

# LINK



The Newsletter of the Great Lakes Regional Pollution Prevention Roundtable (GLRPPR)

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## A Note from the Executive Director

### Activities and New Features

GLRPPR is constantly striving to improve our services. The following information will show how we are doing just that!

### Help Desk Archive

GLRPPR is now archiving the questions and answers from the help desk, which is our online technical assistance service that provides free literature and/or internet searching on a P2 subject performed by our professional librarian and GLRPPR's technical staff. The archived questions and responses, based on the topic and dates, are displayed for easy viewing. Help desk questions and answers are also integrated into the sector resources to which they relate to increased ease of access for the user. As this list grows search capabilities will be added.

### Other Web Site Features

Events and funding opportunities are being integrated into the sector resources to which they relate, as well as appearing on the separate Calendar and Funding Opportunities pages. This is part of a

continuing effort to make the vast amount of information available on the site more accessible and the site more user-friendly overall.

### Measurement

Gary Miller of WMRC continues to act as our regional representative on the national measurement task force. GLRPPR is working with Michigan and Indiana to pilot the use of the PPRC agglomeration tool to begin collecting measurement data. Lessons learned will be passed on to the other states and organizations within the region.

### Conference Planning

#### GLRPPR Winter Conference

GLRPPR is coordinating the GLRPPR winter meeting in Chicago on March 9th. The program will be held at McCormick place in conjunction with the Envirotech Expo. Please see the GLRPPR conference information page at <http://glrppr.org/meetings/> for more information. The GLRPPR program will be held for a half day and will feature program updates and summaries from several of our members. In the afternoon GLRPPR members are encouraged to attend the Envirotech Expo.

#### Environmental Summit

I am acting as the local coordinator for planning the Environmental Summit that will be hosted by EPA and NPPR in Chicago on April 11-14, 2005. I am also serving on the national coordination committee as well as the content committee, coordinating the local planning committee, and serving on the contractors committee.

#### Auto Salvage Environmental Workshop—Chicago

The IL Department of Commerce & Economic Opportunity is organizing a half-day environmental regulations overview for auto salvage facilities. GLRPPR is helping

support these workshops by promoting the program to people within the region and offering the pre-existing auto salvage resources that GLRPPR has available, namely the Auto Salvage topic hub at <http://glrppr.org/hubs/>. A workshop will be held on April 8, 2005 in Peoria, IL, (<http://www.illinoisbiz.biz/bus/sba.html>) with others to follow.

#### *GLRPPR Summer Conference*

We are in the process of planning the summer conference, which will be held in New York City on August 25th and 26th. We have partnered with the New York Academy of Science and EPA Region 2 to host this conference. Additional details will be available soon on the GLRPPR Web site!

Debra Jacobson, GLRPPR Executive Director

## Featured Articles

### Teaching Sustainable Design At Purdue University

*by Inez Hua and Julie Ann Stuart, Professors at Purdue University*

Increasing standards-of-living in industrialized nations and the current pace of population growth globally has placed enormous pressure on the quantity, quality, and availability of material resources. The impacts are evident at a variety of scales, and range from water quality impairment of local watersheds to global climate change. The challenge is to devise strategies for moderating current resource demands and environmental stressors without downgrading living standards. This challenge is best addressed by undertaking efforts in sustainable design. A commonly accepted definition of sustainability is: "Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs." Successful sustainable design activities will require technological advancements significantly beyond the current state-of-the-art. Moreover, technological innovations aimed at overcoming obstacles to sustainable design will require truly multi-disciplinary perspectives. Discovery and learning activities must be implemented at universities so that students possess the skills to address these challenges. Sustainable design and related concepts are gaining increasing visibility in the corporate world and at higher education institutions in the United States and Europe.

