$22,260</td>
<td>325,734</td>
<td>586,321</td>
</tr>
<tr>
<td>Total</td>
<td>$287,045</td>
<td>4,191,218</td>
<td>7,544,190</td>
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WMRC has been working with the U.S. Army Construction Engineering Research Laboratory (CERL) on a project dealing with polychlorinated biphenyl (PCB) laden paint. The paint under study was scraped from the surfaces of machinery, pipes, and the walls of buildings located at a former manufacturing site that is scheduled for demolition. At the time the paint was applied, it was not known that PCBs would later be identified as being environmentally persistent and toxic at high concentrations.

The manufacturing processes used at the site have left some pipes and materials contaminated with dangerous residues that must be rendered harmless so that the Army can safely dispose of these demolition materials. It was originally planned to destroy the dangerous residues by loading the demolition materials into a large oven located on site, and exposing them to elevated temperatures. While the elevated temperatures will neutralize the residues, the concern is that when the demolition materials are heated, the paint on the pipes and materials may release PCBs and dioxins into the air and the environment surrounding the oven.

The aim of the CERL and WMRC project was to determine if the demolition materials could be heated to temperatures high enough to destroy the dangerous manufacturing residues and still not cause the release of PCBs and dioxins from the paint. The paint was heat tested at WMRC using a sampling train apparatus (figure 1) that was modeled after an emissions collection system designed for stack sampling. The apparatus and sampling procedure mimicked USEPA Method 23, “The Determination of Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans from Stationary Sources.” The paints were tested at varying temperatures and exposure times.

Figure 1 - Sampling Train
The sampling train consists of a tank of compressed air, a quartz tube enclosed in a tube furnace (figure 2), a particulate filter (figure 3), a glass trap loaded with XAD adsorbent and five impinger tubes (figure 4). In operation, a ceramic weigh boat containing a paint sample is placed in the quartz tube, the sampling train is sealed, and the airflow started. As the furnace heats the sample and compounds are volatilized from the paint, the moving air transports them from the furnace to the XAD trap and impingers where they are held for later extraction and analysis.

The opened tube furnace and the quartz tube are shown below (figure 2). One of the weigh boats is visible in the center of the tube in figure 2.

The particulate filter contained a glass fiber filter and was located after the quartz tube. The filter oven (figure 3) is heated to the same temperature as the tube furnace. The filter is present to prevent any particulate from entering and contaminating the sample collection area of the sampling train, while still allowing volatilized compounds to pass into the trap. The filter was collected after each run, and was extracted and analyzed for PCBs along with the XAD adsorbent in the glass trap.
The final section of the sampling train is shown in figure 4. The purpose of the condenser, XAD trap and impingers was to cool the volatilized gasses and trap them on the XAD or in one of the impingers. The collected samples could then be analyzed for PCBs and dioxins.
To date samples have been collected at 300°F, 375°F and 450°F at run times of four and eight hours. Some of the initial PCB analysis has been performed at WMRC, with the remainder of the samples being sent out for PCB and dioxin analysis at Severn Trent Laboratories in Knoxville, Tennessee. PCBs and dioxins have been detected at all sampling conditions, with the higher temperatures showing greater concentrations of the compounds released from the paint.
The Waste Management and Research Center (WMRC) honored 24 Illinois companies and organizations at its annual awards event. The 2006 Governor’s Pollution Prevention Awards winners were honored for their significant achievements in protecting the environment and boosting the economy. The 20th annual Governor’s Pollution Prevention Awards were presented in Bloomington during a luncheon hosted by WMRC. Applicants for the awards were judged in a statewide competition on criteria including technological innovation, environmental significance, economic benefits and commitment to pollution prevention.

“We were impressed again with the variety and quality of the projects undertaken by the winning companies,” said George Vander Velde, WMRC Director. “These businesses and organizations have proven that pollution prevention makes good sense for the environmental and economic health of Illinois. They have achieved their pollution prevention goals and saved millions of dollars in pollution control, waste disposal, energy and raw material costs.”

POLLUTION PREVENTION AWARD (FIRST TIME WINNERS)

SMALL COMPANY

Chem Processing, Inc. (CPI), Rockford, is a comprehensive metal finisher. CPI worked with the Illinois Manufacturing Extension Center and the Illinois Waste Management and Research Center on a waste and water reduction project for CPI’s wastewater treatment system. Out of this collaboration, two project ideas were developed – adding a reverse osmosis wastewater stream to the water softening system, and the segregation of the phosphating process wastewater. Due to these projects, CPI will save 900,000 gallons of water and 9000 square feet of hazardous sludge every year. Together, these projects will save CPI $5,300 a year.

PortionPac Chemical Corporation, Chicago, manufactures products to the industrial cleaning market. Its product design and distribution method are designed to reduce the size of formulations, eliminate overuse of chemicals, provide incentives to use less product, and recycle containers. In 2005, PortionPac committed to two programs to help track and codify environmental policies. Through these programs:

- Chemical formulations were modified to reduce harmful materials resulting in a reduction of air and water pollution.
- Modifications were made to packaging.
- A Management program for developing sustainability in all aspects of the business was implemented.

Spraylat Corporation, Chicago, is a manufacturer of specialty coatings. Spraylat implemented programs that saved over $58,000 and reduced emissions by an estimated five tons per year. Production waste generation was reduced nearly 50% per unit of production. The projects included:
2006 Governor’s P2 Awards

- Switching from rags to wipes, which allowed for more efficient cleaning and reduced waste.
- Using an Eco-Filter to replace filter bags, which saves time, material, and waste.
- Reusing wash solvent has reduced liquid waste volumes nearly 25%.
- Installing new grinding media in the mills, which significantly reduced processing time, allowed increased production, and reduced chemical use.

Consolidated Printing Co., Chicago. Consolidated was one of the first Illinois Great Printers, a designation awarded for its efforts to reduce wastes. Some of Consolidated’s recent improvements include:
- Switching to chemical free processor-less plate making;
- Switching to zero VOC paints and varnishes and solvent-free vegetable oil based inks;
- Installing recycled carpeting, ceiling tiles, formaldehyde free insulation, and mercury-free lights and ballasts;
- Using linseed oil press blanket washers; and
- Eliminating the use of silver in their processes.

LARGE COMPANY

Farmland Foods, Inc., Monmouth. In 2005, Farmland Foods switched the coolant used to cool facility air compressors from water to ethylene glycol. A cooling tower allows the reuse of glycol minimizing material use. This reduction of water usage reduces the demands on the water supply, which helps the City treatment plant stay within its permitted flows during Farmland’s expansion. This project has eliminated a water usage point and has reduced facility wastewater effluent by approximately 86,000 gal per day. The combined water/wastewater cost reduction saved Farmland Foods $60,112 per year. The use of glycol for cooling air compressors and reducing water is a first for a Farmland facility.

Illinois Department of Military Affairs, Springfield, directs and provides support services to the Illinois National Guard. DMA’s Environmental Branch has done P2 assessments at several National Guard facilities and has implemented a pollution prevention program and an Environmental Management System. DMA has installed aqueous parts washers with ultra filtration membrane systems, which has extended the life of parts cleaning chemicals from three months to several years. DMA also has developed and installed an automated weapon cleaning system that uses ultrasonic cleaning combined with aqueous cleaners and ultrafiltration to extend the life of the cleaners. This system has resulted in an annual reduction of 540 gallons of hazardous wastes. DMA also implemented a scrap metal recycling program, began using a detergent free vehicle washing system, and started using solvent paint gun cleaners that include solvent distillation systems in their vehicle painting operations.
CITGO-Lemont. The CITGO Lemont Refinery implemented a flaring reduction project, which was intended to eliminate sources to the flare system. The project team successfully identified and eliminated some of the major flare sources, which reduced certain emissions by 76% and produced a large energy savings. The company also replaced burners on three of its largest process heaters, resulting in an 80% reduction in certain emissions and a five percent improvement in burner efficiency. The plant also undertook a leak detection and repair project, which reduced estimated annual VOC emissions from 109.0 tons in 2000 to 9.2 tons in 2005. Finally, the plant reduced the amount of benzene in its wastewater by over 75% through an improved in-line sampling plan, source elimination, process improvements, and operator training. Additional benefits of this change include recycling and reuse of petroleum-based wastes, and reduced load to the wastewater treatment plant.

