



Directory of Pollution Prevention in Higher Education: Faculty and Programs 1994

Edited by
Pamela Bloch and Joanne Goodwin
University of Michigan



National Pollution Prevention Center
for Higher Education

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Pamela Bloch and Joanne Goodwin
University of Michigan

First edition edited by
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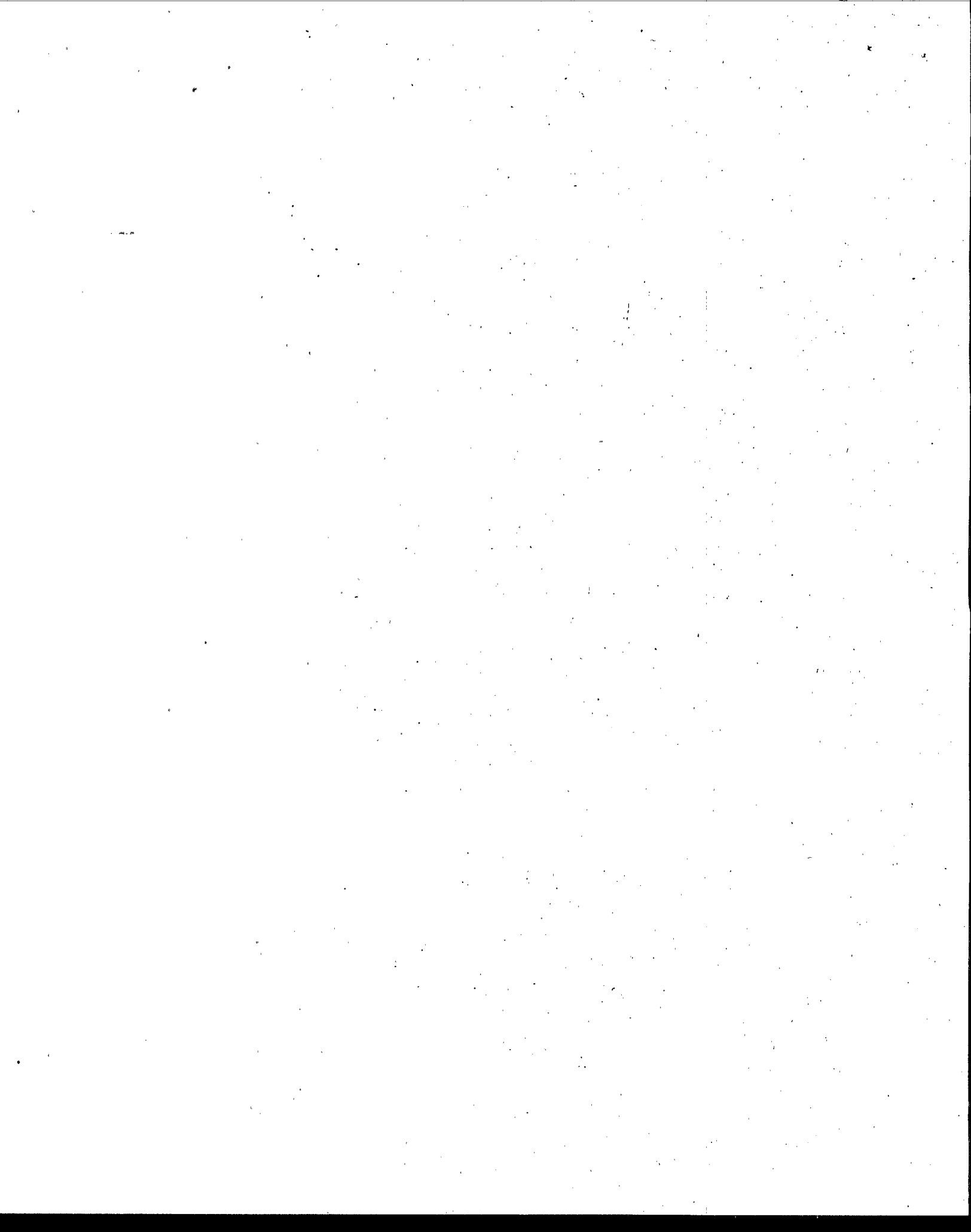
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Preface to Second Edition

In October 1991 the U.S. Environmental Protection Agency established the National Pollution Prevention Center for Higher Education (NPPC) to develop and disseminate pollution prevention educational materials for use in higher education. The NPPC has published this *Directory of Pollution Prevention in Higher Education: Faculty and Programs* in order to help build a national network of pollution prevention educators who can contact each other to share information, ideas, and curricula. You are encouraged to contact anyone listed in this Directory for assistance in integrating pollution prevention concepts and practical experiences into your courses. Through the network represented by these faculty, the NPPC will collect existing educational materials and facilitate the development of new pollution prevention educational initiatives. Information about the NPPC's current publications is on the next page, under "A Note About NPPC Educational Resources."

This is the second edition of the *Directory*. The first edition, published in 1992, was prepared by Nandkumar Bakshani, Ph.D., and David Allen, Ph.D., of the University of California - Los Angeles. It was based on a national survey of people involved in pollution prevention education and prepared for the Pollution Prevention Education Committee of the U.S. EPA's National Advisory Council for Environmental Policy and Technology. This second edition includes 127 more entries than the first edition, bringing the total to 216 faculty. While we have tried to include as many college and university faculty involved in pollution prevention as possible, we recognize that we have not included everyone currently active in the field. It is the intent of the Center to continually update our *Directory* database; therefore, we would appreciate it if you keep us apprised of any changes, corrections, additions, or deletions. We welcome suggestions of people to contact for possible inclusion in future editions as well as other recommendations and information that will make this *Directory* more inclusive and useful.

For ease of reference, the faculty entries in this *Directory* are organized by discipline. However, because approaches to pollution prevention require interdisciplinary efforts, we encourage you to contact faculty in fields seemingly disparate from your own.

We hope this *Directory* will be useful to you in your important work in pollution prevention education.

Jonathan W. Bulkley, Ph.D.
NPPC Director

Gregory A. Keoleian, Ph.D.
NPPC Manager

Pamela Bloch
Directory Editor

Joanne Goodwin
Directory Editor

A Note About NPPC Educational Resources

The Center is developing several educational Resource compendia to disseminate and update pollution prevention education materials. These compendia are designed to help faculty incorporate pollution prevention concepts and principles into their courses. The materials can also be useful to industry, government, and non-profit organizations. The compendia are continually evolving collections of resources from NPPC and faculty nationwide that have proven useful in addressing pollution prevention in classes; they are intended to represent a multisector perspective. Each compendium, which is discipline-specific, identifies problem sets, case studies, journal articles, videos, and/or computer software relevant to that discipline. Current compendia cover accounting, business law, chemical engineering, environmental studies, industrial ecology, and industrial engineering and operations research; future compendia will cover architecture, chemistry, corporate strategy, environmental engineering, and industrial design. A sample contents page from the chemical engineering compendium follows this section.

In addition to these compendia, the Center has also produced specific educational materials such as case studies of refrigerator design and McDonald's packaging. The "Open-Ended Problem: The Design of a CFC-Free, Energy-Efficient Refrigerator" case study presents the challenge of developing and marketing a refrigerator that is 25-50% more efficient than the federal efficiency standard. The problem is posed in the form of two memos. The first introduces the regulatory pressure driving the conversion to the CFC-free energy-efficient refrigerator; the second provides design specifications that can be used to begin work on the problem. The final section compares different alternatives, focusing on energy efficiency and CFC replacement as it affects energy efficiency.

The McDonald's case study focuses on the work of a Joint Task Force of McDonald's Corporation and the Environmental Defense Fund. It gives an overview of the project and discusses the center of McDonald's image problem, its polystyrene "clamshell" packaging for large sandwiches. A thorough life cycle analysis, supported by extensive data, is presented for packaging options that include the clamshell. A teaching note for the case study, notes on life cycle analysis, and background information on this country's solid waste problem are also included.

Please contact us to order any of our educational materials or to suggest materials of which you think we should be aware. Please also contact us if you are interested in creating materials for the Center to disseminate.



**Pollution Prevention and
Chemical Engineering**

NATIONAL POLLUTION PREVENTION CENTER FOR HIGHER EDUCATION

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- ☐ Course Syllabi
- ☐ Open-Ended Problem: "Design of a CFC-Free, Energy-Efficient Refrigerator"
- ☐ Case Study: "McDonald's/EDF Environmental Task Force"
- ☐ Case Study: "Agent Regeneration and Hazardous Waste Minimization"
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- ☐ Video: "McDonald's/EDF Environmental Task Force"
- ☐ Video: "Second Victory at Yorktown"

Introduction to First Edition

Executive Summary

This survey reports the current state of development of pollution education at Universities in the United States, based on a national survey conducted between December 1991 and February 1992. Over 140 individuals (from 80 institutions) believed to be active in pollution prevention education were contacted, and of these, 89 individuals (from 59 institutions) provided information on their pollution prevention education efforts. Summaries of each of the individual reports are given in the section *Summary of Responses*.

Study of the survey reveals that:

- Pollution prevention education is occurring in a large number of academic disciplines but is heavily concentrated in engineering departments, particularly chemical and civil/environmental engineering. Even though chemical engineering is leading in pollution prevention efforts, less than 25% of the chemical engineering departments (32/155) were identified as being active in pollution prevention education and roughly 25% of the thirty-seven hundred 1990 chemical engineering graduates (B.S. degree) were exposed to pollution prevention at some level. It tends to be taught as a specialized senior elective or graduate course, rather than as a fundamental element of the core curriculum.
- Most curriculum development on pollution prevention is done by individuals or small groups in relative isolation at their home institutions. Comprehensive pollution prevention and environmental education efforts have emerged at a few universities, where they are generally associated with research centers.
- Pollution prevention education is gradually penetrating the social sciences and liberal arts. However, educators in these disciplines are aware of the strong technical component of pollution prevention and would like to see a better science background for all students.
- Universities in some states are active in a broad spectrum of pollution prevention activities (see **Appendix C**). These states tend to have mandated pollution prevention and actively assist the development of pollution prevention methods through grants or sponsored studies.
- The lack of consensus of the definition of pollution prevention means that there is no general agreement on the elements and intellectual content of pollution prevention education and research. This lack of definition also hinders transfer of curricular materials among universities.
- The end-of-pipe mind-set that has evolved from years of control regulations prevails among many professionals both in industry and at universities. Even though many industrial analysts agree that pollution prevention is more profitable than end-of-pipe treatment, industry is slow to fund pollution prevention projects at universities. This in turn impedes the proliferation of pollution prevention education at universities.

Pollution Prevention -Survey of Educational Initiatives

Introduction

Innovative companies of today realize that preventing pollution is a proactive, cost effective way to address increasingly stringent environmental regulations. Regulatory agencies are beginning to employ pollution prevention approaches in permit writing and settlement agreements. As pollution prevention becomes the dominant industrial and regulatory strategy for preserving environmental quality, the educational background of environmental professionals and decision makers will require more pollution prevention education. Universities, as institutions charged with educating the next generation of environmental decision makers, should be taking a leading role in defining pollution prevention curricula.

Methodology

The objective of this study was to survey the current state of university-based pollution prevention education in the United States. The survey includes developments of pollution prevention materials in a wide range of disciplines at close to 60 institutions nationwide.

The 140 individuals at Universities and colleges that were contacted during the survey were identified through a variety of sources: previous pollution prevention directories and surveys¹, publications, word of mouth, and other sources. The individuals surveyed were asked to address three broad issues:

- 1) Scope and emphasis of their pollution prevention program;
- 2) Type, level, and frequency of courses, enrollment figures, and teaching aids developed; and
- 3) Complementary research and funding sources.

The fact that the survey focused on individuals is a reflection of the state of curriculum development on pollution prevention. With very few exceptions the pollution prevention educational material developments are being made by individuals acting in isolation or in small groups at their home institutions. These individuals and groups are most often located in the departments of: agriculture, business, chemical engineering, chemistry, civil/environmental engineering, public health, and professional education (university extension schools). Some non-university personnel active in pollution prevention, operating through community colleges, were also contacted. Concerted group efforts at pollution prevention education are rare but, where they exist, are almost always associated with university-based centers.

Findings

The findings of the survey will be grouped into six major categories: definitions, science and engineering, business, social sciences and other disciplines, pollution prevention centers, and state influences. Details of any mentioned activity can be found in the *Summary of Responses*.

Definitions

The term "pollution prevention" has no broadly accepted definition. The spectrum of activities that are called pollution prevention ranges from toxic use reduction to disposal of wastes. This confusion and lack of common terminology limits the transferability of the curriculum materials.

Many people use pollution prevention to refer to the hierarchy of environmental actions as adopted in the Pollution Prevention Act of 1990:

- Prevent or reduce pollution at the source whenever feasible

¹ Washington State Department of Ecology (Publication #91-33); WRITAR, Minneapolis, MN, National PP Survey Results as published in the proceedings of their conference, "Pollution Prevention and Higher Education Curricula," University of Minnesota-St. Paul, Dec. 9, 1991.

- Pollution that cannot be prevented should be recycled in an environmentally safe manner
- Pollution that cannot be prevented or recycled should be treated safely
- Environmentally safe disposal or release should proceed only if no other option is available

Because some people associate this hierarchy with pollution prevention, many believe that pollution prevention covers everything from source reduction to waste disposal. The authors of this survey use pollution prevention to mean *source reduction* which is later defined in section 6603 of the Act to mean (condensed form, not a direct quote):

...any practice that reduces the amount or environmental and health impacts of any pollutant released into the environment prior to recycling, treatment, or disposal. This includes equipment or technology modification, process or procedure modification, reformation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control. Source reduction does not include any activity that is not integral to producing a good or providing a service.

This confusion over the definition of pollution prevention leads to pollution prevention educational materials based on everything from disposal to source reduction and energy conservation. Course materials on pollution prevention that address the entire hierarchy are vastly different from materials that focus on source reduction. Either of those courses would be difficult to integrate with course materials that focus on life cycle analyses or toxic use reduction.

Science and Engineering

The primary focus in environmental engineering education (and in some cases chemical engineering) continues to be on control technologies rather than pollution prevention. A few environmental and chemical engineering programs—among them North Carolina State, Tennessee, and UCLA—are beginning to add pollution prevention classes. Most programs, if they cover pollution prevention at all, do so in a course module. When departments offer these classes or course modules, however, they tend to be directed toward undergraduate seniors, graduate students, or professionals. Many of the courses are electives and are weakly tied to the core curricula. Approaching pollution prevention in this manner implies that pollution prevention is almost an afterthought.

There have been relatively few attempts to inoculate core engineering and science courses with pollution prevention concepts. In some senior chemical process design courses (e.g., UCLA), waste minimization is taught as an engineering optimization procedure. In computer science courses at Carnegie Mellon students employ pollution prevention concepts in automotive product design. At the University of Minnesota and Washington State University, chemistry laboratories are being revised to incorporate pollution prevention procedures.

Business

Business schools have had little history of addressing environmental issues, so the focus of many efforts has been to open the door for environmental topics, be in management of waste treatment costs, minimizing remediation liability, marketing green products, or capital budgeting for pollution prevention. As these programs mature, it is likely that a greater focus on pollution prevention will emerge.

Groups such as the Management Institute for Environment and Business (MEB) have been leaders in developing educational materials for business schools on the business-environment interaction. Other examples include efforts by the Tellus Institute and the Universities of Houston, Michigan, Minnesota, and Washington.

Social Sciences and Other Disciplines

Pollution prevention education has recently entered the domain of the social sciences and liberal arts. For instance, the Anthropology and Archaeology Department of the University of Arizona offers a course that examines data from analyses of garbage and landfills (comparing the public's perception of the composition of a landfill versus actual

garbage in landfills) and applies life cycle analysis to commodities and products. At the University of Minnesota, the Housing, Design, and Apparel Department has introduced a course, "The Designed Environment," that teaches students to use life cycle analyses to help them select the best reusable/recyclable materials to construct a theater set. The course also addresses pollution prevention issues in applied design arts and graphics design.

Pennsylvania State University and UCLA both offer courses in geography that discuss human attitudes and behavior that are causing degradation of the environment. Courses also address public policy issues, such as zoning laws and their impact on commuter driving distances, taxes on pollution, and other positive incentives to prevent pollution. In the field of education, Clark Atlanta University runs an intensive one-to two-week teacher training program on environmental sciences and pollution prevention for grades kindergarten through twelve (K-12). The program emphasizes the need for more science education for K-12 students.

Pollution Prevention Centers

A number of pollution prevention (PP) centers have been established at universities. University-based pollution prevention centers offer the potential for crossing disciplinary boundaries and developing the multi-faceted materials required in pollution prevention education. Such multi-disciplinary efforts can also develop in the absence of a center structure; centers merely provide greater impetus for such exchanges to occur.

State Influences

Universities in 34 out of the 39 states contacted reported some level of ongoing PP activity. The PP activity may or may not be directed from the state level, though a few university departments indicate that state/federal legislation mandating PP is driving their activity. **Appendix [C]** lists university courses or activities alphabetically by state. Almost all states have legislation mandating pollution prevention at some level, but only some states have legislative elements dealing with assistance for the development of educational and informational resources. Grants and sponsored studies to help develop pollution prevention methods are part of these elements. There are many reasons for development of educational resources so **Appendix [C]** may be viewed as just one indicator of the degree of state commitment to pollution prevention education.

Barriers to Pollution Prevention

Professors quizzed on incorporation of pollution prevention courses in their departmental curricula cited several issues, besides the definition of pollution prevention, as potential barriers to this educational endeavor. Often mentioned is academic departmental commitment to pollution prevention. The "academic plate" in most departments is full. Thus, addition of new courses must be at the expense of existing courses. In general, pollution prevention concepts are now being introduced within pre-existing courses.

The dearth of available pollution prevention course materials and tools also affects departmental commitment. For example, professors in business/public administration schools focus on financial evaluation of conventional end-of-pipe investments because teaching or conducting an overall assessment of pollution prevention investments is complex given the lack of understanding of long term, hidden, and less tangible benefits and the lack of tools and materials needed to teach pollution prevention. A few groups (University of Michigan, University of Minnesota, and Tellus Institute) are reportedly committed to develop tools to integrate pollution prevention economics into their mainline functional areas: accounting, finance, and marketing. One of the challenges here is to alter financial investment practices from environmental control to pollution prevention.

Professors in most non-science disciplines understand that there is a technical side to pollution prevention and are concerned over the low level of general science background in the liberal arts and social science student populations. Environmental professionals and legislators poorly versed in the cognitive process of pollution prevention are potential barriers to effective implementation of pollution prevention methods and policy.

The most frequently mentioned problem for the advancement of pollution prevention is the lack of funding for technology research on pollution prevention. Industries interested in meeting their immediate problem—end-of-pipe regulatory standards—have a limited incentive to invest in the development of new pollution prevention technology. Furthermore, since universities generally base tenure and advancement decisions on tangible research results, fewer junior faculty may be willing to pursue pollution prevention projects, which may have less well defined end-points. Funding agencies generally look for short term hard and measurable goals/results in their funding decisions. The result of the problems in funding of pollution prevention research is a paucity of new and important research results that can often serve as valuable course material. Thus the lack of pollution prevention projects adversely impacts the development of quality courses, creating a cycle that further delays the training of new pollution prevention investigators.