The Schools of Industrial Engineering and Civil Engineering at Purdue University teamed to develop a multi-disciplinary graduate course in Sustainable Design at Purdue University that was offered during fall 2003 and 2004. The course objective was to teach a unique perspective on multiple aspects of product design with respect to materials, manufacture, distribution, use, re-

use, and recycling. Students in the course were typically graduate students and advanced undergraduates who earned or are earning engineering or science degrees. The course was structured around lectures, small group and whole class discussion, and guest speakers from industry. During the fall 2004 semester, off-campus students throughout the U.S. participated in the course through Purdue's Continuing Engineering Education (CEE) program, and these students added valuable practical perspectives. Guest speakers for the course have included staff from Eli Lilly and Company, Xerox, Indiana Department of Environmental Management, and Supply Chain Services, Inc. For further information about the course, please contact Professor Hua ([hua@purdue.edu](mailto:hua@purdue.edu)) or Professor Stuart ([stuart@purdue.edu](mailto:stuart@purdue.edu)).

### Better By Design

Manufacturers have long recognized design as key to determining the costs and competitiveness of a product. A number of companies such as IBM, Volvo, Xerox and others primarily in the electronic and transportation sectors, also recognize that it is a unique, powerful stage at which to address environmental impacts. This is the stage when decisions are made about which materials will be used in the product and the processes that will be used during manufacturing. Once these decisions are made, they determine the waste stream for the product's entire lifecycle.

Integrating environmental consideration into design can be as basic as adding a checklist of questions to current product design procedures. Such as, "Is the product as energy efficient as possible?" or "Can the use of hazardous materials be avoided in this product?" or "Does the product contain recycled materials?" The key is to include questions that consider impacts over the entire lifecycle of the product, from raw materials or parts selection, during manufacture and use of the product, to end-of-life or usefulness. Use of this lifecycle perspective upfront, is called Design for the Environment (DfE), eco-design, or green design, essentially all terms for the same concept.

Product design teams can also use flow-charts, software, or a series of open-ended questions such as "How can we make this product easy to reuse or recycle?" to enhance DfE implementation.

### Some Disassembly Required

One of the more readily visible results of the use of DfE has been the ease of product disassembly. This is important for repair, upgrade, or recovery of parts and materials for reuse and recycling. At IBM (Rochester, Minnesota facility) it has generated the additional benefit of making the computers easier to assemble, thus improving manufacturability. This was done through the

use of color coded, cleverly designed connectors that often snap together without the use of tools. As is often the case, the improvements in the environmental attributes of products simultaneously generate other benefits.



A dart connector, which replaces the use of an adhesive, holds acoustic foam securely in place on the inside of an IBM computer front panel.

Office furniture manufacturers such as Steelcase and Grammer A.G. (Germany) have each developed office chairs that readily disassemble for repair and recycling. The Think and Natura chairs respectively, both disassemble within a matter of minutes making them economical to recycle.

### Financial Benefits

A grant project awarded by the Minnesota Office of Environmental Assistance (OEA) for integration of DfE into the product design system at Perfusion Systems (a Cardiac Surgery business of Medtronic, Inc.) generated significant financial benefits for the company. An immediate result was the optimization of a coating process for an oxygenator that resulted in annual cost savings of \$2.1 million. Addressing selection of non-hazardous materials when possible, along with efficient use of materials and energy upfront can significantly cut costs. As a result of this project, all new product designs at Perfusion Systems are now required to use DfE as part of the design process.

### Power for Products

Electronic products typically generate the greatest environmental impacts from energy during the “Use” lifecycle stage. A number of alternative power designs including wind-up power for radios, use of thermic (body heat) to power watches, and miniature fuel cells are being explored or used by product designers. DfE provides an opportunity for product design teams to use their collective ingenuity and creativity to bring environmental attributes along with overall improvements to product design.

### DfE Resources

While some aspects of DfE are highlighted in this article, additional information including guide sheets can be

found on the OEA Web site at [www.moea.state.mn.us/p2/dfe-guide.cfm](http://www.moea.state.mn.us/p2/dfe-guide.cfm).