VENDOR/SUPPLIER

Finishes Unlimited Inc., Sugar Grove, is an employee owned industrial paint manufacturer. The company develops and manufactures EPA complaint water reducible bake enamel and air-dry coatings, which it supplies to industrial users. Users of complaint water reducible coatings significantly lower their volatile organic compound (VOC's) and hazardous air pollutant (HAPs) emissions, and the amount of hazardous waste generated from the coating operation. In 2005, Finishes Unlimited, Inc. converted three Illinois companies to water reducible VOC complaint coatings. These companies reduced their VOC emissions by 70%, or 27.87 tons, and HAPs emissions by 100%, or 9.7 tons. These companies also realized paint and disposal cost savings of over $200,000 per year. By producing only water reducible coatings Finishes Unlimited, Inc. has increased the safety in its own plant.

EDUCATIONAL ORGANIZATION

Pontiac Township High School (PTHS) implemented a Crayon Recycling Program operated by students. The PTHS Ecology students develop receptacles made out of reused decorated five gallon buckets, educated the fifth grade students about following the 3 R's (reduce, reuse, recycle), and helped the fifth graders teach the other students in their schools about the crayon recycling project. For several years, the ecology class also has operated a community storm water pollution education program. To raise community awareness, they stenciled the message “Dump no waste - Drains into our Vermillion” (the local river) on each of the city's storm drains. The students also created and distributed fliers and submitted articles to local newspapers to educate the community about storm water pollution and the stenciling activity.

CONTINUOUS IMPROVEMENT

SMALL COMPANY

Lansing Cleaners in 2005 replaced its last remaining Perc machine with a dry cleaning machine using an environmentally friendly solvent. This machine eliminated the use of a highly regulated chlorine based solvent, and lowered energy costs. This resulted in greater efficiency, while producing a superior product for Lansing's clients. Lansing also has installed LED lighting systems that are 90+ efficient, which has lowered its
lateral consumption and demand for secondary lighting for its facility. The cleaner also installed instantaneous hot water systems to eliminate the typical hot water tank system. Finally, Lansing increased its fleet of natural gas powered trucks from five to eight. This allowed the company to lower its use of gasoline and its harmful emissions while increasing the engine life of its trucks.

**RB White, Inc.** in Bloomington, is a sheet metal fabrication facility. In 1997, R.B. White began using a new state-of-the-art powder coating system. Since then, the company has prevented a total of 225 tons of potential Volatile Organic Company (VOC) emissions through this change. The powder coating conversion also: reduced worker exposure to harmful solvents; improved transfer efficiency, recovery, and reuse of overspray; and provided superior finish with greater durability and improved corrosion resistance. Another benefit of the powder coating system is reduced energy usage. The currently used powder curing process uses convection heating at a savings of as much as $15,000 per month. Implementation of the powder coating system also has enabled R.B. White to expand its business to other companies.

**LARGE COMPANY**

**GE Healthcare**, Arlington Heights, is a manufacturer of radiopharmaceuticals. In 2005, GE Healthcare implemented energy conservation, water conservation, and waste reduction projects. By ramping down power to critical manufacturing equipment during scheduled idle times, an estimated total of 938,054 Kilowatt-hours a year will be conserved. The energy savings is equivalent to the annual electrical consumption of 40 single-family homes ($51,500). The use of polystyrene packaging material was discontinued in favor of an air filled recyclable material. This freed up an estimated 18,000 cubic feet of sanitary landfill space and saved GE Healthcare customers an estimated $13,000 per year. A multifunctional team from the Arlington Heights site also provided guidance and expertise to its satellite facility in New Jersey on a project, which reduced wastewater effluents by 48%.

**Abbott** in Abbott Park, is a health care company that manufactures and markets medical products. The company undertook the following projects in 2005:

- The use of methanol, a Hazardous Air Pollutant, was eliminated in an antibiotic manufacturing process. This resulted in a 95% reduction of HAP emissions, the elimination of wastewater generation, and a saving of $108,000.
- Compressed air leaks were fixed throughout the facility resulting in a 2,168,000-kWh/yr energy reduction, a CO2 emission reduction of 2.5 million pounds per year, and annual savings of $106,000.
- Disposable apparel was replaced with reusable clothing, resulting in the diversion of 12,500 lbs of waste from a landfill each year and a savings of $168,600.
Reducing the frequency of a purified water flush resulted in a reduction of 353,600 gallons of water and a savings of $17,672.

**ITT Bell & Gossett**, Morton Grove, switched from a solvent-based paint to a waterborne paint. It is estimated that this change will save Bell & Gossett $160,000 a year and will eliminate the need for any extensive EPA Title V reporting. The company has reduced its potential air emissions by over 60%. By eliminating the used paint waste solvent, paint filters and associated waste are now sent to a landfill, eliminating the need for specialized waste disposal. The company’s status will go from a large quantity waste generator status to a small quantity generator and it will have drastically reduced the fire and explosion risk. The change also is healthier for employees, as exposure concentrations have also been significantly lowered due to spraying a much less volatile paint that is HAP free.

**Gates Corporation**, Galesburg, mixes slab rubber stock for five other Gates hose manufacturing facilities. Recent pollution prevention projects include:
- A replacement project in the Carbon Black Handling system that has saved $280,000 per year, reduced waste to the landfill, improved raw material usage, and lowered maintenance costs.
- Certain process cleanout materials are now used once and then incorporated into the finished product – resulting in a $28,000 per year savings.
- Improved controls and automating in the cooling tower have saved an estimated three million gallons of water per year.
- Lowering the boiler steam pressure, using low-melt raw materials bags to reduce landfill waste, selling all pallets to a local metal manufacturing plant, and obtaining incoming raw materials in either bulk or returnable containers.

**Nestle’ USA**, Jacksonville, manufactures and packages Coffee-mate®. Environmental projects in 2005 that resulted in a combined estimated savings of $250,000 include:
- A tank farm water use reduction project was initiated to conserve water and reduce effluent. Timers were installed on all wash stations to reduce the chance of operator error in leaving on water hoses.
- Variable Frequency Drive (VFD) units were installed on two cooling towers and an air compressor to control motor speed and reduce energy use.
- Ultrasonic detection devices were purchased to aid in identifying and repairing steam leaks.
- During plant “shutdown” the chilled water temperature is raised for energy conservation
- Tank car condensate was previously dumped into the sewer. All condensate returns are now piped to a recovery tank and reused in the boiler.

**Caterpillar-Mossville Engine Center** has changed to a greener packaging technology, with a focus on increasing profitability and social responsibility. The company worked with suppliers to eliminate waste associated with cardboard, plastic and plywood packaging. These changes range from switching to re-usable plastic tubs from cardboard and metal tubs, to the entire re-design of a gear tray that allows ergonomic assembly and recycling of the plastic tray. Continual savings were achieved through material price reductions and waste volume reduction. Total savings for 2005 equaled $1.7 million, while total waste volume reduction equaled nearly 1.2 million pounds. The project has resulted in environmental benefits of reduced landfill
burden, reduced material prices for Caterpillar, increased supplier efficiency, and has significantly impacted employee health and safety through improved assembly line ergonomics.

**Cardinal Health**, McGaw Park, provides health care products and services. The company instituted a project to reduce its packaging by five percent, or 3.2 million pounds. This goal was met early, with results that were over the target goal. Employees throughout Cardinal Health participated by generating ideas, documenting improvements, and helping with experiments that were necessary to implement changes to these medical packages. Cardinal was able to implement a reduction of over 3.328 million pounds of packaging materials annually with an additional 554,000 lbs of waste reduction identified in pending projects. Projected cost savings are $4.7 million annually and a potential for additional savings that could total to $1.4 million with on going projects.

**Continental Tire North America** (CTNA), Mount Vernon, manufactures radial tires. The company is ISO 14000 Certified and views pollution prevention as one of its core business practices. CTNA decreased the volume of its byproducts sent to landfill by 7.3 million pounds in 2005. CTNA now recycles 71% of all of the waste and by-products that are generated at the plant. CTNA also conserves resources through re-processing a variety of rubber components. Other project resulted in plant lighting being modified to reduce energy usage by 50%, natural gas consumption was reduced by 3.5%, and water usage was reduced by 5%.