The Next Step

There is much that universities, industry and government agencies can do to overcome these barriers to expand pollution prevention education and research.

- EPA could integrate its emphasis on pollution prevention in more of its programs in environmental education.
- Industry could require that entering employees receive pollution prevention training in the same way they automatically receive safety training. Such requirements would significantly increase the demand for pollution prevention materials.
- Accrediting agencies could require some exposure to pollution prevention in the core curricula.
- Efforts to facilitate the exchange of educational materials and general information between college and university educators should continue to be made. This survey was a step towards initiating communication between educators with similar interests.

Such proactive endeavors would no doubt open the door for more university course offerings

Faculty and Programs

Faculty and Programs in Pollution Prevention

Accounting

1

Terri Goldberg

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Is creating a financial analysis curriculum called, "Improving Your Competitive Position: Strategic and Financial Assessment of Pollution Prevention Projects," and should be available by the end of summer 1994. The curriculum is designed to familiarize environmental and operational staff with the procedures and tools for evaluating the financial aspects of a pollution prevention project. Following a broad general introduction to the assessment process, the material focuses on two topics central to financial analysis—costing information and measures of profitability—and concludes with a discussion of qualitative issues.

key words: accounting; business; case studies; economics; professional education; waste audits; workshop

2

William Lanen

School of Business Administration
University of Michigan
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Ann Arbor, MI 48109-1234

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Is developing a case study on the use and results of environmental performance measures in manufacturing. Is also developing life cycle costing models for manufacturing.

key words: accounting; incentives; life cycle analysis

3

Carol Lawrence

School of Accounting
University of Missouri
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Columbia, MO 65211

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Fax: (314) 882-0365

Conducts field research on environmental costing. Has prepared detailed event history case study of organizational decision-making and macroeconomic factors which resulted in multi-million dollar cleanup of PCB's by a major defense contractor. Designed curriculum module on environmental issues in accounting, suitable for Sr. or Gr. advanced managerial accounting course. The module includes descriptions of unique concerns in evaluating P2 investments and survey techniques for assessing environmental risk. It also includes a theoretical model of legacy costs, defined as all costs occasioned by the impact of the firm's activities on the environment, which includes: prevention; assessment; voluntary failure costs, which result from the firm's failure to entirely remove environmentally damaging materials and processes; and involuntary failure cost, which result from the failure to avoid environmental insult. Relates legacy costs to other recent developments such as activity-based costing, life cycle costing, value chain analysis, and quality costs. Includes a three-dimensional model, visualized as a cube, where the three dimensions are product quality,

environmental performance, and cost. Describes measurements needed for the firm to assess its position within the cube, track improvement, and demonstrate that well-thought out strategies must address all three dimensions. Has written curriculum materials, a case study of costs associated with a cleanup of a major PCB spill, and an empirical study of environmental disclosures by corporations and municipalities.

key words: accounting; business

4

Linda Specht

Department of Business Administration
Trinity University
715 Stadium Drive
San Antonio, TX 78212-7200

Phone: (210) 736-7348
Fax: (210) 736-8134

Currently teaching environmental accounting as an independent study course which includes an overview of accounting and auditing issues, the development of a case study, and the development of a questionnaire regarding environmentally related services performed by CPA firms.

key words: accounting

5

Christopher H. Stinson

Department of Accounting
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University of Texas
Austin, TX 78712-1172

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Teaches an MBA level course in environmental accounting in which the students cover the cost accounting analysis associated with pollution prevention. Has researched pollution prevention programs at several firms. Also, he and co-authors are developing non-financial methods for estimating the environmental impact of emissions. Has written a course syllabus, published articles, and unpublished working papers.

key words: accounting; economics; curriculum; life cycle analysis; waste audits

Agriculture

6

Charles Clanton

Dept. of Agricultural Engineering
University of Minnesota
1390 Eckles Ave.
St. Paul, MN 55108

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E-mail: clant001@maroon.tc.umn.edu
Fax: (612) 624-3005

Teaches two classes and conducts research in waste management, including livestock manure, food processing wastes, on-site sewage treatment, and land application of municipal effluents and sludges. Teaches Engineering Principles of Soil-Water-Plants Systems, a Sophomore/ Jr. level course, and Agriculture Waste Management Engineering, a Gr./Sr. level course in which students operate a mock consulting firm in which they receive letters, requests, and waste samples from fictitious clients; test samples; analyze the results; and formulate the design or recommendation. The final lab is a mock hearing.

key words: agriculture; air quality; environmental engineering; food processing; land use; livestock; sewage treatment; regulations; role playing; soil

- 7 **Robert L. Myers**
Agronomy Department
210 Waters Hall
University of Missouri
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Fax: (314) 882-1467

Teaches UG inter-disciplinary courses on environmental science and agriculture science that include components on pollution. An emphasis is placed on taking a systems approach to problem-solving. Also participates in the University of Missouri Environmental Affairs Council, which looks at environmental practices of the University.

key words: agriculture; soil

- 8 **David Pimentel**
6126 Comstock Hall
Cornell University
Ithaca, NY 14853-0901
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E-mail: dp18@cornell.edu
Fax: (607) 255-0939

Teaches and researches in environmental policy, looking specifically at reducing the use of pesticides. Assess costs of using pesticides—both environmental and monetary to farmers. Students are mostly Gr. and Sr. level in agriculture and energy.

key words: agriculture; biology; biotechnology; ecology; energy; entomology; ethics; geography; land use; livestock; pesticides; professional education; public health; risk; soil; water

Anthropology

- 9 **Tim Jones**
Dept. of Anthropology (Archaeology subgroup)
University of Arizona
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Tucson, AZ 85721
- Phone:** (602) 621-6299
Fax: (602) 621-9608

P2 focus is on garbage analysis and landfills. Courses taught in the past include topics such as garbage data analysis and life cycle analysis of commodities and products.

key words: anthropology; behavior; hazardous materials; life cycle analysis; recycling; social sciences; solid waste

- 10 **Doug Wilson**
Archaeological Investigations Northwest Inc.
1034 S.E. 122nd Avenue
Portland, OR 97233
- Phone:** (503) 252-5140
Fax: (503) 252-5405

Currently developing a landfill excavation and exhibit concept with the Oregon Museum of Science and Industry (OMSI) which will integrate past (historical) information on reuse and recycling in the Portland metropolitan area with data excavated from local area landfills. Purpose is to educate the public on landfill composition and the impacts of reuse/recycling programs in Oregon over the past four decades.

key words: archaeology, landfills, recycling

Architecture

- 11 **Leon R. Glicksman**
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The Building Technology Program at MIT is carrying out research on indoor air quality, efficient ventilation strategies, and advanced materials for building systems which minimize environmental pollution. There is a master's and PhD program in building technology. Courses include energy efficient operation. For example, they teach students to research and use efficient ventilation strategies using displacement-ventilation techniques. The result is that for the same volume of air circulated, the building inhabitant is exposed to a smaller concentration of pollutants. They also are looking at insulation which does not use CFC or CFC-derivative products.

key words: air quality; architecture; research center

- 12 **Jan F. Kreider**
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Fax: (303) 492-7317

The University of Colorado's Joint Center for Energy Management addresses the following areas: energy management; renewable energy; energy production and its environmental impacts; indoor air quality; energy system controls; and energy system simulation activities. A Gr. program is also available

key words: architecture; automobile; chemical engineering; computer modeling; energy; life cycle analysis; research center; utilities

- 13 **Patrick Lally**
Director
AIA Environmental Resource Guide
American Institute of Architects
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Washington, D.C. 20006-5292
- Phone:** (202) 626-7463

The American Institute of Architects, as major players in the design community, approved some immediate Actions in Support of the Environment in May 1991. These actions include: encouraging societal participation in incentive programs designed to reduce demand for energy; eliminating the use of CFCs; specifying woods from sustainable forests only in the design; improving fresh air ratios; including environmental costs in the economic equation of buildings; and using life cycle analysis for selecting materials, systems, and assemblies. Mr. Lally is editor of the AIA's Environmental Resource Guide, a quarterly subscription service which provides architects with the resources they need to become more environmentally sensitive. One of the primary goals of the AIA is communicating these actions to universities, as well as the public and private sectors.

key words: architecture; design; incentives; life cycle analysis; energy

Business**14 Richard Allison**

Business and Public Administration
University of Houston
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Has a technically-oriented curriculum with a focus on operation and maintenance. Technical exchange with the petrochemical industry and NASA. Roughly a third of the course material deals with P2 concepts, the remainder with management and crisis handling. Presently University of Houston offers six UG and eight Gr. courses related to P2. State and regional business/industry funding.

key words: business; management; petrochemicals

15 Craig M. Baker

EHMT Program Coordinator
Cosumnes River College
8401 Center Parkway
Sacramento, CA 95823

Phone: (603) 646-2064
E-mail: ken.baker@dartmouth.edu
Fax: (603) 646-1308

Interested in teaching and research in the area of environmental issues facing manufacturing managers. Is developing a course entitled Environmental Issues for Manufacturing Managers which will deal with topics such as regulatory compliance, design for the environment, environmental audits, and toxics use reduction

key words: air quality; business; case studies; computer modeling; energy; hazardous materials; legislation; life cycle analysis; management; modules-educational; plant design; process control; process design; product design; recycling; solid waste; waste audits; water

16 Iain Clelland

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Teaches strategic environmental management, environmental misconduct, technological change and environmental regulation, and design for the environment.

key words: business; design; legislation; management; plant design; process design; product design; social sciences

17 Mark Cohen

Owen Graduate School of Management
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Fax: (615) 343-7177

Teaches MBA courses: 1) Management of Environmental Issues, an overview of law, policy, and management response to current environmental issues; 2) Seminar in Environmental Strategy, a review of current efforts by environmental leaders to incorporate environmental issues into their strategic plans (i.e., marketing, auditing). In the survey course, includes a section on TAM with

readings and films (Pollution Prevention Pays, Second Victory at Yorktown, and others). Also includes a class on life cycle analysis, a class on what business leaders are doing, which is sometimes P2, and invites guest speakers who frequently talk about P2. Conducts research in three areas: 1) government enforcement of environmental laws; 2) Does it pay to be green? 3) Why do firms comply or over-comply?

key words: business; economics; incentives; legislation; management; marketing; policy; regulations; research center

18

Denis Collins

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University of Wisconsin-Madison
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Madison, Wisconsin 53706

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Fax: (608) 263-0477

Teaches a required MBA class on political, ethical, and legal environmental issues of business. Includes a 75 minute class session on how to prevent pollution using 50 Simple Things Your Business Can Do to Save the Earth, by The Earth Works Group, 1991.

key words: business; ethics

19

Mark Cordano

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University of Pittsburgh
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Phone: (412) 492-9417
E-mail: cordano@vms.cis.p.h.edu
Fax: (412) 648-1427

Primarily interested in environmental performance of U.S. corporations. Specific focus is on factors that influence management decisions that influence environmental performance, such as environmental attitudes of managers, corporate environmental history, corporate legal history, number of environmental professionals employed, etc.

key words: attitudes; business; case studies; management; regulations; social sciences

20

John Ettlie

School of Business Administration
University of Michigan
2266C Business Administration Building
701 Tappan St.
Ann Arbor, MI 48109-1234

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Is developing a seven week elective course for operations management majors to be tentatively offered in the fall of 1995 or winter of 1996. Developing case materials for this course (and others) with Ken Baker at Chrysler Corporation. Current research is an analysis of the IMSS (International Manufacturing Strategy Survey) data from 20 countries and 600 cases for "green" themes and their impacts. Has also been asked to serve on the AAMA (American Automotive Manufacturing Association) panel to respond to the EPA's "green sectors" initiative if auto is named as one of the sectors.

key words: business; management; technological change

- 21 **Jonathan Karpoff**
Business Administration (DJ-10)
University of Washington
Seattle, WA 98195
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Fax: (206) 685-9392

Teaches the finance and economics components of the University of Washington School of Business' Environmental Management Program. Also conducts research on natural resource regulation (especially fisheries) and its financial effects on companies that violate environmental laws.

key words: business; economics; finance
- 22 **Anil Khurana**
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621 Commonwealth
Boston, MA 02215
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Fax: (617) 353-4098

As Professor of Operations Management at Boston University, works on issues in manufacturing effectiveness, quality, and product design. Particularly interested in the role of operations managers when they deal with environmental issues, costs, and tradeoffs.

key words: business; product design; professional education
- 23 **Thomas A. Klein**
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Business Ethics & Social Policy Institute
University of Toledo
College of Business Administration
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Toledo, OH 43606-3390
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Is a specialist in macromarketing, ethics, public policy, and marketing systems. Teaches, conducts academic research, and consults in these areas as well as in marketing strategy. Environmental issues and businesses engaged in environmental matters are prominent in all of this work. The institution is primarily involved in sponsored research

key words: agriculture; book-published; business; consulting; energy; ethics; hazardous materials; management; marketing; professional education; recycling
- 24 **Alfred Marcus**
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University of Minnesota
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Incorporating P2 thinking into management courses and a technical assistance program for small and medium sized manufacturers. Has published a book (fall 1991) on environmental issues that will be used in management curricula. Has done work on safety of nuclear power plants and in the energy policy area.

key words: accounting; air quality; automobile; book published; business; case studies; consulting; economics; energy; ethics; legislation; management; petrochemicals; professional education; policy; recycling; social sciences; utilities; workshop

- 25 **Lynda Oswald**
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 University of Michigan
 5204 Business Administration Building
 701 Tappan St.
 Ann Arbor, MI 48109-1234
Phone: (313) 763-9827
E-mail: lynda.oswald@ccmail.bus.umich.edu
Fax: (313) 764-5688
- Prepared business law pollution prevention module for the National Pollution Prevention Center. Teaches environmental law elective at University of Michigan Business School. Research focuses on environmental law issues.
- key words:** business; legislation
- 26 **Keramat Poorsoltan**
 Frostburg State University
 Frostburg, MD 21532
Phone: (301) 689-4297
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Fax: (301) 689-4380
- Teaches strategic management class with a theme for each semester. Themes vary, and in summer 1993, the theme was preserving the environment. Used four cases (Harvard) that were related to pollution control and hazardous waste management. In his management seminar class, specifically assigns papers to be written about pollution control, hazardous waste management, and other environmental issues.
- key words:** business; case studies; ethics; legislation; management; policy; recycling
- 27 **Mark Sharfman**
 Division of Management
 College of Business Administration
 University of Oklahoma
 307 W. Brooks
 Norman, OK 73019-0450
Phone: (405) 325-2651
E-mail: ba0354@uokmvsba.backbone.uoknor.edu
- Is part of an inter-disciplinary research team composed of engineering, ecology, and business faculty who are studying life cycle environmentally-friendly management. They are looking at the effects technology and management practices have on the business organization. Developing interdisciplinary curriculum materials, including an environmental management course that will focus on P2, under an EPA educational grant for environmental management courses in both the engineering and business colleges.
- key words:** behavior; business; ethics; life cycle analysis; management; modules-educational; policy; social sciences
- 28 **Mike Tucker**
 School of Business
 Fairfield University
 Fairfield, CT 06430-7524
Phone: (203) 254-4800 x2833
Fax: (203) 254-4105
- As part of an UG environment minor and an elective MBA class, will be teaching a course entitled Environmental Management and Policy. This class will cover a number of P2 topics including recycling, SEC rulings on corporate liability for hazardous wastes, taxation as a financial motivator, selling pollution credits, and prevention problems at the manufacturing source. Materials used will be case studies, on-site visits to facilities such as a local composting plant, and student prepared work which may involve doing an environmental impact study. Researches contingent valuation of natural

resources to assess a dollar value for the cost of pollution. Contingent valuation is the valuation of natural resources based not only on lost use (in the event of pollution), but also lost possible (or contingent) use to both current and future generations. It has been declared admissible by US government agencies and is likely to open up a new legal area with major ramifications.

key words: business; case studies; computer modeling; contingent valuation; economics; incentives

Centers for Pollution Prevention

- 29 **Matthew Arnold**
Management Institute for Environment
and Business (MEB)
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Fax: (202) 833-6228

MEB is an independent non-profit organization that empowers future leaders to contribute to environmental progress by engaging businesses, universities, and communities in creative problem-solving. MEB has worked with over 100 universities and corporations, undertaking several environmental management education initiatives such as (i) publication of course development modules and a resource guide of abstracted materials, (ii) curriculum development assistance for faculty members building new courses and (iii) production of new case study materials on environmental issues in business.

key words: book-publishes; business; case studies; center; management; modules

- 30 **Edgar Berkey**
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The Center for Hazardous Materials Research (CHMR) and its staff serve as adjunct faculty for classes at the University of Pittsburgh. CHMR has developed and is instructing a series of one week classes which are part of a practicum for the Environmental Technician Program (ETP). ETP is a two year Associate Degree Program offered by the Community College of Allegheny County (CCAC), Pittsburgh, PA. The classes cover a broad spectrum of environmental issues and have some component of P2 in their curriculum. CHMR also conducts P2 training programs for public and private sector audiences.

key words: air quality; center; community college; consulting; environmental engineering; hazardous materials; internship; professional education; recycling; risk; solid waste; solvent substitution; training; video; waste audits; workshop

- 31 **Ron Bhada**
Waste Management Education & Research Consortium
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The Waste-management Education and Research Consortium (WERC) was created in 1990 by the U.S. Department of Energy as a Consortium of the New Mexico State University, the University of New Mexico, and the New Mexico Institute of Mining and Technology in Collaboration with Los Alamos National Laboratory and Sandia National Laboratories. Its mission is to expand resources to

address issues related to the management of all forms of waste, via education, technology development, and technology transfer. The program offers UG, Gr., and associate degree education and professional re-training in environmental management and environmental engineering. 669 students are currently enrolled. Additionally, over 2000 professionals participate in retraining programs via Interactive TV. WERC has developed over 40 innovative technologies in remediation and P2 together with government and industries; eight of these are at the demonstration/commercialization stage. WERC also administers the Carlsbad Environmental Monitoring and Research Center for the purpose of obtaining the best possible environmental data around the DOE WIPP site. An International University Design Contest conducted by WERC has participation from over 25 universities from throughout the US and Mexico.

key words: center; consulting; petrochemicals ; professional education

32 Jonathan Bulkley

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The EPA National P2 Center (NPPC) was established in 1991 to develop and disseminate P2 educational materials for colleges and universities in a variety of disciplines. The NPPC is a collaborative effort between academia, industry, government, and public interest groups. It is actively collecting educational resources from faculty nationwide, as well as developing new material. The P2 modules are composed of some of the following types of materials: introductory/background materials, readings, journal articles, close-ended problems, open-ended problems, case studies, videos, computer software, and other resources. The NPPC is currently working with faculty in the University of Michigan's Industrial Design Department, College of Engineering (chemical engineering, industrial and operations engineering, and mechanical engineering), the School of Business Administration (business law, corporate strategy, managerial accounting, and operations management) and others to develop effective educational modules which integrate P2 and core concepts of the discipline. The NPPC also administers an internship program. The Center publishes case studies, discipline-specific modules, annotated Bibliographies, a faculty P2 directory, software, and videos. A list of documents is available upon request. Funding from EPA and industry.