OEA continues to work with a variety of manufacturers on integrating DfE into product design.

A “Better by Design” DVD, an 8 minute video with testimonials from IBM, 3M, General Mills, and Medtronic explains what DfE is, why it is important, and how to implement it. Contact Fran Kurk, Minnesota Office of Environmental Assistance at (651) 215-0242 [fran.kurk@moea.state.mn.us](mailto:fran.kurk@moea.state.mn.us) for more information.

## Selected Sustainable Design Resources

compiled by Laura L. Barnes, GLRPPR Help Desk Librarian

### Books & Reports

Charter, Martin, ed. *Sustainable Solutions: Developing Products and Services for the Future*. London : Greenleaf Publishing, 2001 (ISBN: 1874719365)

‘Sustainable Solutions’ provides state-of-the-art analysis and case studies on why and how cutting-edge companies are developing new products and services to fit ‘triple-bottom-line’ expectations.

McDonough, William; Braungart, Michael. *Cradle to Cradle : Remaking the Way We Make Things*. New York: North Point Press, 2002. (ISBN: 0865475873)

The authors propose that products should be designed so that, after their useful life, they provide nourishment for something new—either as “biological nutrients” that safely re-enter the environment or as “technical nutrients” that circulate within closed-loop industrial cycles, without being “downcycled” into low-grade uses (as most “recyclables” now are).

Rothenberg, Sandra; Lenox, Michael; Jordan, Benjamin; and Field, Dr. Frank III. *Alpha Motors, LTD. : Integrating Live-Cycle Environmental Concerns into Product Design : Case Study and Teaching Note*. [Baltimore, MD ?] : World Resources Institute, 1998. (Order online at <http://www.wristore.com/almotltdinli.html>. Cost is \$2.50)

Alpha Motors, a subsidiary of a large U.S. automaker, sought a life-cycle analysis (LCA) tool that could help product designers take account of environmental issues when making materials choices. The primary teaching objective of this case is to give students a basic understanding of LCA and the issues involved when integrating life-cycle tools into the product design process.

Ryan, John C.; Durning, Alan Thein . *Stuff : The Secret Lives of Everyday Things*. Seattle, WA: Northwest Environment Watch, c1997. (ISBN: 1886093040) (There is a companion curriculum guide available online at [http://northwestwatch.org/indicators/stuff\\_curriculum.pdf](http://northwestwatch.org/indicators/stuff_curriculum.pdf)) *Stuff: The Secret Lives of Everyday Things* takes you to the places and people you touch every day—when you sip your coffee, tie your shoes, click your mouse, or step on the gas. Once you follow a day in the life of an average

North American and see the secret lives of your food, clothes, and toys, your world will never look the same.

Sawhney, Nitin. *ThinkCycle: Supporting Open Collaborative Design for Product Innovation and Learning in Sustainable Engineering* (Thesis Research Abstract). Cambridge, MA : Massachusetts Institute of Technology, 2002. (Online at <http://web.media.mit.edu/~nitin/thesis/thesis-research-summary.pdf>)

## Journals

*Journal of Sustainable Product Design*  
<http://www.kluweronline.com/issn/1367-6679>  
A peer-reviewed, multi-disciplinary journal focusing on the theoretical, methodological, and practical dimensions of sustainable and eco-product and service design and development. Currently published by Kluwer Academic Publishers. Subscription rates are \$205/year for institutions and \$100/year for individuals. Archived issues from 1997-1999 are available at <http://www.cfsd.org.uk/journal/archive/index.html>.

*Metropolis Magazine*  
<http://www.metropolismag.com/>  
Focus on products from the designer's perspective. See the Sustainable Metropolis part of the site (<http://www.metropolismag.com/cda/sustainable.php>) for current articles about sustainable design.