**Harris Corporation’s Broadcast Communication Division** (BCD), Quincy, manufactures radio and television transmitters. BCD’s pollution prevention projects included:
- Designing a closed loop cooling water system to eliminate cooling water discharges
- Recovering process heat for use to pre-heat incoming city water, to heat two metal finishing rinses and to aid in the heating of the facility and drying of parts
- Using spray guns to increase material transfer efficiency and reduce annual paint filter disposal costs;
- Reducing the toxicity of materials used in the manufacturing process
- Replacing a traditional parts washer with a virtually waste-free unit
- Upgrading a variety of facility lighting applications to reduce energy and improve lighting.

**International Truck & Engine Corporation** in Melrose Park produces diesel engines for midsized trucks and school buses. This plant is one of the first diesel engine manufacturers in North America to be ISO 14001 certified. In 2005, the company modified its engine testing system to recover and reuse the fuel flushed out of its test engines. Because of this process change, International reused 35,510 gallons of fuel, resulting in an annual savings of $168,170 in waste disposal costs. Last year, International also saved more than $500,000 through its Reduce, Reuse, and Recycle efforts.

**SERVICE ORGANIZATION**

**St. Joseph’s Hospital**, Breese, has over the past decade been preparing medical imaging processes for transition from film to digital viewing. This has now been accomplished, and with the exception of mammography, medical imaging services are entirely digital. This eliminates the need for costly film and decreases use of valuable natural resources such as silver. St. Joseph’s also has identified a vendor to recycle corrugated
cardboard, preventing 50,400 pounds of cardboard from entering the landfill in 2005. Additionally, 2,000 pounds of “junk mail” and 1,755 pounds of desk paper were recycled. Medical waste was reduced through acquisition of a special washer for surgical suction canister content disposal, and through employee education and surveillance activities. Styrofoam utilization was decreased by 83% through replacement with reusable products. The hospital donates used or outdated medical equipment to mission programs rather than placing it into the waste stream and has projects for battery, aluminum, and other paper product recycling. Additionally, in an effort to reduce mercury, the hospital screens new products for mercury content prior to purchase.

**Sarah Bush Lincoln Health System** (SBLHS) is located between Charleston and Mattoon. SBLHS established a committee to examine ways to improve the organization's conservation efforts. Working with local and state officials, the company identified steps needed to establish long-term and sustainable pollution prevention efforts. SBLHS conducted a building energy audit and waste audit. The organization installed upgraded lighting bulbs and fixtures with more efficient models, and recycled cardboard. These steps resulted in substantial savings, which Sarah Bush Lincoln Health System can direct to healthcare priorities in the community. SBLHS continue to identify alternative environmentally responsible products for use and is exploring utilizing vermicomposting to eliminate food waste.

**INNOVATE ILLINOIS AWARD**

The Innovate Illinois Award was presented to **Caterpillar’s Mossville Engine Center** for its Advanced Combustion Emissions Reduction Technology (ACERT). ACERT recovers exhaust energy through series turbo charging and uses the energy to manage airflow into the combustion chamber with an electronically controlled variable intake valve. The fuel system allows for multiple injections throughout each combustion cycle; small amounts of fuel are injected at precise times to achieve the combined goals of fuel economy and lower emissions. This optimization translates into air pollution prevention, energy resource conservation, and a cost savings for every ACERT engine customer in Illinois and throughout the world. In future years, ACERT will save businesses and residents over $201 million over the life of the engines sold in Illinois. The technology also translates into significant pollution prevention to Illinois air, and economic and health benefits to Illinois businesses and residents.
WMRC was able to expand its laboratory capability this past year through some new equipment.

Over the last ten years, liquid chromatography/mass spectrometer (LC/MS) has become a vital tool in analytical fields such as environmental sciences, pharmaceuticals and biotechnology. This analytical tool allows for positive identification and quantitation of organic chemicals that are water soluble, thermally unstable or otherwise not compatible with gas chromatographic analysis. Such chemicals include many additives to industrial process streams (e.g. cleaning components), many new generation pesticides, pharmaceuticals and personal care products, and the degradation products of a wide variety of environmental contaminants. This capability has been a pressing and priority need for WMRC’s laboratory for several years but the Center has not had the necessary equipment funds. The year-end release of the Hazardous Waste Research Funding (HWRF) money provided a unique opportunity to finally pursue this purchase.

The new Waters Quattro micro LC/MS/MS instrument is a bench top tandem quadruple mass spectrometer. It has capability for analysis of a wide variety of environmental and industrial contaminant.

Teresa Chow, the Laboratory Supervisor and High Performance Liquid Chromatography (HPLC) Group Leader, was delighted to have this advanced instrument added to the laboratory. Chow and Monte Wilcoxon already have developed the analysis of 14 isoflavones in environmental samples since the new equipment arrived at WMRC. Chow calls this equipment the legacy of Marv Piwoni, the Laboratory Manager who retired recently after 20 years of service to WMRC.
The Library and Clearinghouse at WMRC 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, 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 WMRC Library staff responded to over 300 information requests from clients. In addition, library staff added 387 books and videos, seven serials, and 2,033 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. In addition, the WMRC Librarian conducted environmental story times each week for third grade classes at Dr. Howard Elementary School in Champaign.

In FY 2007, Lauren Bordson, a volunteer from the UIUC Graduate School of Library and Information Science (GSLIS), assisted the Library staff over the UIUC's winter break. Geri Olmstead, another GSLIS student, completed a special library practicum at the Library during the Spring 2007 semester. Each student completed a reference guide while working in the library. These new guides include:

- Environmental Novels: An Annotated Bibliography (Lauren Bordson)
- Great Lakes Pollution: Selected Resources (Geri Olmstead)


WMRC Library staff continues to maintain Environmental News Bits (http://lib.wmrc.uiuc.edu/enb), a web log to update Center staff on environmental news and emerging issues. In FY 2007, 2554 items were posted to the web log.
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 409 publications last year on topics ranging from household hazardous waste to mercury and pollution prevention in schools. During FY 2007, 199,228 WMRC reports and fact sheets were viewed on the web site, more than triple the number of views during FY 2006.

WMRC published five fact sheets during FY 2007. They are:

- **TN07-086** -- *Water Use Reduction at an Auto Assembly Plant* -- Champaign, IL: Waste Management and Research Center, 2006.

All WMRC fact sheets can be viewed on the web at [http://www.wmrc.uiuc.edu/main_sections/info_services/library_factsheets.cfm](http://www.wmrc.uiuc.edu/main_sections/info_services/library_factsheets.cfm).
In a massive feat of recycling, tons of silt clogging Illinois waterways are being reclaimed as rich topsoil for a new Chicago park, providing healthier habitat for native fish, better facilities for recreational boaters and new green vistas for urban residents — all thanks to the state of Illinois’ nationally renowned Mud to Parks project. The project is spearheaded by John Marlin, senior scientist at WMRC.

Illinois Lt. Gov. Quinn, representatives of the Illinois Department of Natural Resources, and a host of municipal officials this summer greeted barges bearing tons of Illinois River mud as they arrived at a new park being created on the old U.S. Steel South Works site in Chicago.

“It’s amazing to realize that this simple concept – dredging up mud from a riverbed and spreading it out on dry land – can yield such enormous benefits to two Illinois communities over a hundred of miles apart,” Quinn said. “This project is improving the health of the Illinois River, making Peoria Lake more boater-friendly, and creating a new park that Chicago residents and visitors will enjoy for generations to come.”

Quinn, who chairs the Illinois River Coordinating Council, was joined at the event by Chicago Park District Superintendent Timothy Mitchell, Illinois Department of Natural Resources Deputy Director Deborah Stone, WMRC’s Marlin, and Chicago aldermen Sandi Jackson (7th Ward) and John Pope (10th Ward). The event marks the second installment of Illinois River mud at the South Works site, a 550-acre parcel on the shores of Lake Michigan about 10 miles south of the Loop. For more than a century, the South Works factory generated slag (molten metallic refuse from the steelmaking process), creating acres of hard, barren ground. In 2004, as part of the plan to redevelop the now-abandoned factory site, the Mud to Parks project brought in 68 barges of silt -- weighing 104,000 tons -- to cover 17 acres of the slag with rich, fertile topsoil 2 to 3 feet deep.