Dr. Bulkley also teaches, with Dr. Keoleian, a professional education course, "Design for Environment (DFE): Fundamentals for Sustainable Development" through the University of Michigan College of Engineering.

key words: accounting; business; case studies; center; chemical engineering; internship; legislation; management; mechanical engineering; modules; policy; professional education

33 Yoram Cohen

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Teaches and conducts research in multimedia transport of pollutants, multipathway exposure analysis, and evaluation of P2 strategies.

key words: chemical engineering; research center; water

34 Anthony Collins

Hazardous Waste and Toxic Substance Research
and Management Center
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The Hazardous Waste and Toxic Substance Research Center (Center) seeks to integrate the fields of environmental policy, economics, and management in developing interdisciplinary research and education programs aimed at effective hazardous waste management. Research conducted by faculty associated with the Center focuses on the following areas: multimedia-exposure assessment of hazardous waste and toxic substances; effects of hazardous materials on environmental and human health; waste treatment, remediation, and disposal technologies; and waste minimization and reduction.

key words: center; economics; hazardous materials; solvent substitution

35 David W. Conn

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Teaches Gr. and UG course through the Department of Urban Affairs and Planning on pollution control planning and policy which includes emphasis on P2. Supervises related major papers and theses. Conducts research and professional outreach in solid and hazardous waste management, with a P2 perspective since 1972. Researches communicating with the public about hazardous materials risks, and about the siting of facilities handling extremely hazardous materials, with risk reduction as a major objective. Member of the P2 Advisory Committee, Virginia Department of Environmental Quality.

key words: air quality; behavior; economics; hazardous materials; incentives; land use; legislation; life cycle analysis; marketing; policy; political science; product design; professional education; public involvement; recycling; risk; role playing; solid waste

36 Lynn A. Corson

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The Indiana P2 and Safe Materials Institute, authorized by the Indiana General Assembly in 1990, was formerly established at Purdue University in January 1994. The Institute is Indiana's focal point for P2 technical assistance, research, curriculum development and training, policy analysis, and development. Indiana's definition of P2 does not include a practice applied to an environmental waste after it has been generated or after it exists in a production process; therefore, out of loop recycling is not included. The Institute is authorized to make grants to individuals and organizations to provide P2 planning services; to engage in research, development, and demonstration of pollution prevention techniques and methods; to develop and deliver training and educational curricula to various audiences; to train and certify P2 planners; to conduct and publish studies concerning

national, state, and local government and business policies affecting P2; and to develop methods to measure P2 progress at the plant and company level.

key words: chemical engineering; civil engineering; consulting; extension; modules- educational; policy; process control; research center; training

37

Anthony Cortese

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Second Nature is a new non-profit environmental organization located in Cambridge, MA. Its main goal is to form partnerships with colleges and universities and facilitate the training of their existing faculties in ways that would help them embed environmental thinking in their curricula. Second Nature has developed partnerships with Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) consortium, and the Brazilian Consortium for Environmental Education and Research. These consortia represent 17 American universities, 4 Brazilian universities, and 7 Brazilian governmental and non-governmental organizations.

key words: center; professional education

38

John C. Crittenden

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The Center for Clean Industrial and Treatment Technologies (CenCCITT) has a mission to assist industry in P2 by devising clean enabling technologies and process design tools, and by pursuing promising leads in treatment, benefaction, and reuse where prevention is not feasible. CenCCITT actively pursues education of participating, active Gr. students and promotes the incorporation of P2 concepts in classrooms across all disciplines.

key words: center; chemical engineering; computer modeling; design; environmental engineering; laboratory; life cycle analysis; plant design; process control; process design; solid waste; solvent substitution; water

39

Cliff Davidson

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The Environmental Institute at Carnegie Mellon is an umbrella organization dedicated to promoting environmental education and research. A key effort of the Institute is the Environment Across the Curriculum Program, where many courses throughout the campus are being revised to include examples of environmental issues. In this way, all students at Carnegie Mellon have the opportunity to learn about environmental issues in the context of different disciplines. For example, each of the six engineering departments has an introductory course designed to acquaint freshmen with that particular engineering discipline: these six courses are being modified to include material on topics such as recycling, process and product design for the environment, waste minimization, and pollution control. Upper level UG courses in engineering are also being modified. Additional revisions are planned for core courses in the sciences, humanities, and other disciplines.

key words: air quality; architecture; atmospheric science; biology; chemical engineering; chemistry; civil engineering; center; computer modeling; design; economics; energy; environmental engineering; ethics; hazardous materials; laboratory; legislation; life cycle analysis; management; mechanical engineering; modules; plant design; policy; process control; process design; product design; recycling; risk; social sciences; solid waste; solvent substitution; utilities; water

40

Gary A. Davis

Director
Center for Clean Products and Clean Technologies
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The University of Tennessee organized the Center for Clean Products and Clean Technologies to focus on the earliest stages of pollution prevention: the design of products and the processes by which they are made. Design choices can sustain or prevent persistent pollution problems, among them toxic waste. This new approach involves the redesign of products and processes with the environment in mind, avoiding the need to install expensive pollution control systems or to site unwanted waste management facilities. The mission of the Center is to develop, evaluate, and promote cleaner technologies that minimize pollution at the source and contribute to long-term sustainable development. The focus of the Center's research is to evaluate products and processes for their life cycle environmental impacts, developing and demonstrating new cleaner products and processes, and assessing and formulating government and market-based measures to encourage the use of cleaner products and cleaner technologies.

key words: automobile; chemical engineering; chemistry; design; economics; energy; environmental engineering; hazardous materials; legislation; life cycle analysis; political science; process design; product design; recycling; research center; risk; solid waste; solvent substitution; water

41

L. Douglas Dobson

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Management Research Fund
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The South Carolina Hazardous Waste Management Research Fund (the Fund) was established by the South Carolina General Assembly as a component of the South Carolina Universities Research and Education Foundation in 1989. Its purpose is to stimulate research, education, and other activities that will help to reduce the amount of hazardous wastes generated, treated, stored, and disposed of in South Carolina. Drawing on faculty expertise at the University of South Carolina, Clemson, MUSC, and South Carolina State University, the Fund has established an extensive program of research directed toward both site remediation and waste reduction issues facing the state. The Fund Publishes P2SC: Pollution Prevention in South Carolina quarterly. P2SC is designed to reach South Carolina's nearly 3,000 generators of hazardous waste, many of whom are not technically trained. P2SC informs its readers about research, technologies, and strategies that will help to meet the goal of preventing pollution before it has to be treated, stored, or discarded. It also offers reviews and explanations of the laws, regulations, and policies related to waste reduction.

key words: center; hazardous materials

42 John Dresty

Pollution Prevention Research and Development Center **Phone:** (203) 486-4015
Environmental Research Institute **E-mail:** dresty@uconnvm.uconn.edu
University of Connecticut **Fax:** (203) 486-5488
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Storrs, CT 06269

The P2 Research and Development Center (PPR&DC) at the Environmental Research Institute (University of Connecticut) is involved with both basic and applied research in P2 and recycling, and Gr. and professional educational programs related to P2. PPR&DC P2 research focuses on fundamental changes in manufacturing processes to reflect P2, and more short-range, practical P2 solutions. Specific research areas include efficient and clean combustion processes/ alternative fuels, high performance polymeric coatings and plastics recycling, toxic substitutions in chemical and materials processing, alternative and non-polluting energy systems, and detinning post-consumer tin cans for improved recyclability. PPR&DC also offers a practice-oriented Gr. degree in environmental engineering. The focus of the degree program is retraining displaced engineers from defense-related activities to work as environmental engineers with a core concentration in P2. In addition, PPR&DC offers short courses in environmental technology, quickly transferring useful state-of-the-art technology to government and industry.

key words: center; environmental engineering; professional education; training; workshop

43 Harry Edwards

Director **Phone:** (303) 491-5317
Waste Minimization Assessment Center
Colorado State University
Fort Collins, CO 80523

Primary focus is on performing waste minimization assessments for small- and medium-sized businesses. Also provides training and seminars. Is currently developing a P2 course to be taught in the engineering department. EPA funded for some projects.

key words: center; mechanical engineering; professional education; waste audits

44 John R. Ehrenfeld

Center for Technology, Policy,
and Industrial Development **Phone:** (617) 253-1694
Massachusetts Institute of Technology **Fax:** (617) 253-7140
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The Center offers an UG program linking business and the environment. The curriculum emphasis is on chemicals in the environment: case studies and guest speakers are used in most courses. The program plans to (i) elucidate a new preventive environmental paradigm centered on business practices, (ii) strengthen the role of science in public decision making, and (iii) foster the learning of the P2 paradigm in students and professionals. The center also plans to interface with the public and private sectors.

key words: business; case studies; center

- 45 **Kurt Fischer**
Center for Environmental Management
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Is the US Director of the Greening of Industry Network, an international research and policy collaborative based at Tufts University and the University of Twente, The Netherlands. Begun in 1991 and guided by an international advisory board, the Network is comprised of nearly 600 individuals from 25 countries, working together to build policies and strategies toward creating a sustainable future through many vehicles. The Network stimulates public dialogue and brings together academic researchers from many disciplines with other stakeholders—business, labor, consumers, government, and others—which traditionally do not work together in coalitions. Network participation is open to all and includes interested individuals from many fields, sectors and countries who respond to the themes and issues the Network poses. Level of participation depends upon individual's interests and availability. There is no fee to participate. Has written and edited materials on greening of industry. Environmental Strategies for Industry: *International Perspectives on Research Needs and Policy Implications* (Island Press 1993) Kurt Fischer and Johan Schot, Eds.; *Greening of Industry Resource Guide and Annotated Bibliography* (Island Press forthcoming); Greening of Industry Network Publication Series with Island Press (commencing 1994); *Business Strategy and the Environment*—peer reviewed journal affiliated with Greening of Industry Network. Greening of Industry Network information is listed on the US EPA's Gopher and WAIS servers (Gopher: Futures.wic.epa.gov.us and WAIS: Wais.com.us\epafutures).

key words: book published; business; case studies; incentives; management; marketing; policy; process design; product design; professional education; research center; social sciences

- 46 **Robert L. Ford**
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The Center for Energy and Environmental Studies (CEES) facilitates the engagement of the University and surrounding communities in interdisciplinary studies and community improvement activities focusing on energy and environmental issues. A multidisciplinary team of physical, biological, computer, and social scientists; engineers; and policy professionals engage in pure and applied research at the University, national labs, and various agencies. They teach at pre-college and college level and conduct outreach activities such as conferences, Saturday pre-college educational sessions, after school computer literacy programs, and symposia. Objectives of the Center include developing and disseminating environmental and energy-related information and strategies, technology transfer, and outreach. CEES has the capability of assessing the level of public awareness of environmental issues. It focuses on P2 and environmental equity issues.

key words: air quality; energy; environmental engineering; recycling; research center; risk; waste audits; water

- 47 **John R. Froines**
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The UCLA Pollution Prevention Education and Research Center (PPEREC) is an interdisciplinary program involving faculty from the fields of chemical engineering, public health, and public policy. Faculty have collaboratively taught courses in P2 and toxics reduction, and have incorporated P2 concepts into the classes they teach individually through their respective departments. In collaborative classes, Gr. and UG students work together in cross-disciplinary teams to address the health, policy, and engineering dimensions of particular industry problems. Through these projects, and individual research, faculty are developing a body of P2 case studies, some of which will be featured in two forthcoming books. The Center has also sponsored a P2 Forum Series, open to students and the general public, which featured speakers (and attracted guests) from industry, government, academia, and public interest and community groups.

key words: books published; case studies; chemical engineering; education; legislation; life cycle analysis; policy; process design; public health; recycling; risk; solvent substitution; urban planning

48 Robert Gottlieb

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See listing for John Froines (record #47).

49 Gerald Groenewold

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The Energy and Environmental Research Center's (EERC) research programs embrace critical relationships in the energy and environment cycle. They include experimental design and analytical methods development, groundwater, carbon-based energy, advanced power systems, non-carbon-based energy, non fuel products from coal, waste utilization, education, and training. The Center's activities in the area of P2 include: a waste audit at University of North Dakota which led to increased levels of recycling on campus; working with proposals for the Greening of University of North Dakota; and working with schools in Grand Forks on environmental education for K-12.

key words: air quality; chemistry; chemical engineering; energy; environmental engineering; hazardous materials; laboratory; policy; process design; recycling; research center; soil; solid waste; water; workshops

50 David Gute

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The Tufts University Center for Environmental Management is involved with a variety of educational programs that emphasize pollution prevention topics. These include the Tufts Environmental Literacy Institute (TELI)—a faculty development workshop held twice a year, the Environmental

Management Institute (EMI)—a series of short courses emphasizing the development of technical and managerial skills, and the Environmental Professional Development (EPD) Program which targets individuals seeking further enhancement of their environmental skill set or the ability to branch into a new career trajectory.

key words: epidemiology; hazardous materials; research center; public health

51 **Ellen Harrison**

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The Center for the Environment promotes waste reduction education and research within the Cornell University by encouraging joint research and outreach proposals with non-center members. The center is active in public information dissemination and education and works with area businesses to reduce waste. The Center has developed short courses on solid waste reduction, presently including P2 concepts. Recent projects include developing a source reduction tool kit for municipalities, a Waste Prevention Tools at Work manual and video, and a Smart Shopping tool kit for educating consumers.

key words: agriculture; behavior; biotechnology; business; case studies; consulting; economics; energy; field trips; K-12; legislation life cycle analysis; policy; professional education; recycling; research center; risk; social sciences; soil; solid waste; video; waste audits; workshop

52 **Roy Hartman**

Center for Recycling and Waste Management Studies
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Offers interdisciplinary UG courses in waste management, life cycle design, and waste reduction technology. Works with area businesses in evaluating their production programs. Believes in early training in science in order to understand environmental issues. Interested in the development of environmentally friendly or substituted goods and goods manufactured from recycled materials; the challenge is developing a market for these goods through incentives. Self-generated funds.

key words: air quality; center; design; energy; incentives; life cycle analysis; product design; professional education; recycling; solid waste; waste audits; water

53 **Thomas Hauser**

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The American Institute of P2 (AIPP), consisting entirely of volunteer experts, is a non-profit organization formed to promote and achieve the adoption of the P2 ethic by catalyzing change and defining and promoting new directions that are environmentally compatible. It serves as a link between EPA, DOE, and industry by generating public and private sector support among its member organizations to aid efforts to achieve the cultural change necessary to adoption of the P2 ethic. Part of the Institute's mission is: to serve as a bridge for communication on the subject of P2, to promote

necessary institutional culture shifts, identify and foster incentives/driving forces, define and communicate the economics of P2, and influence the future directions of the field. Within the general mission, programs and projects are conducted with an overall view of communicating and advocating P2 policies, techniques and services. The AIPP is dedicated to communication and service; it is not a research organization. It generates educational and informational materials; reviews and comments on policies, programs, rules and regulations of various environmental agencies and organizations; participates in and co-sponsors educational and informational symposia and roundtables.

key words: center; civil engineering; communication; culture change; economics; incentives; policy

54 Josephine S. Hensley

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The Toxics Use Reduction Institute was established by the Massachusetts Toxics Use Reduction Act of 1989, and works in conjunction with the State Department of Environmental Protection and the State Office of Technical Assistance. It is a multidisciplinary research, education, and technical support center located at the University of Massachusetts Lowell. The Institute sponsors and conducts research on a variety of policy initiatives and on technical problems such as examining the technical feasibility of safer alternatives to solvent-based inks. The Institute offers conferences and workshops on pollution prevention, design for the environment, toxics use reduction, and other environmental topics. The Institute trains individuals who wish to become state certified Toxics Use Reduction Planners. The Institute also develops grade school and other education curricula and delivers educational programs for teachers.

key words: center; design for environment; hazardous materials; professional education; solvent substitution; workshop

55 Linda Ashman Hicks

Associate Director
UCLA Pollution Prevention Education
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See listing for John Froines (record #47).

56 Nick Houtman

Director
Office of Water Resources
University of Maine Coburn Hall
Orono, ME 04469-5715

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Fax: (207) 581-1426

Administers a water research program that funds 3-4 faculty research projects per year. Conducts conferences. At a recent conference on wastewater, identified P2 needs in conjunction with wastewater discharges at a large genetics lab. Acts as a consultant on water management planning. Administers wastewater sludge clearinghouse.

key words: center; water

57

Chris Johannsen

Environmental Sciences and Engineering Institute
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W. Lafayette, IN 47907-1158

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The Environmental Sciences and Engineering Institute provides a university-wide focus and coordination for interdisciplinary research relating to environmental and natural resource concerns. The Institute involves faculty from the schools of Engineering, Agriculture, Science, Pharmacy, Management, and other schools and departments as opportunities develop.

The objective of the Institute is to bring the intellectual and physical resources of the University to bear in solving the increasingly important scientific, technical, economic, and management problems associated with the development of our basic natural resources. The Institute provides research data and information for private and government agencies interested in development, conservation, and/or protection of these resources. The research centers currently associated with the Institute are: the Laboratory for Applications of Remote Sensing, Water Resources Research Center, Indiana Mining and Minerals Resources Research Center, State Utility Forecasting Center, and Indian Pine Natural Resources Field Station.

key words: agriculture; air quality; anthropology; biology; biotechnology; chemical engineering; civil engineering; computer modeling; computer science; environmental engineering; hazardous materials; K-12; land use; livestock; management; political science; professional education; public health; recycling; research center; social sciences; soil; solid waste; utilities; waste audits; water; workshop

58

Gregory A. Keoleian

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National Pollution Prevention Center
for Higher Education
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University of Michigan
430 E. University
Ann Arbor, MI 48109-1115

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For information about the National Pollution Prevention Center for Higher Education, see listing for Jonathan Bulkley (record # 32).

Dr. Keoleian also conducts research in life cycle design and life cycle assessment, including demonstration projects, with industry partners. Also teaches, with Dr. Bulkley, a professional education course, "Design for Environment (DFE): Fundamentals for Sustainable Development" through the University of Michigan College of Engineering.