## Web sites

**Biothinking for Sustainable Design and Business Vitality**  
<http://www.biothinking.com/>  
This Web site aims to be an educational resource for people wishing to understand how the world, both manmade and natural, operates along biological principles. Biothinking results in products, processes, and business models that are adaptable, sustainable, and well suited to their niche. Includes a publications section at <http://www.biothinking.com/pubs.htm>.

**The Natural Step**  
<http://www.naturalstep.org/>  
The Natural Step's mission is to accelerate global sustainability by guiding companies and governments onto an ecologically, socially and economically sustainable path. They work with some of the world's largest resource users to create solutions, innovative models and tools that will lead the transition to a sustainable future. See in particular the section on sustainability and design at [http://www.naturalstep.org/research/sust\\_and\\_design.php](http://www.naturalstep.org/research/sust_and_design.php).

**Sustainable Product Design**  
[http://www.egeneration.co.uk/centre/modules/sustainable\\_productdesign/](http://www.egeneration.co.uk/centre/modules/sustainable_productdesign/)  
A best practices section of the U.K.-based E-generation Business Education Centre.

**ThinkCycle**  
<http://www.thinkcycle.org/>  
ThinkCycle is an academic, non-profit initiative engaged in supporting distributed collaboration towards design challenges among underserved communities and the environment. ThinkCycle seeks to create a culture of open-source design innovation, with ongoing collaboration among individuals, communities and organizations around the world.

**U.S. EPA's Design for Environment Program**  
<http://www.epa.gov/dfe/>  
The Design for the Environment (DfE) Program provides decision-makers with information, tools, and incentives to make informed decisions that integrate risk, performance, and cost concerns into business decisions. For a complete list of past and present DfE partnership projects, see <http://www.epa.gov/dfe/projects/index.htm>.

## Research Centers

**Centre for Sustainable Design**  
<http://www.cfsd.org.uk/>  
The Centre for Sustainable Design, established within the Faculty of Design at The Surrey Institute of Art & Design, University College in the U.K., facilitates discussion and research on eco-design and environmental, economic, ethical and social (e3s) considerations in product and service development and design. This is achieved through training and education, research, seminars, workshops, conferences, consultancy, publications and Internet. The Centre is also an information clearinghouse and a focus for innovative thinking on sustainable products and services.

**Sustainable Systems Research Center**  
<http://www.ssrc.rit.edu/>  
Based at the Rochester Institute of Technology, the Sustainable Systems Research Center is dedicated to enhancing the environmental and economic performance of products. They do so by developing and enhancing the tools of sustainable design, a holistic approach to maximizing value and minimizing environmental impact.

## Journal Articles

Borland, N.; Wallace, D. "Environmentally Conscious Product Design : A Collaborative Internet-based Modeling Approach." *Journal of Industrial Ecology*, 3(2 & 3), 33-46 (1999).

Buxton, A.; Livingston, A.G.; Pistikopoulos, E.N. "Reaction Path Synthesis for Environmental Impact Minimization." *Computers & Chemical Engineering*, 21, S959-S964 (1997).

Abstract: Reaction path synthesis, the generation of a network of alternative reaction routes for the manufacture of a desired product and the selection of an optimal route, represents a key step in arriving at

environmentally sound process designs. In this paper a systematic procedure for organic reaction path synthesis is described in which minimum environmental impact considerations are incorporated in order to exploit the earliest opportunities for waste reduction.

Charter, Martin. "Managing Eco-design." *Industry and Environment* 20(1-2), 29-31.

Abstract: Business is focusing increasingly on products' environmental performance. Product design and development that considers a product's environmental impacts is a new area. 'Eco-design' or Design for Environment' (DfE) refers to the systematic incorporation of environmental factors at this stage. To move beyond this stage towards 'Design for Sustainability' (DfS) or 'Sustainable Product Design' (SPD), new structures, skills and systems will be required.