“Today, we see green grass and native plants flourishing in dirt that once clogged the channels of the Illinois River,” Quinn said. “This project proves that it is possible to reclaim these vacant acres and convert an eyesore into another lakefront jewel for the enjoyment of people throughout Illinois.”

“Mud to Parks has been a significant victory for the Illinois River Coordinating Council,” Stone said. “Thanks to strong support from the Office of the Lt. Governor and the State of Illinois, this project is a successful component of our efforts to preserve and restore the Illinois River ecosystem.”
The program is a long-standing effort of WMRC. In 2002, Marlin led a demonstration project in which sediment collected from the Illinois River near Peoria was shipped by barge to a Chicago-area landfill. That project demonstrated that silt could be successfully reconverted into clean, fertile topsoil. WMRC also has sponsored research projects that tested the soil and demonstrated its fertility. In February 2003, Quinn’s office gave Marlin a grant of $75,000, which was used as seed money to begin the first Mud to Parks project, shipping mud from Peoria Lake to the South Works site.

“Thanks to John Marlin’s vision, this Illinois River mud – once overlooked as a waste product – is now seen as the extraordinary natural resource that it is,” Quinn said. “We need this kind of common sense and ingenuity as we seek to address the environmental issues that threaten Illinois waterways. I believe the Mud to Parks program can play an important role in helping to restore our rivers and wetlands and create new recreational areas for everyone’s enjoyment.”

The mud in this installment of the program has been dredged from a section of the Peoria Lake, creating a channel 9 feet deep and 100 feet wide near the East Port Marina in Peoria. By clearing the channel, the project improves recreation opportunities for boaters while creating new deepwater habitats for native fish.

The mud – enough to fill seven barges, each holding a load equivalent to 75 tractor-trailers – takes two days to make the trip upriver to Lake Michigan. The cost of the entire seven-barge shipment is approximately $275,000. The cost of this phase of the project is being covered by a $25,000 grant from the City of East Peoria and a $250,000 grant from the Illinois Department of Natural Resources.

Sedimentation is the single largest environmental problem facing the Illinois River. Once one of the nation’s most important fisheries, the Illinois River and its connected backwater lakes are now filling with sediments from topsoil erosion. Many areas that were six to eight feet deep a century ago are now as shallow as 18 inches.

The Mud to Parks program won a 2006 national Innovations Award from the Council of State Governments, which hailed the program for its imaginative approach to solving the problem of topsoil erosion and resulting sediment build-up in river-fed reservoirs and backwaters. Lt. Governor Quinn and Marlin were presented the award in Phoenix in December. Details on winners of the Council of State Government Innovations

“We hope to continue to find private and public partnerships that will expand this program,” Quinn said. “There’s enough silt in Peoria Lake to fill a football field more than 10 miles high. That incredible resource could be used to create new green spaces throughout the Land of Lincoln, and in other states as well.”

Marlin says the sediment placed on the US Steel South Works site in Chicago in 2004 has developed good soil structure and is well vegetated. The site has received numerous visitors including two delegations from the China Dredging Association.

Funding from a supplemental environmental project settlement with Dynegy Inc. this year also supported characterization of more sediment cores. The Illinois Water Survey collected the 8-foot cores between Hennepin and Beardstown along the Illinois River. The cores are being analyzed for potential chemical contaminants, fertility and various physical properties. U of I soil scientist Dr. Robert Darmody is evaluating the suitability of the sediments for use as soil.
The retirement of a long-time leader at Waste Management & Research Center gave the Center an opportunity to revamp the organizational structure of the Laboratory Services and Research departments. After many years of dedicated service, Dr. Marv Piwoni announced plans to retire from his position as the manager of the WMRC Research Funding (http://www.wmrc.uiuc.edu/main_sections/research_fund/) and Laboratory Services (http://www.wmrc.uiuc.edu/main_sections/lab_services/) programs.

Dr. George Vander Velde, WMRC Director, in April 2007 announced plans to provide a smooth transition and continued leadership in the areas overseen by Dr. Piwoni. This involved the interim step of separating the Pollution Prevention (P2) Research program, managed by Dr. Kishore Rajagopalan, from the rest of the Technical Assistance Program, and incorporating the Research Funding Program into the P2 Research Program. Historically, the P2 Research Program has been separate from Laboratory Services, and involves the activities of the P2 Pilot Lab as well as research conducted by WMRC technical assistance providers.

After the departure of Dr. Piwoni in the fall, Dr. Rajagopalan assumed leadership of a new program at WMRC called Research and Development. Activities of the analytical lab, as well as coordination of WMRC staff research and funding of research by other agencies, are all conducted under the guidance of Dr. Rajagopalan. This reorganization will allow the technical assistance and laboratory services programs to work more closely together in the future and create greater efficiencies and opportunities for collaboration among WMRC staff members. Dr. Piwoni will also continue to consult with WMRC on long-term projects that he spearheaded.

Dr. Rajagopalan has vast experience evaluating the performance of innovative technologies for improving process efficiency and reducing waste. He has worked on projects for industries as diverse as food processing, fabricated metals, transportation, chemical processing and electroplating. He holds a BS in Chemical Engineering from the University of Madras (India), an MS in Agricultural Engineering, and a PhD in Food Science, both from the University of Illinois at Urbana-Champaign.

GLRPPR CHANGES

The Great Lakes Regional Pollution Prevention Roundtable (GLRPPR) had a change in leadership during the past year. Bob Iverson now is the Executive Director for GLRPPR. He replaced Carol Knepp who left to take the Director’s position at a children’s science museum in Champaign, IL. Iverson has been Information Services Program Manager for WMRC since 2000. In that post, he coordinates all the communication and outreach efforts of WMRC. He has managed the GLRPPR program and worked with officials of the other P2Rx
Center. When WMRC served as coordinating agency for P2Rx, Iverson was the director of the department that provided this coordination. He has been active in the coordination of programs, conferences, and websites of this federally funded project. Before coming to WMRC, Iverson held positions as Public Relations coordinator for a hospital, news reporter, and assistant to the superintendent of a public school district.

Knepp had succeeded Deb Jacobson as Executive Director. Jacobson has taken a new position as manager of the Chicago area office of WMRC. Since WMRC is the coordinating agency for GLRPPR, Jacobson will still be available to assist GLRPPR with her knowledge and experience. Jacobson took over the Roundtable leadership role in 2000, and spearheaded a tremendous growth in GLRPPR membership and even greater expansion of resources available to our members.

Knepp had coordinated the Greening Schools program, a joint project between the Illinois EPA and WMRC. That program has helped schools provide a safe and healthy environment that can save money, improve learning conditions, and increase efficiency. However, funding for that program has ended, and WMRC is offering limit service on the Greening Schools website (http://www.greeningschools.org/).
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. WMRC has received funding from the U.S. EPA to coordinate PNEAC since 1995. PNEAC maintains services to industry and government agency staff including

- on-line, 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 on-line 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.

A complete review of the Vendor and Supplier Directory was conducted, which included adding approximately 200 new vendor listings. All vendors were also verified and categorized according to product or service to the printing industry.

PNEAC served as a co-sponsor of the Printers National Environmental Health & Safety Conference held in Jacksonville, Florida in March 2007. PNEAC has co-sponsored the program for twelve years. PNEAC presented the fourth annual “PNEAC Partner of the Year” award at this conference. The Partner of the Year award honors an individual who has made significant contributions to PNEAC. Patty Eldridge of the Printing Industries of the Gulf Coast was named Partner of the Year. The first annual “PNEAC Publication of the Year” award was also presented at this conference. Gary Jones of PIA/GATF received the Publication of the Year award for his article Waste Automatic Blanket Wash Cause EPA Troubles.
The Pollution Prevention Resource Exchange (P2Rx™; 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 WMRC funding to support P2Rx.

WMRC coordinates the Great Lakes Regional Pollution Prevention Roundtable (GLRPPR; http://www.glrppr.org), which is typically thought of as the “Midwest P2Rx Center.” GLRPPR, however, serves not only the states in U.S. EPA Region 5, but New York, Pennsylvania, and 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. U.S. EPA awarded WMRC funding to support the operation of GLRPPR for the 12th consecutive year.