59

John Konefes

Director, Iowa Waste Reduction Center
75 Biology Research Complex
University of Northern Iowa
Cedar Falls, IA 50614-0185

Phone: (319) 273-2079**Fax:** (319) 273-2926

Teaches small business owners about multi-media concerns. The Iowa Waste Reduction Center (IWRC) conducts waste audits for businesses with 200 employees or fewer; and manages five other programs. These programs are: the Small Business P2 Center which provides practical approaches to resolving environmental concerns; Solutions for Rural Waste Management which helps rural generators of hazardous wastes learn waste reduction and waste management techniques; Program for Toxic Air Pollutant Studies which identifies low-cost ways for small businesses to reduce toxic air emissions and met new regulatory requirements; Iowa Air Emissions Assistance Program which helps small businesses with air emissions issues; and the By-product and Waste Search Service which

helps businesses of all sizes reuse and recycle by-products and wastes. IWRC conducts workshops and other educational efforts to inform business people and the general public about environmental concerns. The Center has produced one video about itself and another about refrigerant recycling.

key words: air quality; hazardous materials; recycling; small business; solid waste; video; waste audits; water; workshop

- 60 **Michael F. Kostrzewa**
Waste Minimization Assessment Center
Department of Mechanical Engineering
Colorado State University
Fort Collins, CO 80523

Phone: (303) 491-7709
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Fax: (303) 491-1055

The Center is funded by DOE and the State of Colorado Department of Health to provide free energy conservation and P2 assessments to qualified small-to-medium sized manufacturers and businesses. UG and Gr. students, along with faculty from mechanical engineering, perform the one-day visits to the sites. They gather data and generate a confidential report outlining specific recommendations for that site. Implementation surveys are conducted 6-9 months later.

key words: case studies; energy; extension; hazardous materials; mechanical engineering; professional education; recycling; research center; solid waste; solvent substitution; utilities; waste audits; workshop

- 61 **Jack Luskin**
Toxics Use Reduction Institute
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One University Avenue
Lowell, MA 01854

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E-mail: jluskin@woods.uml.edu

See listing for Josephine S. Hensley (record # 54).

- 62 **Archie McDonnell**
Environmental Resource and Research Institute
Land and Water Research Bldg.
The Pennsylvania State University
University Park, PA 16802

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Fax: (814) 865-3378

The research and educational emphases at the Institute are on waste minimization, the bioremediation of hazardous waste, and process residue reclamation. The Institute is part of a consortium of four universities -- NJIT, Ohio State, MIT, and Penn State. The research venture of the consortium is targeted at developing substitute solvents for the pharmaceutical industry. Industry funded.

key words: air quality; biotechnology; computer modeling; environmental engineering; hazardous materials; process control; process design; product design; recycling; research center; solvent substitution

- 63 **J. Derald Morgan**
Waste Management Education & Research Consortium
New Mexico State University
P.O. Box 30001, Dept. WERC
Las Cruces, NM 88003-0001

Phone: (505) 646-2038
Fax: (505) 646-4149

See listing for Ron Bhada (record # 31).

64 Steve Ostheim

Center for Hazardous Materials Research
University of Pittsburgh
320 William Pitt Way
Pittsburgh, PA 15238

Phone: (412) 826-5320

See listing for Edgar Berkey (record # 30).

65 Michael Overcash

Pollution Prevention Research Center
North Carolina State University
Raleigh, NC 27695-7905

Phone: (919) 515-2325

Fax: (919) 515-3465

Based in the Chemical Engineering Department, Pollution Prevention Research Center is currently active in research related to P2 in petroleum refining and silicon chip manufacturing. Has in the past offered a course on industrial waste reduction. The Center itself is not involved with educational aspects of P2, but individual researchers deal with P2 in many of their classes:

key words: chemical engineering; center; consulting; economics; life cycle analysis; petrochemicals; plant design; process design; product design; workshop

66 Ronald M. Pike

National Microscale Chemistry Center
Merrimack College
Cushing Hall RM 305
North Andover, MA 01854

Phone: (508) 837-5137

E-mail: rpike@merrimack.edu

Fax: (508) 837-5017

The mission of the Center is to implement the ideas of chemical use reduction, air quality improvement, exposure limitation, recycling, and waste reduction into every worker's and every student's thinking. The program seeks to introduce the microscale concept in the educational curriculum at all levels to familiarize future generations of scientists including chemists and engineers with the techniques and equipment necessary to work with micro-quantities of chemicals, and undergo a cultural change in the way they view the use of chemicals. The Center has been established at Merrimack College in cooperation with US EPA, the Toxics Use Reduction Institute, and the National Science Foundation. Projects include training workshops for elementary, high school, college/university instructors in microscale techniques. The Center provides information, training, and visitations in second and third world countries. The Center prepares microscale laboratory experiments and textbooks for elementary school and high school level as well.

key words: air quality; book published; center; chemistry; community college; consulting; K-12; microscale; modules; professional education; recycling; solvent substitution; video; workshop

67 Susan Powers

Hazardous Waste and Toxic Substance
Research and Management Center
Rowley Laboratories
Clarkson University
Potsdam, NY 13699-5715

Phone: (315) 268-6542

E-mail: sep@craft.camp.clarkson.edu

Fax: (315) 268-7636

Teaches hazardous waste management classes which incorporate hazardous waste minimization as an integral part. Students in these classes have conducted a hazardous waste audit for Clarkson University with recommendations for minimization techniques for both the laboratories and the physical plant areas. Others have developed complete waste reduction-recycling alternatives for printed circuit board manufacture as part of the Sr. design course. The Hazardous Waste and Toxic

Substance Research Center (Center) seeks to integrate the fields of environmental policy, economics, and management in developing interdisciplinary research and education programs aimed at effective hazardous waste management.

key words: civil engineering; environmental engineering; hazardous materials; laboratory; solvent substitution; waste audits; waste reuse; water

68

Julie Roque

Co-Director
UCLA Pollution Prevention Education
and Research Center
University of California—Los Angeles
Department of Urban Planning
School of Public Policy
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See listing for John Froines (record #47).

NOTE: Julie Roque is currently on leave, until January 1995, serving as Senior Policy Analyst in the Office of Science and Technology Policy in the Executive Office of the President.

69

Susan Salterberg

Coordinator, By-product and Waste Search Service
Iowa Waste Reduction Center
University of Northern Iowa
75 Biology Research Complex
Cedar Falls, IA 50614-0185

Phone: (319) 273-2079

Fax: (319) 273-2926

The By-product and Waste Search Service actively promotes reuse and recycling of Iowa business and industry by-products and wastes. Regional representatives, located at community colleges, a council of governments office, and a solid waste agency meet with business people to identify waste streams, facilitate transfer of those materials to companies for reuse or recycling, and divert wastes from disposal sites. Since 1990, more than 500 transfers of materials have occurred. More than 46,8000 tons of materials have been diverted from disposal sites, saving businesses approximately \$856,200 in disposal costs alone.

key words: business; center; community college; recycling; solid waste; waste reuse

70

Richard Schuler

Waste Management Institute
Center for the Environment
Cornell University
Ithaca, NY 14853

Phone: (607) 255-8576

Fax: (607) 255-0238

The Center promotes waste reduction education and research within the Cornell University by encouraging joint research proposals with non-center members. The center is active in public information dissemination and education and routinely works with area businesses to reduce waste. The Center has developed short courses on solid waste reduction, and is presently expanding efforts to include P2 concepts into existing coursework. On-going projects include developing a source reduction tool kit for municipal waste for the EPA. Funded by the NY State Environment and Research Development Authority.

key words: center; consulting; solid waste

- 71 **Mono M. Singh**
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See listing for Ronald Pike (record # 66).
- 72 **Zvi Szafran**
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See listing for Ronald Pike (record # 66).
- 73 **Thomas L. Theis**
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Research and Management Center
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Fax: (315) 268-7636

See listing for Anthony Collins (record # 34).
- 74 **David L. Thomas**
Hazardous Waste Research & Information Center
Illinois Department of Energy and Natural Resources
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Champaign, IL 61820
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E-mail: davidt@hwrhc.hazard.uiuc.edu
Fax: (217) 333-8944

The Hazardous Waste Research & Information Center (HWRIC) combines research, technical assistance, and informational services to help the State of Illinois better understand and solve its hazardous waste problems. Education plays an important role in the Center's mission which includes P2 curriculum development in areas with limited exposure to the P2 concept such as business and public health schools. The Center also provides training and experience in P2 techniques at its state-of-the-art analytical and research laboratories.

key words: business; hazardous materials; professional education; public health research center;
- 75 **Janet Vail**
Waste Reduction & Management Program
Water Resources Institute
Grand Valley State University
One Campus Drive
Allendale, MI 49401
Phone: (616) 895-3749
Fax: (616) 895-3864

The Waste Reduction and Management Program is a P2 outreach program for business and industry. It sponsors conferences and workshops, facilitates business coalitions, and provides P2 information. The Program frequently works with the Michigan Office of Waste Reduction Services. The Water Resources Institute has an education program on its research vessel for water quality and it is preparing a manual on Michigan air quality regulations.

Ms. Vail also teaches an extension class in Waste Minimization for Wayne State University.

key words: air quality; hazardous materials; professional education; solid waste; water; workshop

76

Allen White

Director, Risk Analysis Group
Tellus Institute
11 Arlington St.
Boston, MA 02116-3411

Phone: (617) 266-5400**Fax:** (617) 266-8303

Oversees program in P2 economics supported by EPA, state governments, and various private corporations. Studies how a firm's capital budgeting process and project financial investment practices may be altered to encourage P2 versus end-of-pipe investments. Has developed P2 finance spreadsheet software tool for project financial analysis licensed to EPA and several state governments. Conducting nationwide survey of corporate environmental practices for EPA. Worked with American Society of Testing and Materials in developing a national standard for total cost assessment (TCA), an alternative approach to conventional financial analysis which better accounts for long-term, hidden, and less tangible benefits of P2. Also involved in developing corporate-wide indicators of environmental performance. Methods, tools, and case studies developed will be available for educational purposes.

key words: accounting; business; case studies; center; economics

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Thomas Young

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See listing for Anthony Collins (record # 34).

78

Amy Zander

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See listing for Anthony Collins (record # 34).

Chemical Engineering

79

David Allen

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Is working to include P2 concepts into a freshman level environmental literacy course. Has also completed a problem manual for engineers (sponsored by the EPA) that deals with real P2 situations. Teaches UG and Gr. engineering courses with an emphasis on P2, including a course taught jointly by engineering, public health and urban planning professors on toxics reduction. Is actively involved in promoting P2 within the university and with area businesses. Is publishing a textbook on P2 for Sr. level engineering students. Is a co-director of UCLA's P2 Education and Research Center.

key words: book published; case studies; chemical engineering; public health

80

Jesse Ausubel

The Rockefeller University
1230 York Avenue
New York, NY 10021-6399

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Fax: (212) 327-7519

The Program for the Human Environment at the Rockefeller University was established in June 1993. As part of a biomedical research institution, the program endeavors to better understand basic mechanisms influencing both global and local environmental processes that affect human welfare. The program supports selected research initiatives, hosting visiting environmental scientists, and encourages and participates in inter-disciplinary collaborations in environmental science. A main research theme of the program is industrial ecology. Industrial ecology is the study of the totality of the relationships between different industrial activities, their products, and the environment. They propose to develop a generic Gr. level curriculum in industrial ecology for engineering, and possibly business schools around the country. Their activities include research in materials flow, energy infrastructure, and environmental aspects of public health. They intend to systematize existing knowledge of P2 and waste minimization as well as uncover existing and new uses for materials previously considered waste.

key words: atmospheric science; chemical engineering; design; energy; process design; recycling; risk

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Martin Bide

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RI Center for Pollution Prevention
Chemical Engineering Dept.
Crawford Hall
Kingston, RI 02881

Phone: (401) 792-2276
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Fax: (401) 792-2581

Researches and teaches about textile wet processing, including preparation, dyeing, printing, and finishing. Teaches Sr. level courses, Dyeing and Finishing which includes P2 techniques, and Textiles and the Environment, which includes P2 techniques. In spring 1995, will teach Gr. level course, The Environmental Effects of Textile Processing. Currently has a research grant from EPA via the RI Department of Environmental Management to undertake a project for the RI textile industry.

key words: chemical engineering; consulting; process design; recycling; research center; textile.

82 **Robert M. Counce**
Dept. of Chemical Engineering
University of Tennessee
419 Dougherty Bldg.
Knoxville, TN 37996-2200

Phone: (615) 974-5318

Teaches UG course in industrial P2 that is open to Gr. students from all disciplines. The main questions addressed in the course are: what is P2?, how does it fit in?, and how do we integrate it into our thinking? Uses case studies where appropriate. Conducts P2 design and process analysis for area businesses and industries. Good exchange with and support from ORNL and Department of Energy.

key words: chemical engineering; design

83 **Michael B. Cutlip**
Department of Chemical Engineering
University of Connecticut
Box U-222
Storrs, CT 06269-3222

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Fax: (203) 486-2959

Interested in the use of numerical methods in the solution of engineering problems. Co-author of POLYMATH, which allows user-friendly interactive solution of a variety of problems involving Simultaneous Ordinary Differential Equations, Simultaneous Linear and Nonlinear Algebraic Equations, and Polynomial, Multiple Linear and Nonlinear Regressions. POLYMATH is currently in use by over 120 Chemical Engineering Departments. This software finds wide application in fundamental unit operations, reactor design, process control, process dynamics and process design calculations. It enables more realistic problems to be easily and effectively solved in engineering and scientific coursework. Most research is in chemical reaction engineering and includes catalytic and electrochemical fuel cell systems. Catalysis interests are interdisciplinary and are pursued with faculty in chemistry. Current work involves adsorption, gettering, photocatalysis, and steady state/transient catalysis over new materials which are characterized by a variety of surface science instrumentation. The fuel cell work involves very detailed modeling of fuel cell electrodes as well as the study of multi-component electrocatalyst systems and fundamental properties of electrode systems.

key words: adsorption; catalysis; chemical engineering; computer modeling; electrochemical reaction engineering; numerical analysis; process design; reaction engineering

84 **Dianne Dorland**
231 Engineering Bldg.
Dept. of Chemical Engineering
University of Minnesota, Duluth
10 University Dr.
Duluth, MN 55812

Phone: (218) 726-7126

E-mail: ddorland@ua.d.umn.edu

Fax: (218) 726-6360

Has a new program that addresses chemical engineering aspects of P2 in Jr. and Sr. level courses. Emphasizes flexibility, especially in the design component of engineering; urges students to reassess how we currently handle processes. Is developing interdisciplinary projects dealing with "green technology." Funded to conduct P2 opportunity assessments for small businesses and industry.

key words: air quality; chemical engineering; hazardous materials; legislation; process design; solvent substitution; waste audits

85

Sheldon Duff

Department of Chemical Engineering
University of British Columbia
2216 Main Mall
Vancouver, British Columbia V6T 1Z4, Canada

Phone: (604) 822-9485
E-mail: sduff@chml.ubc.ca
Fax: (604) 822-6003

Teaching Sr. UG and Gr. courses in P2 and treatment. Main focus is on design of wastewater treatment facilities, however also covers environmental impact, recycling, reuse, closed cycle operations, and industrial ecology.

key words: biology; biotechnology; case studies; chemical engineering; design; environmental engineering; water

86

Rex T. Ellington

Science and Public Policy Program
University of Oklahoma
Sarkeys Energy Center
100 E. Boyd, Rm. R208
Norman, OK 73019

Phone: (405) 325-2554
E-mail: ellinto@gsian.offsys.uoknor.edu
Fax: (405) 325-7695

Curriculum and course development for engineering and business UG, Gr., honors, and continuing education on P2 toward sustainable development with total economic, environmental, energy use, and product quality. Research on total system and total life-cycle-plus-management, including organizational effects. Total system case studies. Formed Eco-Cycle Quality Management Group which works on development of improved methods of analysis and decision making to help business people.

key words: business; center; chemical engineering; ecology; engineering; management; policy

87

Cheng-Shen Fang

Dept. of Chemical Engineering
U of Southwestern Louisiana
Box 42251
Lafayette, LA 70504

Phone: (318) 231-5350
Fax: (318) 231-6688

Teaching and research focus is in the areas of petrochemical waste treatment/minimization and P2. The bulk of the work is in end-of-pipe treatment, primarily because the region is heavily regulated by the EPA, and industry funding is concentrated in meeting its short term needs. Some state funds are available for the study of the local photochemical smog (despite low automobile densities) and atmospheric emission surveys. Also interested in CO2 recovery from coal-fired power plants.

key words: air quality; chemical engineering; management; petrochemicals; utilities

88

Jim Ferrell

Pollution Prevention Research Center
North Carolina State University
Raleigh, NC 27695-7905

Phone: (919) 515-1818
Fax: (919) 515-3465

Has offered a course on industrial waste reduction. Works with the Pollution Prevention Research Center which is based in the Chemical Engineering Department, and is currently active in research related to P2 in petroleum refining and silicon chip manufacturing. The Center itself is not involved with educational aspects of P2, but individual researchers deal with P2 in many of their classes.

key words: chemical engineering; center

89 Marvin Fleischman

Waste Minimization Assessment Center
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Louisville, KY 40292

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bitnet: m0flei01@ulkyvm

Fax: (502) 852-6355

Teaches P2, Waste Treatment, and Disposal, a non-traditional course focusing on concepts, applications, and issues, exemplified by real life examples. Emphasis is on P2 from the perspective of an industrial waste generator or plant engineer. The Center does full facility quantitative (pre-project engineering level) waste minimization assessments at manufacturing facilities using students and faculty. These assessments include a waste characterization/audit, identification of waste prevention and minimization opportunities, and a preliminary technical and economic assessment of waste minimization options. The Center also offers short courses and lectures in P2 and waste minimization. Through the Center, one course in industrial waste management and one in P2 and waste minimization are offered as part of the Chemical Engineering curriculum. These broad and diverse courses include guest speakers, field trips, and a class project at an area manufacturing facility. Has written problems and materials taken from waste minimization assessments for use in waste management courses or materials balance

key words: chemical engineering; field trips; hazardous materials; life cycle analysis; management; recycling; research center; solid waste; training; waste audits

90 William James Frederick

Head of Chemical Engineering
Gleeson 103
Oregon State University
Corvallis, OR 97331

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Fax: (503) 737-4600

Teaches a course on waste minimization and P2 to Sr./Gr. level engineering students. Introducing both these concepts into Sr. design and freshman chemical engineering courses. Conducting/directing research in industrial waste minimization in pulp and paper manufacture. Conducts waste minimization audits for local industry.

key words: chemical engineering; pulp and paper; waste audits

91 Jeanette Garr

Dept. of Chemical Engineering
Youngstown State University
Youngstown, OH 44555

Phone: (216) 742-3020

Fax: (216) 742-1567

Teaches industrial pollution control, wastewater treatment, and accident and emergency management with heightened awareness of P2. Research interests include application of artificial intelligence and neural network methodologies to process dynamics and control. Environmental policy decisions are based on a myriad of factors covering a wide range of disciplines. Is currently exploring the application of neural networks to model decision-making processes.

key words: chemical engineering; computer modeling; process control

92 Rakesh Govind

Dept. of Chemical Engineering
University of Cincinnati
697 Rhodes Hall (ML 171)
Cincinnati, OH 45221

Phone: (513) 556-2761

Fax: (513) 556-3473

Teaches concepts of waste minimization and P2 through process synthesis/optimization. Research interest is in efficiency through detailed computer analysis of plants. Dr. Govind is interested in developing P2 courses, which can only be developed through research. The funding for P2 is, however, lacking.