Finster, Mark; Eagan, Patrick; Hussey, Dennis. "Linking Industrial Ecology with Business Strategy : Creating Value for Green Product Design." *Journal of Industrial Ecology*, 5(3), 107-125 (2001).

Abstract: As organizations practice environmental design, some discover green design positively impacts business performance. This article demonstrates how an organization can employ existing design methods and tools to craft an environmental product design strategy that enhances its business strategy. These tools expand the toolbox of the industrial ecologist and enable the link between green design and business improvement.

Hoffman, W.F. III. "Recent Advances in Design for Environment at Motorola." *Journal of Industrial Ecology*, 1(1), 131-140 (1997).

Abstract: Motorola is a large electronics company that uses design for environment (DfE) to address customers' environmental needs. In working to integrate environmental considerations into product design, Motorola has encountered new challenges in product design, and as a result has had to develop new frameworks and employ new analytical tools. This article describes those challenges and Motorola's efforts to date.

McDonough, W; Braungart, M. "Towards a Sustaining Architecture for the 21st Century: The Promise of Cradle-to-cradle Design." *Industry and Environment* 26(2-3), 13-16 (2003).

Abstract: Cradle-to-cradle design is an ecologically intelligent approach to architecture and industry that involves materials, buildings and patterns of settlement which are wholly healthful and restorative. Unlike cradle-to-grave systems, cradle-to-cradle design sees human systems as nutrient cycles in which every material can support life. Materials designed as biological nutrients provide nourishment for nature after use; technical nutrients circulate through industrial systems in closed-loop cycles of production, recovery and remanufacture. Following a science-based protocol for selecting safe, healthful ingredients, cradle-to-cradle design maximizes the utility of material assets.

Oakley, B. T. "Total Quality Product Design--How to Integrate Environmental Criteria into the Product Realization Process." *Total Quality Environmental Management*, 2(3), 309-321 (1993). Abstract: This article shows how the marriage of corporate environmental stewardship and TQM, better known as TQEM, is particularly well suited to the area of product design and why environmental health and safety experts can improve a product's environmental performance.

Rios, P.; Blyler, L.; Tieman, L.; Stuart, J.A.; Grant, E. "A Symbolic Methodology To Improve Disassembly Process Design." *Environmental Science & Technology (ES&T)* 37(23), 5417-5423 (2003).

Abstract: This paper introduces the concept of design symbols to help the operator more efficiently survey product complexity with respect to location and number of fasteners to remove a structure that is common to all electronics: the housing. With a sample of 71 different computers, printers, and monitors, we demonstrate that appropriate symbols reduce the total disassembly planning time by 13.2 min. Such an improvement could well make efficient the separation of plastic that would otherwise be destined for waste-to-energy or landfill.

Rounds, K.S.; Cooper, J.S. "Development of Product Design Requirements Using Taxonomies of Environmental Issues." *Research in Engineering Design*, 13(2), 94-108 (2002).

Abstract: In this paper, the authors develop and apply three approaches for preparing taxonomies that assist in gathering, storing, using, and reusing Design for Environment requirements.

Segar, J.W.; Bradfield, S.L.; Wright, J.J.; Realff, M.J. "EcoWorx, Green Engineering Principles in Practice." *Environmental Science & Technology (ES&T)* 23(23), 5269-5277 (2003).

Abstract: The 12 Principles of Green Engineering have been proposed as a framework within which to examine existing products and guide their redesign as well as to evaluate new product designs. The EcoWorx system represents a recyclable carpet tile product that is assessed using the 12 Principles of Green Engineering and cradle-to-cradle design principles to evaluate environmental, qualitative, and economic performance as compared to existing Shaw carpet tile products.

Sheng, Paul; Worhach, Paul "A Process Chaining Approach toward Product Design for Environment." Sheng, Paul; Worhach, Paul. *Journal of Industrial Ecology*, 1(4), 35-55 (1997).

Abstract: This article presents an approach toward product design for environment (DfE) at the level that integrates environmental hazard analysis with models of transformation processes.