NEW ONLINE RESOURCES

During the past year, GLRPPR began developing two new “P2 in Schools” Topic Hubs. Sustainable School Design (Construction and Retrofitting) will provide 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. These Topic Hubs will be released in late 2007. A complete list of Topic Hubs developed by GLRPPR and other P2Rx Centers is available at http://www.glrppr.org/hubs.

The GLRPPR Blog (http://www.glrppr.org/blog) was also introduced this year, as an experiment in providing 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.
Another innovation this year included the development of RSS feeds for all the GLRPPR Sector Resources. Sector Resources ([http://www.glrppr.org/sectors](http://www.glrppr.org/sectors)) are compendia of documents; links; events; funding opportunities; archived questions and answers; and expert contacts related to a particular industry sector or subject. Rich Site Summary/Really Simple Syndication (RSS) is a tool that expands information dissemination beyond the web site by allowing users to view selected information directly via news aggregators and feed readers. See [http://lib.wmrc.uiuc.edu/glrppr-blog/?p=32](http://lib.wmrc.uiuc.edu/glrppr-blog/?p=32) for further information and instructions for how to subscribe to the RSS feeds.

GLRPPR staff members also developed a P2 Search tool ([http://www.glrppr.org/search](http://www.glrppr.org/search)) that simultaneously searches 45 web sites devoted to pollution prevention and related concepts. The tool is powered by Google and will help users find specific, quality information more efficiently than using the standard Google search. Users can also add this specialized search box to their blog, web site, or iGoogle page for free (see [http://www.google.com/coop/cse?cx=004724651416754607692%3Ampgeoex_lec&hl=en](http://www.google.com/coop/cse?cx=004724651416754607692%3Ampgeoex_lec&hl=en)).

**ANNUAL CONFERENCE**

Pollution prevention professionals, health experts, business leaders, and others shared their knowledge during the Great Lakes/Great Plains P2 Conference held in March. The conference, which was a joint effort of U.S. EPA Regions 5 and 7, was held at the U.S. EPA offices in Chicago.

There were sixty registered participants for the conference. In addition, a number of EPA officials (or personnel) attended various sessions, participants from a concurrent Hospitals for a Healthy Environment (H2E) meeting joined one session, and there was even an opportunity to listen to presentations by conference call.

The conference began with presentations from EPA leaders of Regions 5 and 7 discussing current and future projects. An update was also provided by leaders of the National Pollution Prevention Roundtable (NPPR). The jam-packed agenda included sessions on:

- **Lean & Clean—Tools/Programs:** This session was a broad perspective of the application of Lean and Clean systems and tools used to improve environmental performance while increasing production efficiencies. It featured presentations from EPA officials and success stories from Steelcase, Inc. and TechSolve Inc.
• Stormwater Issues and the Housing Industry: A discussion of a project in Wisconsin where government and home-builders worked together to reduce storm water runoff. The session also featured an environmental consultant discussing new technical solutions for NPS reduction from urban land, both existing and new development.

• P2 Intern Programs: Officials from Regions 5 and 7 spoke about their successful programs and discussed how to develop and improve such programs.

• Mercury Reduction and Elimination Projects: This featured presentations on the Great Lakes Mercury Phase-Down Strategy and on new techniques to reduce dental mercury waste.

The second day of the conference began with an introduction to the P2 Results Data System (http://www.glrppr.org/measurement) and how it can be used to document a P2 program’s success. A hands-on training session offered opportunities to learn about this online tool. Other presentations discussed:

• U.S. EPA and Illinois-Indiana Sea Grant Education and Outreach projects concerning prevention of open burning, pharmaceutical disposal, and electronic waste management.

• The Chicago Waste to Profit Network

• A waste measurement tool that has been designed for health care facilities, provided by Laura Brannen, Executive Director of Hospitals for a Healthy Environment (H2E)

The conference ended with an afternoon discussion of the continuing development of a Midwest Product Stewardship Council by representatives from state and local governments in EPA Regions 5 and 7.

Presentations from the Great Lakes/Great Plains P2 Conference are available online at: http://www.glrppr.org/meetings/Spring2007.
A company’s lighting and water usage are often overlooked by plant managers and facility engineers as a way to save money. They search for more obvious conservation opportunities in heating, air conditioning, compressed air, boilers, etc. Lights are overhead and taken for granted. Water is usually hidden inside equipment, fixtures, plumbing and walls or floors. Both of these resources often go unnoticed.

The Waste Management and Research Center (WMRC) know there are potential savings in common commodities such as lights and water. WMRC staff worked with Highland Machine to assess these savings. Armed with this knowledge, other companies and the general public can change the way they operate.

Highland Machine is one the largest sheet metal fabricators and precision machinists serving the Midwest. Located in Highland just 40 miles east of St. Louis, this facility comprises three buildings, totaling approximately 140,000 square feet with a workforce of 130 employees. Manufacturing operations include: engineering, machining, assembly, finishing and packing. Highland Machine requested WMRC’s assistance in reducing its consumption of water and electricity.

The largest water consumer at Highland Machine is its first-shift powder coating operation. Here, all fabricated parts undergo pretreatment in a 5-stage aqueous spray washer in which they are degreased, rinsed, phosphated, rinsed and sealed. Then the parts proceed to dry-off, powder coating and curing. Historically, the two rinse tanks operated at a continuous flow rate between 5-10 gallons per minute (gpm) of city tap water each, resulting in approximately 1.6M gallons annually. Prior to WMRC’s involvement, no meters or controls were utilized to measure usage, restrict consumption or cut costs. Operators manually turned the water on in the morning and then off at night.

WMRC’s field engineers worked with Highland personnel to install water meters to gather baseline usage data for each rinse tank. Meanwhile, efforts were initiated to determine product cleanliness and appearance standards for product leaving the rinse tanks. WMRC also consulted with the washer manufacturer and the chemical supplier.

WMRC and Highland Machine opted to install and test a conductivity control system, which potentially offered maximum water savings, limited operator involvement, and increased product quality. Conductivity control is a proven technology. Its premise is that water’s conductivity is directly correlated to its contamination. In other words, as water becomes dirtier the conductivity increases. Highland’s conductivity control system would consist of:

- a sensor to detect conductivity,
- an analyzer that monitors the conductivity level relative to a pre-set high and low limit, and
- a solenoid valve on the water inlet, which receives an electrical signal from the analyzer to open or close, allowing or restricting fresh water into the tank.
Over four months, WMRC demonstrated its single-electrode less pilot system on both rinse tank, collected data, measured conductivity levels, and established operating controls. The pilot results indicated a reduction of 58-64% with a simple payback of 4.3 months. With this information in-hand, Highland staff easily solicited the owner’s support in the purchase and installation of a conductivity control system.

A Hach SC-100 controller with two electrode less sensors was installed. This dual-analyzer monitors and controls both rinse tanks thereby reducing the initial equipment investment. WMRC assisted Highland’s personnel with installation, setup and modification of the system. System performance data was collected four times per day by Highland’s personnel and analyzed by WMRC process engineers to maximize system efficiency and savings potential. Tables 1 and 2 show the before/after results of each rinse tank.

### Table 1: Stage 2 Rinse Tank

<table>
<thead>
<tr>
<th>Before Control</th>
<th>After Control</th>
<th>Reduction</th>
<th>Comments</th>
</tr>
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</table>
Annual Water Reduction: 551,000 gallons |

### Table 2: Stage 4 Rinse Tank

<table>
<thead>
<tr>
<th>Before Control</th>
<th>After Control</th>
<th>Reduction</th>
<th>Comments</th>
</tr>
</thead>
</table>
| 3,642 Gallons/Day | 545 Gallons/Day | 85 %      | Annual Projected Savings: $6,649  
Annual Water Reduction: 776,750 gallons |

**WATER SAVINGS TO WHET YOUR WHISTLE**

- Combined Annual Savings: $11,369
- Combined Water Reduction: 1,327,750 gallons (-78%)
- Simple Payback Period: 3.4 months

All of the project’s goals were met or exceeded, while saving money. Water consumption was drastically lowered, the system was automated, and product quality improved.

**LIGHTING ASSESSMENT PROVES QUITE ILLUMINATING**

Most manufacturers don’t know how much it costs to light their facilities. Lights either work or they don’t. If a lamp burns out, it is replaced with a new lamp just like the old one without much thought to the efficiency of the lighting system.