key words: chemical engineering; computer modeling; process design

93

William Hecker

Dept. of Chemical Engineering
Brigham Young University
350 CB
Provo, UT 84602

Phone: (801) 378-6235**Fax:** (801) 378-7799

Has developed a comprehensive UG air pollution control course in which P2 concepts are introduced. His research is in the area of catalytic converters as an end-of-pipe treatment method for NOx reduction. Primarily industry funded.

key words: air quality; automobile; chemical engineering; chemistry

94

J.R. Hopper

Department of Chemical Engineering
Lamar University
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Beaumont, TX 77710

Phone: (409) 880-8784

A simulation of the Sohio process for the production of acrylonitrile from the catalytic ammoxidation of propylene has been performed, using published kinetic and thermodynamic data to illustrate the concepts of P2 by process modification. The study has determined the reaction parameters which will minimize the production of by-products while maintaining the conversion of propylene above 80%. The reaction parameters studied were reactor type, reaction temperature, residence time, and entering feed temperature. The minimum byproducts were produced in an FBR operating at 450 degrees at a residence time of 7 seconds for a conversion of 81%. Also teaches Gr. course, waste minimization.

key words: chemical engineering; chemistry; computer modeling; consulting; energy; petrochemicals; plant design; process design

95

Kristiina Iisa

Associate Professor, Chemical Engineering
Gleeson 103
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Phone: (503) 737-2496**E-mail:** iisam@ccmail.orst.edu**Fax:** (503) 737-4600

Teaches a course on waste minimization and P2 to Sr./Gr. level engineering students. Introducing both these concepts into Sr. design and freshman chemical engineering courses. Conducting/directing research in industrial waste minimization in pulp and paper manufacture. Conducts waste minimization audits for local industry.

key words: chemical engineering; pulp and paper; waste audits

96 **Ralph Kummler**
Chemical Engineering
Wayne State University
Detroit, MI 48202

Phone: (313) 577-3800
Fax: (313) 577-3810

Has taught 300 engineers over the past two years in P2 strategies in the course, "Waste Minimization." Under contract with EPA to provide interns to small businesses in Michigan for waste reduction management. Works directly with industry to provide technical assistance. Operates with part-time faculty and uses case studies from the automobile industry. Funding from auto industry.

key words: air quality; atmospheric science; automobile; case studies; chemical engineering; chemistry; computer modeling; consulting; environmental engineering; hazardous materials; internship; professional education; training; water

97 **Gennaro J. Maffia**
Associate Professor and Chairman
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Widener University
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Teaches P2 concepts as part of a Sr. design courses and also as part of short courses outside the University. Offers a freshman seminar on P2 for engineering and non-engineering students. Has developed a few interactive models that he uses in class. These models run on the True Basic language. Periodically works on projects, contests, and proposals involving P2. Develops case studies which develop unsteady models for common/real world events.

key words: biotechnology; chemical engineering; chemistry; consulting; economics; energy; petrochemicals; process design

98 **Jeffrey Mensinger**
Dept. of Chemical Engineering
Wayne State University
Detroit, MI 48202

Phone: (313) 577-1200
Fax: (313) 961-5603

Teaches a course which provides students with understanding of the overall management requirements for conducting waste minimization/pollution prevention assessments and insights to achieve the implementation of proposed programs. Course includes case histories of successful programs.

key words: chemical engineering; economics; management

99 **James Noble**
Dept. of Chemical Engineering
Tufts University
4 Colby St.
Medford, MA 02155

Phone: (617) 628-5000 x2089
Fax: (617) 627-3991

Has developed a course, Hazardous Waste Treatment Technologies for chemical and civil engineers. The course introduces P2 concepts focusing on pollution control and waste treatment.

key words: chemical engineering; civil engineering; hazardous materials

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Vito Punzi

Dept. of Chemical Engineering
Villanova University
800 Lancaster Avenue
Villanova, PA 19085

Phone: (610) 519-4946
Fax: (610) 519-7354

Teaches a technical elective course in industrial hazardous waste handling and minimization open to chemical engineering Jr.'s and Sr.'s. Feels that engineering students must have a good background in chemistry and unit operations to understand and spot opportunities for waste reduction. Engineering decisions are driven by the bottom-line economic amelioration, and P2 may be best worked into a course from that viewpoint. Research includes treatment and recovery of heavy metals from industrial waste waters and environmental application of reverse osmosis.

key words: chemical engineering; computer modeling; economics; hazardous materials; process design; recycling; water

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Joseph Reynolds

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Phone: (718) 920-0187
Fax: (718) 796-9812

Offers a Gr. elective three unit engineering course on P2. Directed an NSF workshop in 1992-93 for college faculty that was concerned with the development of a problem workbook on P2. Co-author (with L. Theodore) of the 1992 Van Nostrand Reinhold book, Pollution Prevention. Currently preparing a tutorial of P2. Runs seminars on P2 for EPA.

key words: book published; chemical engineering; professional education

102

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Teaches a P2 course designed for Jr. and Sr. UG chemical engineering students. Personal notes as well as materials available from EPA and other government agencies are provided. One part of the course deals with pyrolysis process since this is the strength of the research team lead by Dr. C. Roy. Several articles published in scientific literature form the core of the material provided to the students. Two videotapes are available, one of which has been produced by Beyond 2000 from Australia on vacuum pyrolysis process.

key words: center; chemical engineering; chemistry; consulting; energy; hazardous materials; petrochemicals; plant design; process design; product design; recycling; soil; solid waste

103

Henry Shaw

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New Jersey Institute of Technology
University Heights
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Newark, NJ 07102

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Fax: (201) 802-1946

Responsible for teaching Gr. and UG courses in air pollution control, global environmental problems, catalysis, and plant design. Economic aspects of P2 are covered in the plant design course. Research

includes aspects of thermal destruction of hazardous wastes, incineration techniques, and the scale-up of organic reactions in multiphase aqueous systems in order to replace chlorinated solvents as an approach to P2. Directed the NJIT initiative to establish the Emissions Reduction Research Center, an NSF Industry/University Cooperative Research Center for P2 Technology with MIT, Ohio State, and Penn State.

key words: air quality; atmospheric science; center; chemical engineering; chemistry; computer modeling; energy; hazardous materials; management; nuclear engineering; petrochemicals; plant design; policy; process design; solvent substitution; utilities

104

Dilip Singh

Dept. of Chemical Engineering
Youngstown State University
Youngstown, OH 44555

Phone: (216) 742-1737**Fax:** (216) 742-1998

Teaches industrial pollution control, wastewater treatment, and accident and emergency management with heightened awareness of P2. Research interests include application of artificial intelligence and neural network methodologies to process dynamics and control. Environmental policy decisions are based on a myriad of factors covering a wide range of disciplines. Is currently exploring the application of neural networks to model decision-making processes.

key words: chemical engineering; computer modeling; process control

105

Louis Theodore

Dept. of Chemical Engineering
Manhattan College
Bronx, NY 10471

Phone: (718) 920-0185**Fax:** (212) 796-9812

Offers a Gr. engineering elective three unit engineering course, Pollution Prevention. The course devotes considerable time to the overall philosophy and the economic issues of P2. Introduces students to equipment and process calculations. Uses the textbook he co-authored. Developed a US EPA training course (including slides) titled Pollution Prevention. Directed an NSF Pollution Prevention Workshop in 1992-93 for college faculty. Has co-authored (with J. Reynolds) 1992 Van Nostrand Reinhold book, Pollution Prevention, and a tutorial entitled Pollution Prevention, with sixty problems dealing with topics from energy conservation to home issues (ETS Theodore Tutorial, Roanoke, VA, 1994). Currently working on P2 Problems and Solutions which will be ready in late 1994 (Gordon and Breach, New York, NY); and on a non-technical text keying on pollution prevention which will be ready in 1994 entitled, Fifty Major Environmental Issues Facing the 21 Century (Prentice-Hall).

key words: air quality; book published; chemical engineering; consulting; ethics; hazardous materials; professional education; risk; solid waste

106

Dean Ulrichson

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Dept. of Chemical Engineering
Iowa State University
Ames, IA 50011

Phone: (515) 294-6944**E-mail:** dlulrich@iastate.edu**Fax:** (515) 294-2689

Teaches safety, health, and environmental topics in process simulation and design. Also teaching a Sr. elective course that introduces P2 concepts in all of the above topics. Coordinating development of an environmental engineering curriculum.

key words: chemical engineering; process design; public health

- 107 **Margrit von Braun**
Dept. of Chemical Engineering
University of Idaho
6th and Urquhart
Moscow, ID 83843

Phone: (208) 885-6113
E-mail: cdixon@crow.csr.uidaho.edu
Fax: (208) 885-7462

Has built P2 concepts into chemical engineering courses entitled Advanced Plant Design and Hazardous Chemical Waste. The courses are open to Sr. and Gr. students. Has added classes in P2, environmental audits, and hazardous waste management open to Jr., Sr., and Gr. students.

key words: chemical engineering; environmental science; hazardous materials; plant design

- 108 **Gregory Yawson**
Chemical and Metallurgical Engineering
Wayne State University
Detroit, MI 48202

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Currently teaches P2 as part of a Gr. level course as well as a pre-college program. Major thrust is research in industrial and agricultural waste recycling, recovery, and reuse. Directs an EPA funded source reduction internship program for Michigan residents. Also involved in developing a two-year associate degree program related to P2. Member of UNEP/IED contact list of experts on cleaner production, and the International Association for Clean Technologies and Global Network for Low and Non-waste Technologies.

key words: agriculture; chemical engineering; hazardous materials; internship; professional education; recycling; solid waste

Chemistry

- 109 **Thomas Carrol**
Dept. of Natural Science
Keuka College
Keuka College, NY 14478

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Fax: (315) 536-5216

Introduces P2 concepts in general and organic chemistry courses and laboratories. Has reduced waste in all chemistry experiments (e.g. substituted (i) CrO₃ with bleach in the synthesis of adipic acid from cyclohexane and (ii) K₂CrO₄ with non-polluting organics in spectrophotometer demonstration of Beer's Law). Science advisor to the Westchester Environmental Coalition. The Chemistry Department is in the planning stages for an environmental bachelor's degree at Keuka College.

key words: chemistry; consulting; laboratory

- 110 **Terrence Collins**
Mellon College of Science
Carnegie Mellon University
Schenley Park
Pittsburgh, PA 15206

Phone: (412) 268-6335
E-mail: cdow@andrew.cmu.edu
Fax: (412) 268-1019

Teaches UG and Gr. courses on benign chemistry - the development of environmentally-conscious chemicals to replace preexisting toxic chemicals.

key words: chemistry

111 Gary Hickernall

Dept. of Natural Science
Keuka College
Keuka College, NY 14478

Phone: (315) 536-4411
Fax: (315) 536-5216

Introduces P2 concepts in general and organic chemistry courses and laboratories. Has reduced waste in all chemistry experiments (e.g. substituted (i) CrO_3 with bleach in the synthesis of adipic acid from cyclohexane and (ii) K_2CrO_4 with non-polluting organics in spectrophotometer demonstration of Beer's Law). Science advisor to the Westchester Environmental Coalition. The Chemistry Department is in the planning stages for an environmental bachelor's degree at Keuka College.

key words: chemistry; consulting; laboratory

112 Bruce R. Kowalski

Center for Process Analytical Chemistry
University of Washington
BG-10
Seattle, WA 98195

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Fax: (206) 543-6506

Founder and Director of the Center for Process Analytical Chemistry (CPAC), a NSF Industry/University Cooperative Research Center at the University of Washington (Seattle). CPAC's mission is to develop on-line, real-time chemical analyzer systems for process optimization and control for both increased industrial competitiveness and P2. Founded the area of chemometrics, the use of multivariate mathematics to solve chemical problems. Chemometrics is essential for analysis of the complex issues resulting from advanced chemical analysis of industrial processes or environmental contamination sites. CPAC is developing a new type of chemical sensor, a second order sensor, which requires chemometrics to analyze the data produced in response to the analyte of interest in the presence of unknown interferences. CPAC is currently involved in a project for the Westinghouse Hanford Company using spectroscopy and chemometrics to non-invasively measure the moisture content in Hanford waste tanks. Professor Kowalski has trained numerous post-doctoral and visiting scientists in the area of chemometrics.

key words: chemistry; chemometrics; computer modeling; hazardous materials; laboratory; process control; process design; professional education

113 Kent Mann

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207 Pleasant St., SE
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Has upgraded several chemistry laboratory experiments with P2 in mind. In general chemistry courses he relates the chemistry of the environment to real issues such as acid rain, ozone depletion, etc. Chemistry, as a discipline, is not a significant waste generator; however, waste reduction and P2 work in the group has been spurred recently by high disposal costs. The department commitment to P2 is strong and future plans include development of a comprehensive P2 curriculum. Uses micro-scale lab techniques. State funded.

key words: chemistry; laboratory

114 Elizabeth A. McGrath

Center for Process Analytical Chemistry
University of Washington, BG-10
Seattle, WA 98195

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Ms. McGrath is the Environmental Coordinator for the Center for Process Analytical Chemistry (CPAC), an NSF Industry/University Cooperative Research Center at the University of Washington, Seattle. CPAC's mission is to develop on-line, real-time chemical analyzer systems for process optimization and control for both increased industrial competitiveness and P2. Improved continuous real-time monitoring is necessary for regulatory compliance and implementation of P2 strategies. Guest lectures in a process analytical chemistry class for Gr. and Sr. level students on P2 concepts and the future direction of the environmental movement in order to get practical information to students so that they can make better evaluations of the work they undertake. She acts as an interface between the EPA and other environmental organizations to facilitate their involvement with CPAC. CPAC is also involved with the UW science outreach program to high schools administered in the Chemistry department.

key words: chemistry; hazardous materials; process control; wastewater

115 Mario Molina

Department of Earth Atmospheric & Planetary Sciences **Phone:** (617) 253-5081
Massachusetts Institute of Technology **Fax:** (617) 253-0354
Building 54-1312
Cambridge, MA 02139

Research and teaching focus on the chemistry of the global atmosphere and the way it can be affected by humans. Emphasizes the need to understand what is happening in order to understand how to change. Global atmospheric pollution can be prevented by stopping emissions. Laboratory work focuses on the chemistry of ozone depletion in high latitude stratosphere. One aspect of research involves investigations of elementary gas phase chemical and photochemical reactions.

key words: atmospheric science; chemistry

116 Samuel P. Sawan

Department of Chemistry **Phone:** (508) 934-3680
University of Massachusetts, Lowell **E-mail:** sawans@woods.uml.edu
One University Avenue **Fax:** (508) 943-3028
Lowell, MA 08154-2881

Studying the interaction of supercritical carbon dioxide with polymers and adhesives for applications such as cleaning or disassembly of manufactured goods. These studies are driven by the need to find replacements for CFCs for cleaning and other industrial applications. Additionally, such studies may allow for the facile disassembly and recycling of products that have been manufactured using adhesives.

key words: adhesives; atmospheric science; center; chemistry; plastics; polymers; recycling; solvent substitution; supercritical fluids

117 Alec Scranton

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Michigan State University **E-mail:** scranton@egr.msu.edu
A 202 Engineering Building **Fax:** (517) 336-1105
East Lansing, MI 48824-1226

Conducts research on the development of high-performance coatings and inks which emit no volatile organic components during cure. While most of his work in the area is focused on research rather than education, he has discussed the topic in several courses he teaches, and in public presentations on P2. The emission of volatile organic components (VOCs) from curing inks and coatings is a

leading cause of atmospheric pollution. Numerous studies have shown that when these VOCs enter the atmosphere they result in the formation of smog and air pollution. Researches use of pollution-free, high performance coatings.

key words: air quality; chemistry; solvent substitution

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T. Spiro

Chemistry Department
Princeton University
Princeton, NJ 08540

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Research interests are in mass flows and exposure to toxic chemicals (dioxin, lead, cadmium) and in chemical mechanisms of pollutant mobilization in soils. Teaching focuses on environmental chemistry (published a textbook) and chemistry for non-science students via environmental issues.

key words: air quality; book published; chemistry; hazardous materials; petrochemicals; water

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Eric M. Suuberg

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Brown University
Providence, RI 02912

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Fax: (401) 863-1157

Has conducted research in energy conversion, fire safety, nitrous oxide mitigation, automotive tire recycling, and plastics recycling. Also involved in many aspects of coal chemistry and combustion. Has taught courses on environmental aspects of energy conversion and on chemical and phase equilibria of environmental systems.

key words: chemical engineering; chemistry; energy

120

Scot Wherland

Dept. of Chemistry
Washington State University
Pullman, WA 99164

Phone: (509) 335-3360

Is working on introducing P2 ideas in a general chemistry course and laboratory experiments. Has gradually substituted toxic and heavy metals in the unknowns with non-toxic elements. Is actively looking down the P2 road for the development of strong chemistry education curricula.

key words: chemistry; laboratory

Civil and Environmental Engineering

121

Paul Anderson

Department of Environmental Engineering
Illinois Institute of Technology
3201 South State Street
Chicago, IL 60616

Phone: (312) 567-3531

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Fax: (312) 567-3548

Has developed a one semester course to expose engineering students to quantitative aspects of P2.

key words: chemistry; civil engineering; design; environmental engineering; hazardous materials; process design; training; waste audits; water

122 C. Robert Baillod

Civil and Environmental Engineering
Michigan Technological University
1400 Townsend Dr.
Houghton, MI 49931

Phone: (906) 487-2520

Education in P2 at Michigan Tech is built upon knowledge created in two ongoing efforts. The first of these is the Center for Clean Industrial and Treatment Technologies (CenCITT), a multi-million dollar Exploratory Research Center sponsored by the EPA. The second is a three year curriculum development project, Educating Engineers for the Environment (E3), sponsored by the Westinghouse Foundation and Hughes Aircraft. Fundamental information on clean technologies created in the CenCITT research program is translated into Gr. and Sr. level engineering courses. At the engineering baccalaureate level, a team of twelve faculty have developed an introductory course emphasizing clean technologies and P2 and have produced videotapes of most lectures. Current efforts are directed at developing engineering design projects for use in Sr. and Gr. level courses.

key words: clean technology; environmental engineering

123 Curtis Bryant

Dept. of Civil Engineering
University of Arizona
Tucson, AZ 85721

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Fax: (602) 621-2550

Is interested in developing interdisciplinary educational modules focusing on human attitudes and technical capabilities needed to foster P2. Believes that human behavioral implications and consumer perspective on product use and waste are key factors in planning for avoidance and substitution in P2. Worked with anthropologist Dr. Rathje on the psychology of garbage production and opportunities for reuse. Is seeking funding from federal agencies.

key words: behavior; civil engineering; modules; solid waste

124 Ed Chian

School of Civil and Environmental Engineering
Georgia Institute of Technology
Atlanta, GA 30332

Phone: (404) 894-7694

Fax: (404) 853-3177

Teaches courses in solid waste management, industrial waste treatment, sustainable development/technology, hazardous wastes management, etc. Research interest is in the areas of developing sustainable technology, P2 in metal finishing industries, solidification/stability, recycle/reuse of contaminated soils and hazardous materials, ground water remediation, etc. Also actively participating in the Center for Sustainable Development at Georgia Tech.

key words: biotechnology; chemical engineering; civil engineering; environmental engineering; hazardous materials; professional education; recycling; water