Stephan, David G.; Knodel, Robert M.; Bridges, James S. "A "Mark I" Measurement Methodology for Pollution

Prevention Progress Occurring as a Result of Product Design Decisions.” *Environmental Progress*, 13(4), 232-246 (1994).

Abstract: A methodology for assessing progress in pollution prevention resulting from product redesign, reformulation, or replacement is described. The method compares the pollution generated by the original product with that from the modified or replacement product, taking into account, if desired, the various lifecycle stages of the product. The pollution prevented (or sometimes increased) as a consequence of the redesign is delineated with respect to the media affected (water, air, or soil/groundwater) and with respect to human health impacts, use impairment impacts, and disposal capacity impacts.

Taraska, J. “Some Disassembly Required.” *Metropolismag.com*, July 2004, 2 p. (2004). [Online at [http://www.metropolismag.com/html/content\\_0704/ste/](http://www.metropolismag.com/html/content_0704/ste/)]

Abstract: With Think, Steelcase creates a comprehensive environmental strategy that reconfigures all aspects of the manufacturing process -- from the chair’s initial conception to its eventual disassembly. The result is an elegant, ergonomic, and environmentally sustainable midpriced office chair.

Thurston, D.L.; Srinivasan, S. “Constrained Optimization for Green Engineering Decision-Making.” *Environmental Science & Technology (ES&T)* 37(23), 5389-5397 (2003).  
Abstract: Green engineering requires the designer to consider a very extensive set of environmental impacts. To minimize these impacts, the designer must significantly expand his or her “toolset” of product design concepts, alternative materials, manufacturing systems, and analytic methods for addressing life cycle impacts. This can overwhelm a designer, who then resorts to overly simplistic rules or checklists out of necessity. The central issue is how to identify all “pollution prevention pays” opportunities and then how to deal with the unavoidable tradeoffs that arise after all these opportunities have been exhausted. This paper presents a framework for employing mathematical decision modeling toward this end.

## Coming Soon...Spring 2005 Edition

The Spring 2005 Edition of the LINK newsletter will focus on alternative fuels. The LINK Fall 2005 article solicitation will be sent to GLRPPR members via e-mail on or about March 1, 2005; articles will be due March 31. Send article ideas or questions to Wayne Duke at [wduke@wmrc.uiuc.edu](mailto:wduke@wmrc.uiuc.edu).

## Items of Interest

### Publicly Owned Treatment Works Mercury Outreach

In July 2003, the Indiana Dept. of Environmental Management (IDEM) received a Pollution Prevention Incentives for States grant for \$90,000 from the U.S. Environmental Protection Agency. IDEM has used the grant throughout 2004 to help publicly owned treatment works promote pollution prevention and source reduction measures for mercury to various industries. IDEM is developing an educational program that will include various outreach materials and training on sectors where mercury contamination may be present in effluent released to POTWs. IDEM formed a workgroup comprised of representatives from various POTWs, hospitals, the Indiana Dental Association, and more. The workgroup reviewed and approved outreach materials developed by IDEM.

IDEM’s Office of Pollution Prevention and Technical Assistance is also following the draft streamlined mercury variance rule closely to help promote mercury pollutant minimization program requirements that may be implemented as a result of this rule. The intent is to show POTWs how they can use the educational materials as part of a mercury pollutant minimization program plan. Fact sheets have been developed to promote best management practices or virtual elimination for colleges & universities, dental offices, general industry, health care facilities, and POTWs. These fact sheets, in conjunction with other available resources, should provide municipalities with an initial education strategy for these potential sources of mercury in their facility. The fact sheets are available on IDEM’s Web site at [www.IN.gov/idem/mercury/potw/](http://www.IN.gov/idem/mercury/potw/).