At Highland’s request, WMRC performed a lighting assessment with the goals of:

1. identifying current lighting expenditures,
2. identifying efficient upgrades,
3. educating management with available options, and
4. effecting change.

The assessment included: counting the types of lighting fixtures, the wattages of the fixtures and the height at which the fixtures were hung. The cost paid per kilowatt-hour (kWh) and demand rate charges were calculated from prior energy bills. Annual expenditures were calculated based on the hours of operation and the wattages drawn for each type of fixture. Recommended improvements, total wattages and annual operating costs were identified for each type of fixture. The difference between its current cost for lighting and the cost for lighting after improvements identified the potential savings.

The lighting assessment identified that Highland Machine currently spends $38,072 annually for its lighting. Implementing the recommended improvements could reduce the direct costs of lighting its production processes by $17,581 per year, plus an additional $4,370 reduction in demand rate charges.

- Total annual savings: $21,951 (-58%)

Because Highland Machine employs electricians who would perform the upgrade as production load permitted, WMRC recommended the following upgrade to Highland's lighting:

- Replace 141 metal halide HID fixtures with T8 fluorescent $28,200
- Convert 529 fluorescent T12 2-lamp fixtures to T8 $13,225
- Convert 63 fluorescent T12 4-lamp fixtures to T8 $1,890
- Convert 6 fluorescent T12 8’ fixtures to 4’T8 $270
- Total Materials Cost $43,585
- Simple Payback Period (materials only): 1.99 years

THE FINAL WORD

As demonstrated at this facility, huge opportunities exist for conservation and cost savings. Overhead and beneath the floors lay opportunity. In the case of water, money is literally “going down the drain.” The challenge is first realizing that it’s there…then doing something about it. Highland Machine saw the potential savings, seized it and is currently reaping the benefit of its labor. For more information about water or energy conservation, contact:

Dan Marsch - WMRC Peoria Office - Work: 309 671-3196 - Fax: 309 671-3106 - dmarsch@wmrc.uiuc.edu

Mike Springman - WMRC Brighton Office - Work: 618 466-3806 - Fax: 618 466-9688 - wmrc@piasanet.com
Informing the public about the many interesting and important projects at Waste Management & Research Center (WMRC) is an on-going commitment. WMRC staff members had a number of publications and poster presentations during the year.

**PUBLICATIONS**


**PRESENTATIONS**

Barnes, L.L. “Environmental Information: Trends and Issues.” (University of Illinois Graduate School of Library and Information Science, Urbana, IL, March 7, 2007).

Barnes, L.L. “Environmental Storytime” series (Dr. Howard Elementary School, Champaign IL, weekly, August 2006-May 2007).


Brown, J. “WMRC Projects and Services.” (Back of the Yards Neighborhood Council Industrial Committee Meeting, Chicago IL, July 18, 2007).


SUSTAINABILITY NETWORK LAUNCHED

WMRC is one of the charter members of a newly-formed organization to promote and facilitate sustainable principles and practices.

Partner in the Region 5 Sustainability Network include the Federal Environmental Executive, Department of Defense, the Army, Michigan Department of Environmental Quality (DEQ) and other state and federal agencies. The Michigan DEQ hosted a signing ceremony at the Next Energy Center in Detroit’s Tech Town. The Region 5 Sustainability Network will serve to connect federal and state agencies with each other and with leaders of sustainability from local governments, organizations, and businesses. The Network is structured to be an open and objective forum where members share successful projects and technologies and take a regional approach to promote and facilitate sustainability.

Also signing the charter were the Department of Defense, the Navy Region Midwest, Defense Logistics Agency, Illinois Waste Management and Research Center, the Michigan Army National Guard, and Wisconsin Department of Natural Resources. The EPA Regional Administrator for Region 5 and representatives from other states also plan to sign the charter in the coming months. The Sustainability Network started its activities with a survey of member needs.

WMRC Director George Vander Velde (second from left) joins the other charter members at a meeting of the Region 5 Sustainability network.
WMRC 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.

WMRC 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. WMRC staff assists companies to develop and implement processes that are more environmentally friendly and less wasteful. WMRC staff work closely with customers to help them identify opportunities to improve efficiency by reducing raw material utilization and waste.

Services offered by the technical assistance experts at WMRC include:

- Pollution Prevention –Energy efficiency
- Water purification and conservation methods
- Environmental Management Systems
- Testing of alternative technologies

No matter the size of the project, WMRC can provide a sustainable solution!

**CHICAGO INDUSTRIAL REBUILD PROGRAM**

WMRC partners with ComEd to provide energy, waste reduction, and process improvement assessments to manufacturers in the Chicago area. WMRC’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, WMRC 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 with other ‘change agents’ to implement these practices. During the two-year grant period, WMRC 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.
TECHNICAL ASSISTANCE

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. WMRC is acting as a technical partner to assist with the development of the overall program. WMRC works directly with businesses and with City of Chicago Departments to assess activities and identify opportunities for by-product exchange, new technology needs, and waste reduction or efficiency opportunities.

Over the past year, WMRC staff has worked with participating companies to understand one another’s processes, material flows and operational needs. The goal of this work was to bring down barriers that hide valuable synergistic opportunities between the companies. WMRC staff has helped identify synergies and coach companies to explore and test potentially valuable synergies. In addition, WMRC 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 TECHNOLOGY DIFFUSION INITIATIVE (TDI):

TDI is a collaborative effort between Kentucky, Minnesota, and Illinois to work with various sectors and to leverage each states technical expertise. Illinois is targeting the fabricated machinery and metal products (M&MP) sector which employs over 80,000 people. The M&MP sector has a diverse number of processes (forming, shaping, heat treatment, surface preparation, and finishing). Each of these processes imposes a significant burden on the environment and present unique economic opportunities. TDI focuses on bringing together a wide variety of expertise in areas such as machining, formulations, recycling, product management, and environmental, health, & safety to address the uncertainties in adoption of new technologies.

The key features of this partnership are:
1. Technical assistance is driven by individual facility need. The partnership provides a forum through which articulated needs of end-users are addressed through collaborations with chemical suppliers and vendors, consultants, and academia.

2. Integrated multiple pathway approaches are the core framework to reduce the environmental footprint of metal working fluids (MWFs).

3. Technology testing is carried out at mentor sites (sites chosen to include perceived industry leaders and maximum project visibility). A mentor site must be willing to show other industrial facilities the testing it has done. Incentives for industrial participation are access to highly trained technical experts, consultants, and tailored solutions to problems identified by the industrial representatives.

4. Following a successful technology implementation, other industry participants are allowed access to mentor sites to witness first-hand details of project conception, implementation, and applicability.

**CLEAN AIR COUNTS**

During FY 2007, WMRC provided technical assistance to 10 paint manufacturers and users in the Clean Air Counts program. Crest Industries, International Truck and Engine, and Finishes Unlimited implemented VOC reduction strategies and reported a combined VOC reduction of 81,831 lbs. per year. Akzo Nobel/Des Plaines reported a HAPs (hazardous air pollutants) reduction of just over 100,000 lbs. per year.

Four facilities joined the Clean Air Counts (CAC) pollution prevention initiative in FY 2007. They are Fox Valley Park District, Illinois Army National Guard, Ace Hardware Paint Manufacturing Facility - Chicago Heights, and Ace Hardware Paint Manufacturing Facility – Matteson. In total, 15 facilities have joined the CAC P2 initiative since 2004.

In May 2007, WMRC was authorized to proceed with work on developing ozone reduction strategies that could be implemented on a municipal level. With input from the CAC Communities Workgroup, WMRC was directed to research and model ozone reduction strategies for leaf blower use and vehicle anti-idling. This work will continue into FY 2008.

Clean Air Counts is 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. This multi-year initiative seeks to achieve specific and significant reductions in targeted smog-forming pollutants and major reductions in energy consumption.

Clean Air Counts is made possible through the support of The Searle Funds at The Chicago Community Trust, Grand Victoria Foundation, The John D. and Catherine T. MacArthur Foundation, Gaylord and Dorothy Donnelley Foundation, and the United States Environmental Protection Agency.
Can you see air? Not usually, but you can see the visible impact air has on your company’s “bottom-line.” Compressed air costs your company real money, usually a substantial amount of money. Compressed air is often taken for granted as a necessary cost, and is often abused and wasted. Because of this, it tends to get squandered and misused. WMRC has developed an easy way for a company to determine the cost of air.