125 Mohamed Dahab

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University of Nebraska - Lincoln
W348 Nebraska Hall
Lincoln, NE 68508-0531

Phone: (402) 472-2371

E-mail: mdahab@unl.edu

Fax: (402) 472-8934

Teaches Solid Waste Engineering to Gr. and Sr. students, in which 10-15% of the material is about P2 concepts. Developing a course on P2 including the basic concept and theory, and clean manufacture and processing. Will use the electroplating industry as an example.

key words: civil engineering; environmental engineering; hazardous materials; process design; recycling; risk; solid waste; waste audits; water

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Carol Diggelman

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Milwaukee School of Engineering
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Milwaukee, WI 53201-0644

Phone: (414) 277-7320**E-mail:** diggelman@warp.msoe.edu**Fax:** (414) 277-7470

Has developed and teaches a course, Introduction to Hazardous and Solid Waste Management, from the perspective of pollution prevention. Students are required to complete an engineering term project, comparing RCRA Subtitle C Management of a waste system typical of what graduates are likely to encounter in an industrial setting with what is currently being done to reduce that waste stream based on information from the literature, practitioners, and vendors. Risks and costs of RCRA Subtitle C management are compared to those associated with pollution prevention.

key words: environmental engineering; hazardous materials; life cycle analysis; policy; recycling; risk; solid waste; solvent substitution; waste audits; water

127

Ryan Dupont

Asst. Director, Utah Water Research Laboratory
Civil and Environmental Engineering
Utah State University
UMC-8200
Logan, UT 84322-8200

Phone: (801) 797-3227**Fax:** (602) 621-2550

A Sr. elective course in P2 will be introduced in the UG program, winter 1993. Course covers P2 concepts in both industrial and private sectors, and provides a quantitative approach for decision making in terms of emissions reduction and economics through P2 fundamentals and case studies. Research focus on treatment methods using low energy, in-situ bio-treatment on soils.

key words: biotechnology; civil engineering; economics;

128

Kumar Ganesan

Dept. of Environmental Engineering
Montana Tech
Butte, MT 59701

Phone: (406) 496-4239**Fax:** (406) 496-4133

Has recently introduced P2 as an integral part of a course in air pollution control systems. Plans to organize research projects aimed at development of new technology for air pollution reduction and prevention. Offers several professional education courses related to air quality engineering, spotting P2 opportunities, and taking the necessary action to minimize pollution.

key words: air quality; civil engineering; professional education

129

Isabel Heathcote

School of Engineering
University of Guelph
Guelph, Ontario, CANADA N1G 2W1

Phone: (519) 824-4120, x 3072**E-mail:** heathcot@net2.eos.uoguelph.ca**Fax:** (519) 836-0227

Co-teaches with William James, Gr. course on pollution control planning based on Ontario legislation for P2 in surface water and non-point source P2.

key words: consulting; environmental engineering; expert systems; incentives; land use; legislation; policy; role playing; social sciences; solvent substitution; waste audits; water

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William James

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Phone: (519) 824-4120 x 2433
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Fax: (519) 767-2770

Co-teaches, with Isabel Heathcote, Gr. course on Pollution Control Planning based on Ontario legislation for P2 in surface water and non-point source P2. Works with a research group of approximately 10 Gr. students on modeling the long term impacts of surface water pollution and flows resulting from urban development. Projects include: enhancements to US EPA programs SWMM4 and HSOE; field experiments on porous pavement; stormwater BMPs like wetlands infiltration; solar thermal enrichment of receiver waters due to urban pavement; use of GIS and weather radar in computer-controlled sewage systems; and sources controls of urban runoff pollutants. Manages an electronic bulletin board called SWMM users and a quarterly newsletter called SWMM News and Notes that reaches 4,000 readers.

key words: book published; civil engineering; computer modeling; consulting; electronic bulletin board; land use; professional education; urban drainage; water; workshop

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Reid Lea

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823-Engineering Bldg.
New Orleans, LA 70148

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Fax: (504) 286-5586

Teaches a formal course in P2 plans. Course is designed to develop these plans for industry as required by state law.

key words: civil engineering; legislation

132

Joseph M. Marchello

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Norfolk, VA 23529-0241

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Fax: (804) 683-5354

Teaches Gr. courses in civil and environmental engineering, specifically in P2, air quality, solid, and hazardous waste. Teaches a course specifically on P2 and includes P2 concepts in the others. Uses case studies from various sources, for example the American Institute of Chemical Engineers, the University of Tennessee, and EPA reports. Recent projects deal with refuse-derived fuel and bioremediation, and on control of diesel engine air emissions.

key words: air quality; automobile; environmental engineering; hazardous materials; petrochemicals; process design; recycling; solid waste

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Donald Modesitt

Environmental Engineering Program
Department of Civil Engineering
University of Missouri
Rolla, MO 65401

Phone: (314) 341-4452
Fax: (314) 341-4729

Teaches an introductory environmental engineering course which teaches methods like process modification to achieve better environmental results. In a water and wastewater engineering course for Sr. and Jr. level engineering students, introduces ideas like using recycled water in industry. Areas of interest are environmental engineering education and research and consulting in the areas of water quality, waste water treatment, municipal solid waste, hazardous waste, public health, and aquaculture. Consultant to municipalities, industry, and individuals on alternative solutions. Active in professional organizations such as the National Society of Professional Engineers, Water Environment Federation, American Waterworks Association, American Academy of Environmental Engineers and the American Society of Civil Engineers.

key words: biology; chemistry; civil engineering; consulting; environmental engineering; hazardous materials; public health; recycling; solid waste; water; wastewater

134

Frederick G. Pohland

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of Environmental Engineering
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Teaches and researches environmental engineering operations and processes, industrial and hazardous waste management, and environmental impact assessment. P2 and waste minimization as well as life cycle assessment and risk management are included in many of the courses taught within the Gr. program in Environmental Engineering. A new course in P2 using industrial case studies has been introduced in Chemical Engineering.

key words: civil engineering; environmental engineering; hazardous materials; process design; professional education; solid waste; water

135

Robert B. Pojasek

Tufts University
c/o GEI Consultants
1021 Main St.
Winchester, MA 01890

Phone: (617) 721-4097
Fax: (617) 721-4073

Gr. level course on P2 currently in fifth (1994) year and offered in both Spring and Fall semesters. Creative problem-solving skills and quality improvement tools utilized to identify P2 opportunities in an industry setting. The Descriptive Approach to P2 pays particular attention to the engineering method of assessment, data analysis, feasibility study, and implementation. Students utilize their skills and tools in manufacturing firms and prepare a feasibility report in lieu of a final examination. This is an elective course in both the Hazardous Materials Management program and the Environmental Engineering M.S. Program in the Department of Civil and Environmental Engineering. The detailed course syllabus is available to anyone requesting a copy. Dr. Pojasek has a national training and consulting practice at GEI Consultants, Inc. and is past president of the American Institute for P2. He is also working with other universities to help implement P2 into curricula.

key words: accounting; air quality; behavior; book published; design; civil engineering; economics; environmental engineering; field trips; hazardous materials; incentives; legislation; life cycle analysis; management; plant design; process control; process design; product design; professional education; solid waste; waste audits; water

136 Angelos Protopapas

Dept. of Civil and Environmental Engineering
Polytechnic University
6 Metrotech Center
Brooklyn, NY 11201

Phone: (718) 260-3632
Fax: (718) 260-3136

Introduces P2 concepts in two groundwater hydrology courses. The courses emphasize contaminant transport, treatment technologies, and P2. Plans to offer an extension course on P2 open to the broader Metrotech community (an academic-industrial complex).

key words: civil engineering; water

137 Lisa Riedle

Dept. of Civil Engineering
University of Wisconsin - Platteville
1 University Plaza
Platteville, WI 53818

Phone: (608) 342-1539
Fax: (608) 342-1566

Plans to introduce source reduction and P2 from a broad perspective into the current environmental thinking within the Department of Civil Engineering. Teaches substitution and avoidance as sound environmental practice with respect to the use of many consumer products.

key words: behavior; civil engineering

138 Ken Williamson

Apperson Hall 202
Dept. of Civil Engineering
Oregon State University
Corvallis, OR 97331-2301

Phone: (503) 737-6837
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Fax: (503) 737-3052

Has worked with Sandra Woods on developing waste reduction seminars that have served as an introduction to P2 at the Gr. level. The issue of integrating P2 and other environmental problems into engineering curricula is currently being studied.

key words: environmental engineering; hazardous materials

139 Sandra Woods

Apperson Hall
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Oregon State University
Corvallis, OR 97331

Phone: (503) 737-6837
Fax: (503) 737-3099

Has worked with Dr. Ken Williamson on developing Waste Reduction seminars that have served as an introduction to P2 at the Gr. level. The issue of integrating P2 and other environmental problems into engineering curricula is currently being studied.

key words: civil engineering

Design

- 140 **H. Randolph Holt**
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Since decisions made during the design process can drastically affect a product's environmental impact, he has been looking at ways to augment design methodology and subsequently minimize this impact. Efforts have centered on electronic design, but they could be applied to other designs as well. Rather than develop a separate course, he has integrated the concepts into standard course offerings.

key words: design; design for environment; electrical engineering; electronic design

- 141 **Kenneth Hunnibell**
Industrial Design Department
Rhode Island School of Design
2 College St.
Providence, RI 02903-2784

Phone: (401) 454-6160
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Has been teaching in the industrial design department since 1963. Teaches a course which examines the content and causes of today's ecological problems and formulates ethical responsibility both as citizens/consumers and designers/artists. Uses field trips, guest lecturers, field research, and discussions to include environmental impacts in developing design and artistic processes. Also teaches electives and studios which emphasize this ethic.

key words: design; product design; professional education

- 142 **Yuriko Saito**
Philosophy Department
Rhode Island School of Design
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Providence, RI 02903-2784

Phone: (401) 454-6578
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Teaches courses, including electives and studios, which examine the content and causes of today's ecological problems and formulates ethical responsibility both as citizens/consumers and designers/artists. Uses field trips, guest lecturers, field research, and discussions to address environmental issues in developing design and artistic processes.

key words: design; product design; professional education

Economics

- 143 **George Criner**
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University of Maine
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Fax: (207)-581-4278

Offers courses (with field trips) from Sophomore to Gr. levels in waste reduction. Main areas of interest are in the land application of waste materials and the variation of waste with seasons. Would like to see a course in composting in the near future. Partial funding from an NSF grant.

key words: economics

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Faye Duchin

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New York University
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As Vice President of Education of the International Society for Ecological Economics, developed a curriculum in Ecological and Development Economics which studies the interrelations of population, consumption, and technological change, and how, looking at these interactions, economic change and benefit can come about with the least damage to the environment. She is currently working with the United Nations University (Tokyo) to develop a few training courses, to be offered in several Asian countries, based on this curriculum. The curriculum covers changes in the size and composition of the population, social and economic change (including consumption), and technological change. The Institute for Economic Analysis has also developed a two-week training program in the construction and use of ecological/economic models to evaluate concrete, sector-level strategies for economic development. Changes in land, water, and air use and pollution will be examined. This course will be offered for the first time in Indonesia in July 1994. Supervised an investigation for the Earth Summit in Rio de Janeiro of strategies for environmentally sound economic development. Has done similar work in Indonesia and other developing countries and has carried out many studies of technological change in the US economy. Currently, has been examining ways in which plastics are used and the prospects for recycling them.

key words: accounting; case studies; computer modeling; economics; energy; input-output model; recycling; social sciences; sustainable development; technological change

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Is involved with the Miami University Sustainability Project which includes faculty from the Depts. of Economics, Marketing, Finance, Management, Geology, Zoology, and Geography. They have a three-year grant and are developing case studies. Also a member of the International Environmental Ethics Task Force for the Council on Ethics in Economics. Project involves developing a Sr. level capstone course in sustainability along with written materials. The latter include an anthology of readings on sustainability, research articles, and our major effort - book on sustainability that includes six introductory chapters on the History of Sustainability, Macro and Micro Issues in Measurement, Ethics, Policy, and Business-Science Synthesis, along with twelve case studies that are currently underway, looking at successful sustainable initiatives by business. The monograph will be finished in 1995. Several of the cases deal with Pollution Prevention.

key words: business; case studies; economics; ethics; incentives; policy; social sciences

146

Lester Lave

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Conducts research on "product and process design for the environment" or green design. Individual projects include software tools for environmentally conscious product design, examination of life cycle analysis, municipal solid waste recycling and disposal, and social evaluation of product packaging. Teaches courses which include material on tradable pollution permits, understanding regulatory strategies, and environmental policy.

key words: economics; green design; life cycle analysis; product design; recycling

Engineering

- 147 **Hadi Dowlatabadi**
Engineering and Public Policy
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Research interests revolve around environmental impacts of energy use. Research in the electric utility arena has spanned issues from urban air pollution to acid rain to climate change. Has also studied emissions from mobile sources exploring tropospheric air pollution in the U.S. A common theme throughout this research is decision-making under scientific, technical, economic, environmental, and regulatory uncertainty.

key words: air quality; atmospheric science; automobile; computer modeling; economics; energy; engineering; life cycle analysis; policy; risk; utilities

- 148 **William H. Glaze**
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Several courses are offered in Gr. and PhD. degree programs that include aspects of P2. These include: Management of Hazardous Waste, Air Pollution Control, and Current Applications in Environmental Management.

key words: air quality; atmospheric science; biotechnology; chemistry; computer modeling; economics; engineering; environmental engineering; management; risk; water

- 149 **Christopher Hendrickson**
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Conducts research on "product and process design for the environment," or "Green Design." Individual projects include: creating software tools for environmentally-conscious product design, examination of life cycle analysis, and municipal solid waste recycling and disposal.

key words: engineering; policy; product design; recycling

150 Edward Klevans

Nuclear Engineering
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Teaches a Sr. and Gr. level course on radioactive waste management. Areas of interest include liquid metal reactor design, thermal hydraulic safety, plant life extension, and fuel management. Plans to include waste minimization concepts into the neutronics and design area.

key words: nuclear engineering; plant design; utilities

151 Fran McMichael

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Director of Carnegie Mellon's Center for Solid Waste Management. Teaching and research focus on solid waste management, particularly battery recycling and waste management.

key words: engineering; policy; recycling; solid waste; waste management

152 Indira Nair

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Teaches project courses for UGs. Recent courses have focused on green automobile design, component labeling for recycling/reuse, and design for waste avoidance.

key words: engineering; policy; product design; recycling

153 Dundee Navin Chandra

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Currently developing product disassembly guideline software to aid in product design for the environment. Co-teaches UG project courses which in recent years have included product pollution prevention projects.

key words: engineering; product design

154 Edward S. Rubin

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Pittsburgh, PA 15213

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Is the Alumni Professor of Environmental Engineering and Science at Carnegie Mellon University. He holds joint appointments in the departments of Engineering and Public Policy and Mechanical Engineering, and is also Director of CMU's Center for Energy and Environmental Studies. Teaching and research are in the areas of environmental control, energy utilization and technology-policy interactions.

key words: air quality; chemical engineering; computer modeling; design; economic modeling; economics; energy systems; engineering; green design; life cycle analysis; mechanical engineering; plant design; policy; process design; research center; risk; solid waste; systems modeling; utilities

155

K.B. Rundman

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Michigan Technological University
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Houghton, MI 49931

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Focuses on material flow in an industrial society. Is developing a new Sr.- Gr. level course on material and energy flow in an industrial society, and has co-developed a sophomore level course, Engineering for the Environment. Is also incorporating P2 concepts (focusing on recycling, air quality, and solid waste problems in the foundry industry) in a course on cast metals, a Sr. level hands-on experience

key words: engineering; life cycle analysis; materials engineering; process design; product design; recycling; waste audits

156

Wayne E. Woldt

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Lincoln, NE 68583-0726

Phone: (402) 472-8656**E-mail:** bsen010@unlvm.unl.edu**Fax:** (402) 472-6338

Conducts research and technology transfer on topics that address the issues of environmental contamination and the management of solid and hazardous waste. Specific areas of research include: P2 for industrial/commercial generators, integrated solid waste management systems, detection and mapping of subsurface contamination, risk assessment and management, use of geoelectrical data to define site hydrogeology, consideration of imprecision and subjective judgments using fuzzy set theory, and multidimensional mapping of environmental phenomena using geostatistical techniques.

key words: civil engineering; computer modeling; engineering; environmental engineering; extension; hazardous materials; life cycle analysis; modules; professional education; risk; solid waste; training; waste audits

Environmental Studies and Liberal Arts

157

Terence Ball

Social Sciences
University of Minnesota
Minneapolis, MN 55455

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Teaches a course dealing with P2 ethics. This project-oriented course encourages paying attention to and critically examining the consequences of our actions on the environment. Students are required to submit a written report or a project video tape for the course.

key words: behavior; ethics; political science; social sciences

158 Lisa Bardwell

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University of Michigan
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Ann Arbor, MI 48109-1115

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Teaches an environmental studies course that builds a series of pollution prevention discussion sections and assignments around a life cycle assessment lecture. The notion of cradle to grave thinking is incorporated broadly throughout the class, ranging from more traditional industrial production to thinking about costs of getting orange juice or apple juice into one's stomach. Also helping to develop a curriculum for a university environmental audit service-type course.

key words: behavior; life cycle analysis; waste audit

159 John E. Carroll

Dept. of Natural Resources
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University of New Hampshire
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Teaches both Gr. and UG courses on international environmental ethics and values as applied to pollution, environment, toxics, natural resources, agriculture, and energy; the application of ecological thought to pollution control; and the role of religious/spiritual values in pollution control.

key words: book published; ethics; geography; social sciences

160 Noellette Conway-Schempf

Green Design Initiative
GSIA 224
Carnegie-Mellon University
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Pittsburgh, PA 15206

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Directs Carnegie Mellon University's Green Design Initiative, a program to develop environmentally-conscious products and processes. The initiative involves i) research aimed at providing industry with P2 tools and technologies, and ii) educational programs aimed at instilling an environmental awareness among university graduates, regardless of major, by incorporating environmental modules and case studies into required core courses.

key words: design; life cycle analysis; management; product design

161 Nancy Coppola

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New Jersey Institute of Technology
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Fax: (201) 565-0586

Member of a faculty team developing a P2 curriculum initiative under a grant from EPA to research, write, and implement a multi-disciplinary textbook across a technical curriculum. The team's book, Pollution Prevention from a Humanities and Social Science Perspective, is a task oriented casebook that examines P2 from a philosophical, ethical, aesthetic, social, cultural, political, and economic perspective. Currently refining this work for eventual distribution outside NJIT.

key words: modules

162

David Eagan

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In Fall 1991, Fall 1992, Fall 1993, and Spring 1994, the capstone seminar for Sr.'s in the Environmental Studies Certification Program has focused on environmental issues affecting the University of Wisconsin-Madison. Students working individually and in teams design research projects on some aspect of the University's use of resources, environmental impact, or natural history. Projects are done in collaboration with staff and administration clients who work with students to ensure that projects will directly benefit the University of Wisconsin. Lately projects have been more action-oriented. Copies of all student reports are on reserve in the Environmental Studies Library and are available as a resource for the entire campus. Some of the projects have helped to contribute to waste reduction and P2. In Spring 1994 for example student projects led to i) a switch to recycled paper in self serve copiers in a campus library, and ii) the establishment of an on-line system to redistribute surplus laboratory chemicals. Co-edited The Campus and Environmental Responsibility with David Orr, a book of case studies on campus-based environmental initiatives.