## FRP Scrap

Waste reduction methods, like maximizing transfer efficiency during spray up or minimizing trim waste from molded parts, can limit fiber reinforced plastics (FRP) scrap. But, even the best available FRP manufacturing technologies generate scrap. This solid waste is typically in the form of overspray, trimmings, or non-compliant parts. Currently, FRP solid waste is landfilled.

In 2004, a focus group conducted by Minnesota Technical Assistance Program (MnTAP) indicated that FRP fabricators are interested in recycling their scrap. FRP scrap can be recycled by mechanical, pyrolysis, or chemical means. When considering the recycling of FRP scrap, three main issues need to be addressed:

- technical processing issues
- transport and logistics
- economics

Kyle Bartholomew, MnTAP FRP specialist, wrote the report “Fiberglass Reinforced Plastics Recycling,” summarizing the current state of FRP recycling. Find it online at <http://mntap.umn.edu/fiber/scrap.htm>.

## OPP Joins a New Office

On October 1, 2004, the new Ohio Office of Compliance Assistance and Pollution Prevention (OCAPP) opened with combined staff from the Office of Pollution Prevention (OPP), the Small Business Assistance Office at Central District Office and the Division of Air Pollution Control's Small Business Assistance Program.

OCAPP will still provide advice and on-site assessments to help businesses prevent pollution. Preventing pollution saves raw materials, avoids disposal costs, and increases competitiveness. In some cases, reducing the amount of pollution or waste may eliminate a company's need to be regulated by Ohio EPA. In addition, non-regulatory staff members will make site visits to evaluate plant-specific conditions and recommend cost-saving strategies.

This office will also provide free and confidential multimedia compliance assistance. Services include a toll-free hotline, Web site, environmental workshops, and publications that explain environmental requirements in plain English. Businesses with fewer than 100 employees are eligible for on-site compliance assessments. For more information about OCAPP, visit the Web site at [www.epa.state.oh.us/ocapp.html](http://www.epa.state.oh.us/ocapp.html) or call (800) 329-7518.

## Sustainability in Agriculture Grant

The University of Wisconsin has received a new grant to look at sustainability in agriculture. Entitled 'An Analysis of Environmental Management Approaches with Six Midwestern Dairy Farms: Informing Progress Toward a Sustainable Agriculture,' the goal of the project is to analyze the gaps and the strengths of six different approaches to managing the environmental impacts of Midwestern dairy farming. The objective is to identify whether, and how, each approach falls short of achieving environmental sustainability and how an Environmental Management System (EMS) might strengthen farm sustainability.

The six management approaches are:

- certified Organic,
- certified by the Midwest Food Alliance,
- grass-based Holistic Management,
- Biodynamic,
- permitted Confined Animal Feeding Operation (CAFO), and
- conventional farm meeting NRCS requirements for incentive payments.

Document analysis, along with six case studies, will be used to pinpoint environmental vulnerabilities and to develop and publicize recommendations toward filling the gaps with each approach. Using tools developed for EMS implementation, the case study farms will be studied to determine what needs to be done to make them more sustainable. Expected outputs include:

- Analyses, case studies and recommendations for the certification, permitting structures and management procedures associated with different environmental management approaches, and their gaps and strengths in managing for sustainability;
- Evaluation of improvements on six dairy farms achieved through an EMS; and
- Press releases, presentations, a guide for farmers, and articles about the project findings and recommendations.

Projected outcomes will include improved environmental management on six model farms, increased clarity among practitioners and advocates about the environmental sustainability potential of different management programs, and improved understanding of what an EMS offers to sustainable agricultural practice.

For further information about the project contact Mill Ingram ([mingram@wisc.edu](mailto:mingram@wisc.edu)) or visit the Web site at [www.uwex.edu/farmandhome/](http://www.uwex.edu/farmandhome/).

## Fine Print

LINK is a free quarterly publication of the Great Lakes Regional Pollution Prevention Roundtable. For subscription information, please contact the editor or see our Web site at [www.glrppr.org](http://www.glrppr.org).

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