There is a wealth of handbooks and “how-to” publications available on the market. However, the reader may need a PhD in engineering to decipher the mountains of calculations and constants.

WMRC’s work sheet is different in its approach and methodology. It provides general, practical rule-of-thumb applications and recommendations. It provides the user a simple worksheet to assist in identifying areas of opportunity that may exist at one’s own facility. Once realizing this, the user may then seek additional assistance from a professional air management service provider who will assess the system and recommend equipment and determine costs.

This work sheet is available on-line at the WMRC web site. Go to http://www.wmrc.uiuc.edu/main_sections/info_services/library_factsheets.cfm and look for the fact sheet TN07-087 The Visible Cost of Air.
The Waste Management and Research Center (WMRC) supports research that addresses sustainability, pollution prevention, waste management, energy, and environmental issues of consequence to the State of Illinois. Currently, several of the research projects are focusing on assessing environmental contamination and risk of various organic and inorganic substances, correlating specific chemical exposures to their effects, and examining bioavailability and transport of contaminants. Other studies are looking at alternative fuel development and use, water conservation and quality issues, and sustainable building technology practices. The results of these projects will provide valuable information to the scientific and regulatory communities in Illinois and throughout the nation. The information assists Illinois’ decision-makers in their efforts to make sound environmental and energy decisions, which ultimately impact the citizens of Illinois.

Five research projects were completed and six new projects began in FY2007. A total of 15 projects are continuing into FY2008. These projects are described below:

**RESEARCH PROJECTS COMPLETED IN FY2007:**

**Low-temperature Diesel Fuels, Additives, and Chemicals from Vegetable Oils** - Joshua Sterge and his colleagues at the University of North Dakota Energy & Environmental Research Center attempted to develop an economical process for converting vegetable oil into a biodiesel fuel suitable for use in cold weather. They optimized a two-step ozonolysis process on the bench scale for production of high-value chemicals derived from glycerol and cold-weather biodiesel additive derived from biodiesel. The first step of the process, which oxidized glycerol into high-value chemicals, showed high conversion selectivity to valuable glyoxal in aqueous solution. A by-product of this step consisted of short-chain oxygenated carboxylic acids present as glyceryl esters. These acid by-products included glycolic acid, which is valuable in the cosmetics industry and as a raw material for production of biodegradable polymers. The glyceryl esters could be transesterified for recovery of the acids as methyl esters and the glycerol portion of the ester recycled for further conversion. The second step of the process yielded a product with improved cold-weather properties relative to biodiesel. However, when the product was blended with biodiesel at ratios less than about 1:2, minimal effect on cloud point or pour point was observed. A brief economic assessment of the process suggested that the as-designed process would not be economical on a large scale. The process was designed inefficiently and could possibly be made economical with a better plant design. However, the expected selling price for the additive product from the second step would prohibit its use as a cold-weather biodiesel, and the process can only be made economical if the biodiesel ozonolysis step is removed.

**New Catalytic DNA Fluorescent and Colorimetric Sensors for On-site and Real time Monitoring of Industrial and Drinking Water.** Dr. Yi Lu and his research group at the Department of Chemistry at UIUC have developed new fluorescent and colorimetric sensor technologies for on-site, real-time detection and quantification of toxic metal ions such as lead, mercury and uranium in industrial and drinking waters. They used a combinatorial biology method called in vitro selection to obtain catalytic DNA with high specificity and selectivity for the metal ions. The presence of metal ions causes the catalytic DNA to cleave, resulting in either a dramatic increase of fluorescent signals or a distinctive change of colors. The sensors are highly sensitive and selective. The catalytic DNA fluorescent biosensors make it possible to analyze metal ions using simple portable fluorometers, and the catalytic DNA colorimetric biosensors can eliminate equipment...
altogether. This is possible because the toxic metal ions can be detected through simple color changes, just like pH paper.

**Unstable Two-phase Mixtures for Metalworking – A Greener Alternative?** – This project was led by Dr. Shiv Kapoor and Dr. Richard DeVor from the Department of Mechanical Science and Engineering at UIUC. It focused on developing transiently stable emulsions by examining the important factors affecting lubrication, cooling, and phase separation. Earlier work had indicated that transiently stable emulsions could give comparable lubrication to oil containing metalworking fluids (MWFs) when used in high speed machining. Oil containing MWFs are usually formulated to be highly stable emulsions. They are difficult to maintain, recycle, and treat as waste. Transiently stable emulsions offer fewer problems for waste treatment, and can be more easily maintained and recycled than oil containing MWFs. This research characterized lubricating and cooling functionality, determined the separation kinetics, and investigated the effect of centrifugation on accelerating phase separation. Based on machining tests, the transiently stable emulsions performed as well, and in some cases better, than the industrial MWFs. This project will be helpful in efforts to reduce the environmental footprint of the metalworking and machining industry.

**Tool and Process Design for Semi-dry Drilling of Steel: An Innovation for Green Manufacturing** – Dr. Nourredine Boubekri (now at the University of Northern Texas) and Dr. Behrooz Fallahi of the Department of Mechanical Engineering at Northern Illinois University investigated the effects of using minimum quantity lubrication (semi-dry) in drilling using HSS tools with different coating and geometries. The treatments selected for minimum quantity lubrication in this study are commonly used by industry under flood cooling for these materials. A full factorial experiment was conducted and regression models for both surface finish and hole size were generated. The regression models then were used in a pareto optimization study and the trade off between surface finish and hole size deviation from the nominal size was determined. The results showed a definite increase in tool life and better or very acceptable surface quality and size of holes drilled when using minimum quantity lubrication as compared to flood cooling. This research effort provides information on new tool technologies that show promise for increasing the economic viability and reducing pollution for the large Illinois metalworking industrial sector.

**Promoting Biodiesel Adoption in Illinois** – Dr. James Anderson of the UIUC School of Architecture and Building Research Council, along with Todd Rusk of WMRC, conducted this study that helped to develop WMRC in-house capabilities for biodiesel production from variable quality feedstock – yellow grease and brown grease. It also provided the opportunity for several outreach activities to promote and educate the public on the production and use of biodiesel. The groups participating included a number of high schools, park districts, private citizens, and businesses, as well as the UI. Further collaborative opportunities are being investigated.

**RESEARCH PROJECTS INITIATED IN FY2007:**

**Fate Analysis of Polybrominated Diphenyl Ethers in Anaerobic Digestor Sludge** – Knowledge of the fate of polybrominated diphenyl ethers (PBDEs) in the digester sludge of wastewater treatment plants is very limited. This research project being conducted by Dr. Karl Rockne and his colleagues at UI-Chicago is inves-
tigating whether BDE-209, the deca-brominated form, can be debrominated to more toxic and bioavailable congeners in wastewater treatment plants. Continued use of BDE-209 hinges on its non-toxicity so it is important to understand its reductive debromination potential. The field phase of the research is comprised of a detailed analysis of PBDEs throughout the sludge treatment train in the Calumet Water Reclamation Plant and a reference plant in Chicago. The laboratory phase is focused on determining the potential and rate of reductive debromination in controlled studies. 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.

Database Development for Comparative Analysis of the Performance of Metalworking Fluids in Machining Operations - Dr. Shiv Kapoor of the Department of Mechanical Science and Engineering, along with fellow researchers at UIUC, is developing a database that will aid industrial users in the selection of metalworking fluids (MWFs) that are economical and minimize environmental impact. The researchers are evaluating ten MWFs for a variety of parameters and the results of the tests will be given in a product performance matrix which can be utilized by end users to choose fluids based on specific performance qualifications. A MWF performance model will be developed from the experimental data that allows the prediction of the performance of fluids not specifically evaluated.

Overcoming Barriers to P2 and Recycling for Construction Waste - Dr. Mohamed El-Gafy (now at the University of Michigan), and Dr. Richard Boser of Illinois State University are exploring ways to accelerate the adoption of waste minimization and pollution prevention (P2/recycling) practices by Illinois homebuilders. The project is documenting the current extent of adoption of P2/recycling practices by Illinois home builders in two selected counties – McLean and Will County; examining major barriers inhibiting the diffusion of P2/recycling practices in the construction industry; identifying the best management practices (BMPs) for the minimization and reuse of waste materials and for accelerating the adoption of P2/recycling practices; and facilitating pilot projects and demonstration events to promote the adoption of the BMPs.