key words: case studies; recycling; waste audits

163

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U of Minnesota
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Teaches course entitled, The Introduction to the Designed Environment, (200 students/year) which focuses on the interaction of the human with the social, natural, and designed environments. The roles of professional designers and consumers of design are investigated as they affect decisions relating to daily life, P2, and life cycle analysis. Consequences of these decisions are explored in relation to the human ecosystem. P2 is further explored via field trips to landfills and recycling centers as well as through student research papers.

key words: behavior; design; field trips; life cycle analysis

164

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Teaches UG courses on environmental issues, global change and Mexico, emphasizing social causes and consequences of problems such as drought, deforestation, and pollution. Researches human dimensions of global environmental change and environmental issues in Mexico. Grants from NSF, NASA, EPA, Greenpeace. Member of NASA and NOAA committees on global change.

key words: atmospheric science; geography; policy; social sciences; water

165

Todd MacFadden

Cooperative Extension Service
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Bozeman, MT 59717

Phone: (406) 994-3451

E-mail: acxtm@trex.oscs.montana.edu

Is designing a semester-length introduction to pollution prevention course for Native Americans to be taught at a local community college. Interested in integrating concepts from Native American culture with pollution prevention themes.

key words: community college; culture change; extension; social sciences

166 Marilyn Raphael

Geography Department, Bunche Hall
University of California-Los Angeles
405 Hilgard
Los Angeles, CA 90024

Phone: (310) 206-4590

Teaches a freshman course, Relationship With the Environment, that addresses questions such as why pollution exists and how climatic conditions can escalate the effects of pollutants locally. Also teaches Environmental Impact Analysis, a hands-on experimental course in which students complete a P2 related group project. Both of the courses are offered twice a year and class enrollment usually exceeds 50 students. Research interests include global climate and how it may be affected by low level greenhouse gases. May seek government funding for future projects.

key words: air quality; atmospheric science; geography; social sciences

167 James N. Seiber

Sierra Pacific Professor
of Environmental Science and Engineering
University of Nevada- Reno
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Gr. curricula are offered in atmospheric sciences, ecology/ evolution/conservation biology, environmental engineering, hydrology/hydrogeology, environmental science and health. Included is coursework/research dealing with pollution in air/water/soil/biota, and the prevention and remediation of pollution.

key words: agriculture; air quality; atmospheric science; center; chemistry; environmental engineering; hazardous materials; risk; water

168 Joel Tarr

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Teaches courses which center on critical issues in American environmental history. Courses involve discussions of urban and industrial metabolism over time and how wastes were generated and then disposed of. Discusses technological and policy options and evolution of pollution control legislation.

key words: pollution history; social sciences

169 Becky Yust

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St. Paul, MN 55108

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Fax: (612) 624-2750

Teaches course entitled Introduction to the Designed Environment, (200 students/year) which focuses on the interaction of the human with the social, natural, and designed environments. The roles of professional designers and consumers of design are investigated as they affect decisions relating to daily life, P2, and life cycle analysis. Consequences of these decisions are explored in relation to the human ecosystem. P2 is further explored via field trips to landfills and recycling centers as well as through student research papers.

key words: behavior; design; field trips; life cycle analysis

General Pollution Prevention

170 William Budd

Program in Environmental Sciences and
Regional Planning
Washington State University
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Has developed an introductory P2 course and an advanced course in environmental auditing. These courses are exclusively devoted to P2. P2 is also incorporated into courses in hazardous waste management and environmental engineering. The curricula are being supported by funds from EPA and the Washington State Department of Ecology.

key words: environmental engineering; hazardous materials; waste audits

171 Steven Hamburg

Environmental Ombudsman's Office
University of Kansas
Haworth Hall
Lawrence, KS 66045-2106

Phone: (913) 864-3208

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The Environmental Ombudsman's Office develops programs and policies to reduce the environmental impacts of the UK. The Office does not limit its activities to any one resource or impact. Past work has dealt with energy efficiency, P2, water conservation, paper use, recycling, and other issues. P2 work includes chemistry lab waste, paint solvents, pesticides, cleaning products, and ozone depleting compounds. The office prepares brief position papers and summaries for each project. A seminar, Issues in Resource Conservation has been offered in the past in which students work on projects which improve operations at the University. University of Kansas also has an Environmental Studies Program (phone: 913-864-4169).

key words: design; energy; land use; policy; recycling; solid waste; waste audits; water

Industrial Ecology

172

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130 Biotechnology Building
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Teaching emphasis in P2 includes use of biotechnology and biophysical processes to interface with environmental problems.

key words: agriculture; biology; biotechnology; center; chemical engineering; chemistry; energy; hazardous materials; K-12; laboratory; modules-educational; soil; solid waste; water

173 Valerie Thomas

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Works with students to try to determine what materials are used and how in the entire industrial system. Studies problems caused by these materials and looks for opportunities for P2. Work focuses on industrial ecology of cadmium, lead, and dioxin, mostly at the regional, national, or global scale. Special emphasis is on the use of exposure assessment in industrial ecology, and on the technical factors contributing to the continuing international use of leaded gasoline.

key words: book published; research center

Law

174 Elizabeth Geltman

National Law Center
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Currently teaches: Survey of Environmental Law and Policy, Environmental Issues in Business Transactions, and Clinical Studies in Environmental Law. These are three of 22 courses taught in the George Washington University National Law Center Environmental Law and Policy Program. The orientation of each is P2. Various courses look at role of lawyer as counselor and teach, for example, how to structure transactions to have a better environmental impact; deal with how to permit a facility and identify hazardous waste issues; look at policy aspects like the trend for EPA to merge compliance and enforcement; and look at life cycle analysis.

key words: book published; business, consulting; hazardous materials; land use; legislation

175 James P. Karp

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Crouse-Hinds School of Management Suite 400
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Syracuse, NY 13244-2130

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Teaches and researches in the areas of land use regulation, environmental law, and sustainable development. One segment of the sustainable development course is on P2. In the environmental law course, students study statutes which address P2 such as NEPA, RCRA, Toxics Substances Control Act.

key words: business; land use; legislation; management; professional education

176 Nancy Kubasek

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Bowling Green State University
Bowling Green, OH 43403-0265

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Currently teaches an UG course in Environmental Law and has just developed a Gr. course entitled Environmental Law for Managers. Both courses include material on P2, especially the latter course. In August 1993, published Environmental Law, a textbook for non-law students that incorporates material on P2.

key words: book published; business; legislation; professional education

- 177 **Maxine Lipeles**
Engineering and Policy
Washington University
1 Brookings Dr.
St. Louis, MO 63130

Phone: (314) 935-5455
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Teaches Sr. and Gr. level courses in environmental law. Covers the five primary environmental laws and their application and interpretation with respect to waste minimization and P2. Students are asked to write a paper on selected environmental issues from a legal standpoint. The benefits of P2 will be targeted.

key words: legislation; policy

- 178 **Richard Ottinger**
Center for Environmental Legal Studies
Pace University Law School
White Plains, NY 10603

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Directs the Energy Project, which seeks to have electric and gas utilities invest in energy conservation and renewable resource derived power. Teaches a utility reform course educating lawyers in advocacy of the above. Published a study valuing societal costs of pollution from power plants, and advocates the use of these values in utility resource selection and pollution taxes.

key words: economics; energy; incentives; legislation; utilities

Management

- 179 **Rogene Buchholz**
Legendre Soule Professor of Business Ethics
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Has been teaching a course for five years entitled Environmental Issues for Management at the M.B.A. level in the College of Business Administration. Teaches a similar course at the UG level as part of an Environmental Studies minor. Co-authored a book entitled Managing Environmental Issues: A Casebook; Sole author of Principles of Environmental Management: The Greening of Business, both are published by Prentice Hall.

key words: book published; business; case studies; ethics; legislation; management; modules; policy; professional education

180

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Naugatuck Valley Community-Technical College
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Offers an associate degree and certification program in environmental management of the industrial sector. Courses include: regulations, hazardous materials, waste management, soil resources, environmental chemistry, industrial safety, waste minimization, control processes, and environmental management.

key words: air quality; community college; management; policy; recycling; water

181

Andrew King

Management and Operations Management
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Teaches courses in business and the environment, organizational theory, technological innovation, and operations management. Researches organizational adaptation in response to new external environmental demands; technological and organizational determinants of learning, innovation, and cooperation; organizational and technological evolution; governance structures for cooperation and innovation; mathematical models of organizational behavior. Also interested in sustainable enterprise, use and diffusion of environmental technology, and strategic responses to environmental regulation- particularly in plastic packaging.

key words: behavior; business; economics; management; process control; process design; recycling; social sciences; water

182

James E. Post

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Teaches environmental management, including topics such as organizational change processes, measurement, public accountability, ethical and legal issues, and community relations.

key words: book published; business; case studies; ethics; legislation; management; policy; professional education; social sciences

183

Gordon Rands

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Fax: (814) 863-7261

Incorporating P2 thinking in management courses, which is a move away from the pollution control thinking that predominates in most businesses. Feels that most management students lack physical sciences background to understand and evaluate P2 solutions. Research interests in P2 focus on managerial implications of implementing P2: the role of organizational culture and leadership.

human resources management for P2, identifying and overcoming sources of internal resistance to P2, etc. Member of two networks of management scholars focused on environmental issues (The Greening of Industry Network Organizations and the Natural Environment Interest Group of the Academy of Management [email: one-l@clvm.clarkson.edu]). Have published a book (fall 1991) on environmental issues that will be used in management curricula. Has published a book (fall 1991) on environmental issues to be used in management curricula.

key words: behavior; business; economics; ethics; management; policy

184

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Teaches an integrative Environmental Management course to business school audiences at the UG, Gr., and executive MBA levels at the University of Virginia and abroad. Speaks fluent German and recently returned from a year-long sabbatical examining corporate environmental practices in Germany. Current research interests include green investing, environmental auditing, German-American comparative waste disposal practices and general environmental management topics related to teaching responsibilities. Holds advanced degrees in both ecology and Business Administration.

key words: accounting; business; economics; finance; incentives; investments; life cycle analysis; management; marketing; professional education

Mechanical Engineering

185

Barney L. Capehart

Industrial and Systems Engineering
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Through the University of Florida Energy Analysis and Diagnostic Center, performs industrial assessments in order to reduce energy costs and to reduce industrial waste generation. Teaches a course each year on Energy Management. Director of the University of Florida Interest Network. Author of textbook, *Guide to Energy Management*, Fairmont Press, Atlanta, GA 1994

key words: computer modeling; consulting; energy; mechanical engineering; professional education; utilities; waste audits

186

Shirley Fleischmann

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The School of Engineering at Grand Valley State University has just completed a two year curriculum development project in which they have developed and classroom tested student design projects and problems through which students learn to incorporate environmental issues from the first stages of a design project. They have embedded an environmental theme into the entire curriculum for all engineering students in their program. Curriculum resources have been developed for freshmen - introduction to design classes, material sciences, ethics, thermodynamics, manufacturing

processes, and heat transfer as well as Sr. projects. A notebook of these materials, "Teaching Environmentally Responsible Design," is available upon request. The School of Engineering also manages a "Padnos Design Competition" for environmentally responsible student design projects.

key words: air quality; case studies; curriculum; design; energy; environmental engineering; ethics; laboratory; legislation; mechanical engineering; modules; process design; product design; recycling; solid waste

187 Mahendra S. Hundal

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University of Vermont
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Teaches about design for the environment in his design course. Current research focuses on how to design products for lower pollution. Has written a paper on design for environment.

key words: design for environment; manufacturing; mechanical engineering; product design

188 J.K. Spelt

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University of Toronto
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Teaches a half-year course entitled Environmental Engineering, which is a required core course for all Sr. Mechanical Engineering students. A large part of the course deals with the concepts of P2 engineering, although the students are also introduced to other topics such as applied ecology, regulatory theory, the causes of environmental disturbances, pollution control, and various aspects of energy conservation.

key words: mechanical engineering

Microbiology

189

Charles Kulpa

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Teaches a Gr. environmental science course. Instrumental in a P2 project—removal of sulfur from petroleum products by bio-treatment of crude oil. Funded by the US Army and industry. Looking at gene transfer.

key words: biology; biotechnology; microbiology; petrochemicals

Policy

- 190 Richard Andrews**
Dept. of Environmental Sciences & Engineering
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Chapel Hill, NC 27599-7400
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E-mail: pete_andrews@unc.edu
Fax: (919) 966-7911
- Teaching and research focus on public policy incentives about and against pollution. Compares U.S. federal government with state, local and international (mainly European) policies. Currently chairing advisory committee for the U.S. Congress Office of Technology Assessment on Rethinking Environmental Regulation and steering them toward P2 incentives. Chaired National Research Council workshop on waste reduction research needs in social sciences. Wrote a recent article on P2 issues in EPA Journal. Also currently writing a book on the history of environmental policy.
- key words:** incentives; legislation; policy; professional education; public health
- 191 Nicholas Ashford**
Center for Technology, Policy,
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- Teaches a two semester course in environmental law and policy. The first semester addresses air, water, and hazardous waste legislation; economic incentives; and P2. The second semester teaches risk assessment and the regulation of pesticides, pharmaceuticals, food additives, OSHA, TSCA, radiation, and biotechnology; compensation systems for chemical or radiation injury; and technology-based strategies (P2) as alternatives to risk-based legislation. The materials are law cases, law review articles, and articles from scientific and engineering journals. The material is being prepared for a comprehensive, technology-focused textbook on environmental law and policy.
- key words:** biotechnology; book published; legislation; policy; public health; regulations; risk
- 192 Kathleen Bawn**
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- Teaches a course on the development of national environmental policies, emphasizing the ways political institutions influence the choice and administration of environmental regulation. P2 and incentives for implementation of P2 methods will figure prominently in the normative evaluation of environmental policy and of alternative policies.
- key words:** incentives; legislation; policy; political science; social sciences
- 193 Robert A. Frosch**
J.F. Kennedy School of Government
Center for Science and International Affairs
Harvard University
79 J.F. Kennedy Street
Cambridge, MA 02138
Phone: (617) 495-8132
E-mail: frosch@ksgbbs.harvard.edu
Fax: (617) 495-8963

Teaches course with Professor William C. Clark entitled Environment and Public Policy, which builds on ideas from industrial ecology. Students are Kennedy School Gr. students and Jr.s at the UG level. Even with P2 there will continue to be process waste, and waste from products at end-of-life. Researches industrial ecology, in particular, looking at barriers to reuse of materials which appear to be similar to or the same as materials used as manufacturing feed stock. Looks at how these barriers might be reduced by public policy interventions such as regulations, liabilities, or information systems. Examining industrial views and published materials. To begin with, research is concentrating on metals.

key words: behavior; economics; hazardous materials; incentives; legislation; life cycle analysis; management; policy; product design; recycling; solid waste

194 Steve Galitzer

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Ward Hall
Kansas State University
Manhattan, KS 66506-2501

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Fax: (913) 552-6952

Actively promotes P2 and waste minimization programs through the classroom; satellite TV productions of industrial P2 programs (i.e. mining waste), newsletters, etc. Strong proponent of the incentive-based P2 programs for industry to reduce the number of waste streams, improve worker health & safety, and get off the EPA fee system. Is also studying the possibility of augmenting revenue sources for the EPA (regulatory fees, etc.) and expanding P2 programs. Would like to see a bibliography of all the work at the five EPA centers to, among other things, improve communication between the centers.

key words: air quality; consulting; hazardous materials; incentives; policy; public health; professional education; video

195 Tom Payette

Henry Ford Community College
5101 Evergreen
Dearborn, MI 48128

Phone: (313) 845-6398

Has taught sections of the introductory course in American Government and Politics since 1968. Emphasis has always been on encouraging and helping students to participate competently in the democratic policy-making process. Since environmental and energy issues have moved into an increasingly important position in the public policy agenda, devotes the last third of course to basic natural and physical science principles which are essential to environmental literacy. Philosophy is to teach concepts and principles necessary to improve students' grasp of issue before it is decided and reduce emphasis on institutional details of the policy-making process.

key words: community college; energy; policy; political science; recycling; social sciences

196 Robert Stone

Building E40-242
Massachusetts Institute of Technology
1 Amherst Street
Cambridge, MA 02139

Phone: (617) 253-8621
Fax: (617) 253-7140

Research interests are inherent safety, policies to promote recycling by increasing the demand for secondary materials, and the design of policies to stimulate innovations in P2.

key words: economics; incentives; legislation; policy; recycling

Professional Education**197 John Atkinson**

College of Engineering - UMC
Engineering Extension
W1000 Engineering Building East
Columbia, MO 65211

Phone: (314) 882-8880 or
(800) 776-1044

E-mail: atkinj2@rpi.edu.internet

Fax: (314) 882-7584

Teaches a two day course, Pollution Prevention - Compliance, Planning, and Profiting. It is a seminar/lecture and workshop. Provides a method of implementing a proactive P2 program stressing human, business, and financial solutions to organizational and cultural barriers.

key words: business; environmental engineering; extension; professional education

198 Kristine Benson

Deputy Director
Alaska Health Project
Waste Reduction Assistance Program
1818 West Northern Sights, Suite 103
Anchorage, AK 99517

Phone: (907) 276-2864

Fax: (907) 279-3089

Teaches waste reduction and P2 concepts, regulations, health and safety, and waste disposal in Sr. level environmental health course. The course is open to all disciplines. The course materials are available nationally. Uses audio-visuals. Has developed several manuals to assist and educate local businesses and industry on waste management and planning for the future. Funded by various in-state agencies.

key words: modules; professional education; public health

199 Clari Binder

Environmental Health Services
University of California--Santa Barbara
120 Cremona Drive, #C
Goleta, CA 93117-3075

Phone: (805) 681-5200

Fax: (805) 681-5370

Trains employees to become registered environmental health specialists. These specialists are qualified to be environmental enforcement inspectors. Uses site visits and videos to demonstrate the complexity of waste inspection and P2.

key words: professional education; video; waste audit

200 Richard Bright

Education and Training
Clark Atlanta University
Atlanta, GA 30314

Phone: (404) 880-8515

Fax: (404) 880-8522

Director of a K-12 teacher training program which focuses on P2 and environmental science concepts. The program emphasizes science education for K-12 educators to better prepare students for college and P2 issues. Field trips are part of the curriculum. CEPER and Dept. of Energy funded.