Correlations of Agrochemical Residues in Drinking Water and Birth Defects in Illinois - This project is being led by Dr. Manoj Mohanty of SIU – Carbondale. He is investigating the relationship between conception rates, birth defects, and other adverse pregnancy outcomes and the concentration of agrochemicals, specifically atrazine, glyphosate, and nitrate, in drinking water supplies in Illinois. By its nature, this project is a collaborative effort with several other agencies, including the Illinois Department of Health and the U.S. Geological Survey. The causes of nearly 60% of the birth defects are still unknown. It is expected that the results obtained in this study in Illinois will bring us a step closer to finding answers to some fundamental questions in this area.

Identification of the Sources and Temporal Patterns of Sediment-associated Toxicity in the Illinois River - Dr. Lydy and his colleagues at SIU – Carbondale are building upon previous work on the toxicity of pore-waters to Illinois River aquatic organisms by examining toxicity due to sediment-associated ammonia, while also investigating 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 tox-
Rickett is not known. Sites are being sampled during multiple seasons to identify potential temporal patterns in sediment toxicity. Expected results will include quantification and source identification of Illinois River sediment toxicity and estimates of the temporal variation of this toxicity. This project will generate data that will be used in combination with previous work on pore-water toxicity (conducted over 15 years ago) to better understand potential causes of benthic population declines within the Illinois River. This information will be useful for planning sediment dredging and beneficial use activities in the river.

**Perchlorates in the Illinois Environment** - The goal of this project directed by Rita Dolan of Greenwood Environmental Consulting, Inc. is to examine the level of perchlorates at various sites in Illinois to determine if there is a contamination issue in Illinois drinking water supplies. Perchlorate is an inorganic ion that can affect human health by disrupting thyroid function. There is wide disagreement regarding acceptable exposure levels. The U.S. EPA has adopted a concentration of 24.5 ppb as a Drinking Water Equivalent Level and may eventually regulate perchlorate. Currently, there is insufficient data to demonstrate whether there is a perchlorate risk in Illinois water supplies. Perchlorate has been detected in groundwater found near some federal facilities and manufacturing sites. This study will gather samples and/or data from eight sites in Illinois and analyze the samples to detect at-risk water supplies, or to demonstrate that perchlorate contamination is not an issue.

**RESEARCH PROJECTS WITH AMENDED COMPLETION DATES THAT ARE FINISHING IN FALL FY2008:**

**Whole-cell Biocatalysts for Producing Biodiesel from Waste Fats** - This research project being conducted by Dr. Guang Jin and associates at the Department of Health Sciences at ISU is determining 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. This project ends August 31, 2007.

**Risks to Insectivorous Birds in the Calumet Region from Transfer of Contaminants from Sediments to Emergent Aquatic Insects** - Dr. David Soucek and Sue Gallo of the INHS are studying the transfer of contaminants (PCBs, DDD/DDE, and metals) from sediments to insectivorous birds via emergent aquatic insects in various wetland sites in the Lake Calumet region. The study is aimed at quantifying the risks to insectivorous birds (using tree swallows as a model) by examining the health and productivity of the bird populations. The researchers are investigating how the food chain and food sources affect contaminant loads in tree swallows nesting at the wetland sites. The results will aid in the assessment process of ecological risks, guide the remediation process, and provide
a baseline of data with which to compare the success of remedial restoration activities in the Calumet area. Completion date is December 30, 2007.

**RESEARCH PROJECTS CONTINUING FROM FY2006:**

**Isoflavones in the Environment: A Pilot Study** - The primary objectives of this pilot study being conducted by Jeff Levengood of the IL Natural History Survey and Teresa Chow of WMRC are (1) to develop a better method for the separation of 16 isoflavones and metabolites in water and sediments/detritus, optimizing sensitivity and the separation of the compounds; (2) to explore the use of fluorescence detection to increase the sensitivity of detecting some analytes; and (3) to determine if isoflavones or their metabolites are present in measurable concentrations in water and detritus of amphibian breeding habitat in highly agricultural areas in central Illinois, at a time when tadpoles of a variety of frog species are developing and actively feeding.

**Mercury Concentration in Wetlands associated with Coal-fired Power Plants in Illinois (seed project)** – Dr. Richard Halbrook and his colleagues at the Cooperative Wildlife Research Laboratory at SIU received funding to provide preliminary data and protocols for evaluating the current mercury status in wetlands surrounding coal-fired electrical generating plants and also provide a mechanism for monitoring and evaluating the efficacy of efforts to reduce mercury emissions.

**Hydrologic and Hydraulic Modeling for the Restoration of the Calumet Marshes: Assessment of Runoff Scenarios** – Dr. Yanqing Lian and Dr. George Roadcap of the IL State Water Survey, along with Dr. Ximing Cai of UIUC, are constructing hydrologic and hydraulic models for the entire Calumet region in south Chicago. These models will be used as a basis for determining the best water management strategies for the Lake Calumet Cluster Site and the adjacent marshes and ponds that it affects. In collaboration with other projects in the area, the researchers expect to evaluate a combination of various measures to help in achieving water flow regime and water quality targets for the restoration of the Lake Calumet region, which has been used for a waste management site in the past.

**Expanded CMS Pilot Projects in SMEs** – Dr. Thomas Bierma at the Department of Health Sciences at ISU is building 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 the first two years. The longer-term value of this approach is to improve the competitiveness of Illinois industries to ensure their financial viability into the future.

**Developing the Basis for Creating Environmental Networking Organizations in Downstate Illinois** – Dr. Susan Morgan and Dr. Jianpeng Zhou of the Department of Civil Engineering at SIU – Edwardsville are evaluating the potential for the development of environmental networking organizations in the metro-east region of St. Louis to increase the use of WMRC services by local industries. A large amount of hazardous waste is generated in Madison and St. Clair counties, indicating that there is room for pollution prevention activities. The project is identifying interested parties, defining the needs of industry, and exploring the
feasibility and usefulness of creating networking organizations in these two counties in western Illinois. The researchers will work with WMRC to implement the recommendations of the project.

**Topsoil Modification during Suburbanization: Impact on Demands for Municipal Water** – Dr. Robert Darmody of the Department of Natural Resources and Environmental Sciences at UIUC is investigating the impact on water usage of various construction practices. The study has focused on new construction in northeast Illinois and is examining topsoil removal, soil compaction, and associated effects on water percolation rates, and the ultimate impact on water use for lawn and garden watering. The research aims to define construction practices that will help to minimize post-construction water usage and help with water shortages in that region of the state.

**Greening Metalworking Fluids Purchasing Using Multicriteria Methodologies** - Researchers Dr. Michael Plewa and Dr. Elizabeth Wagner in the College of ACES at UIUC, along with Dr. Kishore Rajagopalan of WMRC, are developing methodologies that will help industrial users make intelligent choices in purchasing metalworking fluids (MWFs). The information being gathered includes 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. This work complements that of Dr. Shiv Kapoor.

**RESEARCH SEMINARS IN FY2007**

Three research seminars were presented at WMRC in FY2007 as part of the Brown Bag seminar series:

- Dr. Yi Lu discussed his work on “Catalytic DNA Fluorescent and Colorimetric Sensors for On-site and Real time Monitoring of Industrial and Drinking Water”;
- Dr. Yanqing Lian and Dr. George Roadcap presented a talk on “Hydrologic and Hydraulic Modeling for the Restoration of the Calumet Marshes”; and
- Dr. Michael Plewa gave a seminar on “Comparative Mammalian Cell Toxicity of Nitrogen- and Carbon-Based Drinking Water Disinfection By-Products.”

**RESEARCH CONFERENCE**

WMRC hosted a mini-conference entitled “Characteristics and Reuse Potential of Illinois River Sediments” on March 1, 2007. Over seventies researchers, consultants, and other interested people attended the one-day event. There were eight speakers on various aspects of research associated with the Illinois River on sediment quality, sedimentation rates, and sediment remediation and reuse plans. Most of this research has been funded by WMRC.

**PUBLICATIONS**