key words: field trips; K-12; professional education

- 201 Patrick D. Eagan**
Engineering Professional Development
University of Wisconsin
432 North Lake Street
Madison, WI 53706
Phone: (608) 263-7429
E-mail: eagan@engr.wisc.edu
Fax: (608) 263-3160
- Teaches design for the environment, industrial ecology, and remediation courses to professionals nationally. Life cycle analysis, which is a tracking method used to evaluate the environmental impact of any item, is emphasized. State funding.
- key words:** accounting; design; design for environment; life cycle analysis; product design; professional education
- 202 Cheri Eir**
Toxics Program
University of California--Berkeley
2180 Milvia St., Suite 308
Berkeley, CA 94704
Phone: (510) 644-7719
Fax: (510) 644-6015
- Runs an internship program where interns study and audit waste streams. Currently works to enforce, through routine inspection/enforcement programs, an ordinance requiring acceptable P2 plans from generators. Will train hazardous material specialists to carry out the program.
- key words:** hazardous materials; internship; legislation; professional education; waste audits;
- 203 Cynthia Fridgen**
Resources Development
Natural Resources Bldg.
Michigan State University
East Lansing, MI 48824
Phone: (517) 355-9578
E-mail: 22331fri@msu.edu
Fax: (517) 353-8994
- Runs an educational outreach program on handling hazardous materials. Assists area small businesses in their solid waste and hazardous waste handling. Focuses on risk perception and subsequent behavioral response.
- key words:** behavior; hazardous materials; professional education; solid waste
- 204 Burns E. Hegler**
Director, Energy Analysis and Diagnostic Center
The University of Missouri - Rolla
313 Engineering Research Lab
Rolla, MO 65401-0294
Phone: (314) 341-4718
E-mail: bhegler@umrvmb.umsr.edu
Fax: (314) 341-6579
- Emeritus Professor of Electrical Engineering and Director of the Energy Analysis and Diagnostic Center (EADC) at the University of Missouri-Rolla where he teaches and is engaged in extension activities involving conferences, short courses, funded grants/contracts, and technical assistance to businesses and industry. Advisor for transfer students in Electrical Engineering. Since the establishment of the EADC in 1989, he has conducted over 120 industrial energy audits. Has also conducted audits in both energy and safety for other commercial and/or government activities. Has written 158 papers and has conducted over 75 short courses and conferences in his areas of interest, which include general industrial safety, reliability, electrical circuits, and energy management. His most recent papers are concerned with reducing the costs of energy for business and industry.

key words: consulting; environmental engineering; energy; extension; management; process control; professional education; research center; training; waste audits

205

Joel S. Hirschhorn

Hirschhorn & Associates
4221 Forbes Blvd., Suite 240
Lanham, MD 20706-4325

Phone: (301) 731-4095**Fax:** (301) 731-4099

Has designed and presented many P2 lectures, seminars, and workshops in the U.S. and developing countries. Materials designed and used are specific to particular audiences, including industrial engineers and managers, government managers, and academics. Foreign programs have been given in Indonesia, Egypt, Morocco, Poland, Latvia, Mexico and the Philippines.

key words: book published; case studies; consulting; economics; environmental engineering; hazardous materials; legislation; management; process design; product design; professional education; recycling; regulations; solvent substitution; waste audits; workshops

206

David Liebl

Solid and Hazardous Waste Education Center
University of Wisconsin-Extension
610 Langdon St.
Madison, WI 53703

Phone: (608) 262-0385**E-mail:** liebl@wisplan.vwex.edu**Fax:** (608) 262-6250

The center develops and conducts educational programs to communicate the need for P2 and its cost/benefit analysis. Targeted audiences are business managers, facility managers, government officials, engineering consultants, and extension agents. The courses use a hands-on format. The Center draws experts from industries, trade organizations, equipment suppliers, relevant government agencies, etc. to assist in their educational efforts.

key words: extension; hazardous materials; plant design; process control; process design; product design; professional education; recycling; solvent substitution; video; waste audits; workshop

207

Gayla Neumeyer

W1013 Engineering Building
University of Missouri
Columbia, MO 65211

Phone: (314) 882-8366**E-mail:** neumeyer@ecvax2.ecn.missouri.edu

The University of Missouri-Columbia's Energy Systems and Resources Program offers a 3-credit hour Gr. course for secondary science teachers on the environmental aspects of energy supply and demand. This two-week intensive course will be offered for the first time during the summer 1994 semester and is funded by Union Electric Company (St. Louis, MO) and the University of Missouri. Environmental implications of the complete fuel cycle of existing energy technologies and future energy sources will be reviewed. Evening sessions will focus on the societal implications of energy use and policy in relation to the environment.

key words: air quality; atmospheric science; energy; K-12; land use; plant design; policy; professional education

208

Wayne Pferdehirt

Solid and Hazardous Waste Education Center
University of Wisconsin-Extension
610 Langdon St. Room 529
Madison, WI 53703

Phone: (608) 265-2361**E-mail:** pferdehirt@enr.wisc.edu**Fax:** (608) 262-6250

Directs continuing education courses in the design of collection systems for recyclables and solid wastes, and material recovery facilities to process recyclables. The Center develops and conducts educational programs to communicate the need for P2 and its cost/benefit analysis. Targeted audiences are business managers, facility managers, government officials, engineering consultants, and extension agents. The courses use a hands-on format. The Center draws experts from industries, trade organizations, equipment suppliers, relevant government agencies, etc. to assist in their educational efforts.

key words: case studies; civil engineering; hazardous materials; internship; process control; product design; professional education; recycling; solid waste; solvent substitution; waste audits; workshop

209 Susan M. Smith

Director, Center for Improving Mountain Living
Western Carolina University
Cullowhee, NC 28723

Phone: (704) 227-7492

Fax: (704) 227-7422

Activities of the Center include P2 assistance to local business/industry, organization of recycling programs, market development, and proper land use. The Center counsels the service industry (tourism, for example) on using legislation to leverage environmental improvements. Also instructs high school teachers, purchasing agents, photography businesses, and others on playing a role in P2 to keep the environment clean. Funded by a variety of state sources and private foundations.

key words: consulting economics; land use; professional education; recycling

210 Paul Still

Florida Center for Solid and
Hazardous Waste Management
University of Florida
2207 NW 13th St. Suite D
Gainesville, FL 32609

Phone: (904) 392-6305

Fax: (904) 846-0183

Teaches short courses (1-2 days) on waste management and regulation with an introduction to P2. Operator, Florida Recycling Marketing System (FRMS) on electronic bulletin board accessed with computer and modem. Toll free number for modem access (800-384-1239). FRMS has waste exchange, recycling, composting, and waste reduction information.

key words: agriculture; composting; hazardous materials; professional education; recycling; solid waste; waste exchange

211 Donna Toy-Chen

HTM Office
Los Angeles Public Works
200 N. Spring St., Rm. 353
Los Angeles, CA 90012

Phone: (213) 237-1209

Fax: (213) 237-1445

Teaches a P2 and technologies course (with field trips) at UC Riverside. Students are taught to recognize and implement waste minimization and P2 technologies. Conducts P2 training for Los Angeles businesses through HTM office. The HTM office also provides evaluation of industrial processes, waste stream analysis, and regulatory assistance to businesses and manufacturers upon request.

key words: field trips; professional education; waste audits

212 Travis Walton

Director
Technology Extension Service
University of Maryland
College Park, MD 20742

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Fax: (301) 403-4105

The Technology Extension Services (TES), through its five field offices in Maryland, provides on-site engineering assistance to manufacturers. This assistance includes analyzing plant and process environmental issues in all media and determining practical solutions. Activities include P2 and waste minimization assistance and workshops. In addition to its own field engineers, TES is supported by faculty and staff of the College of Engineering and other university elements.

key words: consulting; extension; management; plant design; process design; product design; professional education; workshop

213 Diane Wolcott

Environmental Management
University of California--Berkeley
2223 Fulton St.
Berkeley, CA 94720

Phone: (510) 643-7143

Offers many courses in environmental management at UC Berkeley Extension. The courses address the technical aspects of pollution control and the regulation of toxic contaminants and are taught by local professionals. The topics are covered quantitatively. Case studies are used to illustrate techniques for pollution control and P2, hazardous materials management, site remediation, air quality management, and environmental auditing.

key words: case studies; management; professional education

214 Bryan Zetlen

Central Washington University
2606 NW 91 St.
Seattle, WA 98117

Phone: (206) 789-2300
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Has organized numerous technical seminars using local business and government professionals as speakers. Uses a role-playing format to illustrate real world issues. Teaches students about business protocol and how it may be used effectively to implement P2. General consulting to industry and government on telecommunications and environmental issues, including economics. Author of Washington State Department of Ecology Hazardous Materials Response Study and numerous other articles for Daily Trade Journal, Alaskan Fisherman's Journal, and other professional journals.

key words: atmospheric science; business; case studies; communications; consulting; environmental engineering; hazardous materials; land use; life cycle analysis; management; medical; nuclear engineering; policy; professional education; public health; recycling; risk; role playing; satellite systems; telecommunications; television production; transportation; video

Public Health**215 Dan Boatright**

Department Occupational Safety
and Environmental Health
University of Oklahoma
P.O. Box 26901
801 NE 13th, room 413
Oklahoma City, OK 73190

Phone: (405) 271-2070**Fax:** (405) 271-3039

Teaches and promotes waste management in short educational programs for health students and professionals. Would like to expand educational efforts (from risk analysis and waste management) to include some P2 concepts. Works with a variety of health related industries on waste minimization and P2. Federal funding.

key words: consulting; medical; professional education; public health

216 Anna Harding

Department of Public Health
Oregon State University
Waldo Hall 309
Corvallis, OR 97331-6406

Phone: (503) 737-3832**E-mail:** harding@ccmail.orst.edu**Fax:** (503) 737-4001

Teaches and conducts research in area of environmental health, including courses in environmental science, environmental health, solid and hazardous waste, P2, water sampling and analysis, and environmental risk communication. Emphasis in P2 is general, as students who take the course are from various disciplines, including public health, engineering, chemistry, life sciences, and liberal arts.

key words: behavior; environmental health; hazardous materials; life cycle analysis; public health; risk; solid waste; water

Appendices

Appendix A

Index by Name

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Ashford, Nicholas	Center for Technology, Policy, and Industrial Development	Massachusetts Institute of Technology	191
Atkinson, John	College of Engineering	University of Missouri-Columbia	197
Ausubel, Jesse	Program for the Human Environment	The Rockefeller University	80
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Bawn, Kathleen	Political Science	University of California-Los Angeles	192
Benson, Kristine	Waste Reduction Assistance Program	Alaska Health Project	198
Berkey, Edgar	Ctr. for Hazardous Materials Research	University of Pittsburgh	30
Bhada, Ron	Waste Management Education and Research Consortium	New Mexico State University	31
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Binder, Clari	Environmental Health Services	University of California-Santa Barbara	199
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Bryant, Curtis	Civil Engineering	University of Arizona	123
Buchholz, Rogene	School of Business	Loyola University	179

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Carroll, John E.	Natural Resources	University of New Hampshire	159
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Collins, Anthony	Hazardous Waste and Toxic Substance Research and Management Center	Clarkson University	34
Collins, Denis	School of Business	University of Wisconsin-Madison	18
Collins, Terrence	Mellon College of Science	Carnegie Mellon University	110
Conn, David W.	Center for Environment and Hazardous Materials Studies	Virginia Polytechnic Institute and State University	35
Conway-Schempf, Noelle	Green Design Initiative	Carnegie-Mellon University	160
Coppola, Nancy	Humanities	New Jersey Institute of Technology	161
Cordano, Mark	Katz Graduate School of Business	University of Pittsburgh	19
Corson, Lynn A.	Indiana Pollution Prevention and Safe Materials Institute	Purdue University	36
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Counce, Robert M.	Chemical Engineering	University of Tennessee	82
Criner, George	Economics and Policy	University of Maine	143
Crittenden, John C.	Center for Clean Industrial and Treatment Technologies - CenCITT	Michigan Technological University	38
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Dahab, Mohamed	Civil Engineering	University of Nebraska - Lincoln	125
Davidson, Cliff	Environmental Institute	Carnegie Mellon University	39
Davis, Gary A.	Center for Clean Products and Clean Technologies	University of Tennessee	40
Diggelman, Carol	Physics and Chemistry	Milwaukee School of Engineering	126
Dobson, L. Douglas	Hazardous Waste Management Research Fund	University of South Carolina	41
Donaldson, Cynthia D.	Industrial Environmental Management	Naugatuck Valley Community- Technical College	180
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Dowlatabadi, Hadi	Engineering and Public Policy	Carnegie Mellon University	147
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Eagan, David	Institute for Environmental Studies	University of Wisconsin-Madison	162
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Ehrenfeld, John R.	Center for Technology, Policy, & Industrial Development	Massachusetts Institute of Technology	44
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Ford, Robert L.	Center for Energy and Environmental Studies	Southern University at Baton Rouge	46
Frederick, Wm. James	Chemical Engineering	Oregon State University	90
Fridgen, Cynthia	Resources Development	Michigan State University	203
Froines, John R.	Pollution Prevention Education and Research Center	University of California-Los Angeles	47
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Glaze, William H.	School of Public Health	University of North Carolina-Chapel Hill	148
Glicksman, Leon R.	Building Technology Program	Massachusetts Institute of Technology	11
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Gottlieb, Robert	Pollution Prevention Education and Research Center	University of California-Los Angeles	48
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Hartman, Roy	Center for Recycling and Waste Management Studies	Texas A&M University	52
Hauser, Thomas	Civil & Environmental Engineering	University of Cincinnati	53
Heathcote, Isabel	School of Engineering	University of Guelph	129
Hecker, William	Chemical Engineering	Brigham Young University	93

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Hegler, Burns E.	Energy Analysis and Diagnostic Center	University of Missouri - Rolla	204
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Hensley, Josephine S.	The Massachusetts Toxics Use Reduction Institute	University of Massachusetts-Lowell	54
Hickernall, Gary	Natural Science	Keuka College	111
Hicks, Linda Ashman	Pollution Prevention Education and Research Center	University of California-Los Angeles	55
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Hopper, J.R.	Department of Chemical Engineering	Lamar University	94
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Iisa, Kristiina	Chemical Engineering	Oregon State University	95
James, William	School of Engineering	University of Guelph	130
Jelinski, Lynn		Cornell University	172
Johannsen, Chris	Environmental Sciences and Engineering Institute	Purdue University	57
Jones, Tim	Anthropology (Archaeology subgroup)	University of Arizona	9
Karp, James, P.	Crouse-Hinds School of Management	Syracuse University	175
Karpoft, Jonathan	Business Administration	University of Washington	21
Keoleian, Gregory A.	National Pollution Prevention Center for Higher Education	University of Michigan	58
Khurana, Anil	School of Management	Boston University	22
King, Andrew	Management and Operations Mgt.	Stern School of Business	181
Klein, Thomas A.	College of Business Administration	University of Toledo	23
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Lanen, William	School of Business Administration	University of Michigan	2
Lave, Lester	Economics	Carnegie-Mellon University	146
Lawrence, Carol	School of Accounting	University of Missouri	3
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Liebl, David	Solid and Hazardous Waste Education Center	University of Wisconsin-Extension	206
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Mann, Kent	Chemistry	University of Minnesota	113
Marchello, Joseph M.	Environmental Engineering	Old Dominion University	132
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McGrath, Elizabeth A.	Center for Process Analytical Chemistry	University of Washington	114
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Modesitt, Donald	Civil Engineering	University of Missouri	133
Molina, Mario	Earth Atmospheric and Planetary Sciences	Massachusetts Institute of Technology	115

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Morgan, J. Derald	Waste Management Education & Research Consortium	New Mexico State University	63
Myers, Robert L.	Agronomy	University of Missouri	7
Nair, Indira	Engineering and Public Policy	Carnegie Mellon University	152
Navin Chandra, Dundee	School of Computer Science	Carnegie Mellon University	153
Neumeyer, Gayla	Engineering	University of Missouri	207
Noble, James	Chemical Engineering	Tufts University	99
Ostheim, Steve	Center for Haz. Materials Research	University of Pittsburgh	64
Oswald, Lynda	School of Business Administration	University of Michigan	25
Ottinger, Richard	Center for Environmental Legal Studies	Pace University Law School	178
Overcash, Michael	Pollution Prevention Research Center	North Carolina State University	65
Payette, Tom	Political Science	Henry Ford Community College	195
Pferdehirt, Wayne	Solid and Haz. Waste Education Center	University of Wisconsin-Extension	208
Pike, Ronald M.	National Microscale Chemistry Center	Merrimack College	66
Pimentel, David		Cornell University	8
Pohland, Frederick G.	Civil and Environmental Engineering	University of Pittsburgh	134
Pojasek, Robert B.	Civil and Environmental Engineering	Tufts University	135
Poorsoltan, Keramat	Accounting and Business Admin.	Frostburg State University	26
Post, James E.	School of Management	Boston University	182
Powers, Susan	Hazardous Waste and Toxic Substance Research and Management Center	Clarkson University	67
Protopapas, Angelos	Civil and Environmental Engineering	Polytechnic University	136
Punzi, Vito	Chemical Engineering	Villanova University	100
Rands, Gordon	Smeal College of Business Admin.	The Pennsylvania State University	183
Raphael, Marilyn	Geography Department	University of California-Los Angeles	166
Reynolds, Joseph	Chemical Engineering	Manhattan College	101
Riedle, Lisa	Civil Engineering	University of Wisconsin - Platteville	137
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Rubin, Edward S.	Dept. of Engineering and Public Policy	Carnegie Mellon University	154
Rundman, K.B.	Metallurgical and Materials Engineering	Michigan Technological University	155
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Salterberg, Susan	Iowa Waste Reduction Center	University of Northern Iowa	69
Sawan, Samuel P.	Chemistry	University of Massachusetts, Lowell	116
Schuler, Richard	Center for the Environment	Cornell University	70
Scranton, Alec	Chemical Engineering	Michigan State University	117
Seiber, James N.	Environmental Science and Engineering	University of Nevada- Reno	167
Sharfman, Mark	College of Business Administration	University of Oklahoma	27
Shaw, Henry	Chemical Engineering, Chemistry, and Environmental Science	New Jersey Institute of Technology	103
Singh, Dilip	Chemical Engineering	Youngstown State University	104
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Specht, Linda	Business Administration	Trinity University	4
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Appendix D

Update/Correction Form

Name:

Title:

Address:

Telephone Number:

Fax number:

Computer e-mail address:

University Affiliation (if any)

Description of Pollution Prevention Education Activities:

Key words (please circle the appropriate words below or use your own):

accounting
agriculture
air quality
anthropology
architecture
atmospheric science
automobile
behavior
biology
biotechnology
book published
business
case studies
center
chem. engineering
chemistry
civil engineering

community college
computer modeling
computer science
consulting
design
economics
energy
environmental engineering
extension - see prof. education
ethics
field trips
geography
hazardous materials
incentives
internship
K - 12
laboratory

land use
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livestock
management
marketing
mechanical engineering
medical
modules educational
nuclear engineering
petrochemicals
plant design
policy
political science
process control
process design
product design

professional education
public health
recycling
regulations
research center - center
risk
role playing
social science
solid waste
solvent substitution
training - see prof. education
utilities
video
waste audits
water
workshop
other _____

100-100000

100-100000

100-100000

100-100000

100-100000

100-100000

100-100000