

Educational Materials available from the

Center for Sustainable Systems

School of Natural Resources & Environment/University of Michigan



Between 1994 and 1998, the National Pollution Prevention Center for Higher Education (NPPC) published college-level curricula in 16 academic disciplines, as shown in the Table of Contents. In 1999, the NPPC evolved into the Center for Sustainable Systems. The Center's focus is now research, so in addition to the curricula which is still available, research publications are continually being made available, as well. The compendia created by NPPC, as well as other publications, are available via our website: css.snre.umich.edu/index.html. This website contains information about the Center for Sustainable Systems.

TYPES OF MATERIALS AVAILABLE

Introductory Materials

The NPPC published two introductory pieces, "Overview of Environmental Problems" and "Pollution Prevention Concepts and Principles." Each set of discipline-specific materials also includes an introduction describing relevant applications of pollution prevention.

Resource Lists

For each discipline, we publish an extensive bibliography of educational tools and reference materials: books, reports, articles, government documents and curricula. Also listed are relevant organizations and selected faculty active in pollution prevention education.

Annotated Bibliographies

Organized alphabetically, these bibliographies describe some or all of the materials cited in the Resource Lists.

Videos

We distribute two videos for use in the classroom. One complements the McDonald's case study; the other, Amoco and the US EPA, may be used alone.

Selected Readings

These journal reprints provide background information for faculty; many are appropriate for distribution to students.

Syllabi

Professors nationwide provide their course syllabi as examples for colleagues who wish to teach about sustainability. Strategies include discussing it during a single class session, integrating it throughout a course, and developing a course specifically about it.

Student Assignments

Within most disciplines, we've published at least one case study; in certain areas, we've also published homework, exam and open-ended problems, which vary in scope from a half-hour exam question (see "Accounting") to an extensive design project (see "Chemical Engineering"). These student assignments include teaching notes for the instructor and suggested responses to discussion or exam questions.

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NPPC/CSS materials may be freely photocopied for non-commercial educational purposes

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INTRODUCTORY MATERIALS

OVERVIEW OF ENVIRONMENTAL PROBLEMS

How do human actions affect various aspects of the environment? To help faculty and students begin to answer this question, "Overview" provides background information, scientific concepts, and terminology on the following topics:

- Energy
- Climate Change
- Ozone Depletion
- Resource Depletion
- Land Use
- Waste
- Air Quality
- Water
- Ecological Health
- Human Health

Included are numerous figures and tables and a glossary of terms and concepts, all of which are useful teaching tools. (125 pp.) \$19

POLLUTION PREVENTION CONCEPTS AND PRINCIPLES

Introduces the concepts, terminology, objectives, and scope of pollution prevention (P2). Discusses how government and the private sector are currently perceiving and implementing P2 and describes the barriers and benefits encountered. (16 pp.) \$3

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ACCOUNTING

INTRODUCTION

Gives a brief history of environmental accounting, covering key principles and defines relevant terms. Reviews the literature, identifies current trends and issues, and describes how companies are implementing environmental accounting. Also suggests how to use compendium. \$3

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

An alphabetical list which describes 45 relevant publications, all of which appear in the Resource List. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

RESOURCE LIST

Educational Tools: Four annotated bibliographies, 8 case studies, 4 problem sets, and 4 course syllabi. Reference Materials: 35 books/ reports, 75 articles, 3 software programs, 1 audiotape, 1 directory, 9 organizations and 11 faculty active in pollution prevention education. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

COURSE SYLLABI

A collection of syllabi from university courses involving pollution prevention and accounting taught by Mark Cohen (Vanderbilt), Christopher Stinson (Texas), Donald E. Stone (U-Mass), and Mark A. White (Virginia). \$7

CASE STUDY:

3M WASTE MINIMIZATION

Much has been written about performance measurement, but relatively little is known about using environmental measures in industry. This 15-page case illustrates non-financial performance measures on a manufacturing environment, allowing the instructor to focus on either environmental or performance measurement issues when several measures are being used. Includes teaching note. \$2

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CASE STUDY:

REPLACING OZONE-DEPLETING CHEMICALS: TAXES AND DECISIONS FOR A MANUFACTURER

(See "Finance") \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

PROBLEM SET:

OVERHEAD ALLOCATION FOR POLLUTION PREVENTION

30-minute exam question addressing the proper allocation of environmental costs to products. Includes answer key. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

AGRICULTURE

INTRODUCTION

Describes the compendium and the many pollution problems caused by modern ag practices, along with sustainable methods that may reverse the trend. \$1

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

An alphabetical list which describes 30 relevant publications, all of which appear in the Resource List. \$1

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

RESOURCE LIST

Organized by topic, this list cites 240 publications, 23 videos, 1 database, and 2 software packages. Includes contact info for 18 mentor faculty and 10 organizations that provide additional assistance. \$2

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

FARMS AND GREENBELTS

Describes how and why there have been massive changes in U.S. land use since 1950 and suggests how wise planning can preserve our remaining fertile soil for food production. \$2

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CONSERVATION OF FERTILIZERS AND LIVESTOCK MANURE: POLLUTION PREVENTION

Refers to 38 recent articles while discussing how to manage fertilizers, compost, and livestock manures to conserve nutrients and prevent pollution. \$2

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

COURSE SYLLABI AND CURRICULA

Features extensive syllabus by Cornell's David Pimentel listing specific content for 14 sustainable agriculture topics and citing suggested companion articles. Also includes brief outline of Alison Power's "Food, Agriculture, and Society" course taught at Cornell and a reprint of Miguel Altieri and Charles Francis' "Incorporating Agroecology Into the Conventional Agriculture Curriculum" article, which provides strong rationale for agroecology courses, discusses methodology and perspectives, and suggests specific course components. \$3

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

LIFE CYCLE-BASED SUSTAINABILITY INDICATORS FOR ASSESSMENT OF THE U.S. FOOD SYSTEM

60-page report uses the product life cycle as a framework for studying the links between food consumption behaviors, processing and distribution activities, and agricultural production practices. A broad set of indicators are presented, addressing economic, social and environmental aspects of each stage of the food system life cycle. With numerous tables, color figures, and 161 references, this

Continued on Page 3

report provides a useful baseline for understanding and improving upon the sustainability of the US food and agriculture systems. \$20

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

SELECTED READINGS

A collection of key reprints by David

Pimentel et al. \$13

- "Energy Efficiency of Farming Systems: Organic and Conventional Agriculture"
- "Agroecosystem Biodiversity: Matching Production and Conservation Biology"
- "Water Resources in Food and Energy Production"
- "Benefits and Risks of Genetic Engineering and Agriculture"
- "Environmental and Economic Effects of Reducing Pesticide Use"
- "Environmental and Economic Costs of Pesticide Use"
- "Renewable Energy: Economic and Environmental Issues"
- "Environmental and Economic Costs of Soil Erosion and Conservation Benefits"
- "Environmental and Economic Benefits of Sustainable Agriculture"

WORKSHOP PROCEEDINGS: A LIFE CYCLE APPROACH TO SUSTAINABLE AGRICULTURE INDICATORS

In February 1999, 60 farmers, professors, policymakers and researchers convened at the University of Michigan to discuss sustainable agriculture indicators for dairy, fruit, grain and pork production.

These proceedings include presenters' manuscripts and/or slides, summaries of case study presentations and the panel discussion, as well as descriptions of the final indicators developed by the working groups. These indicators serve as an initial standard against which farms and agricultural institutions, nationwide, may evaluate their progress toward sustainability, both in theory and in practice. \$10

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ARCHITECTURE

MODULE ONE: INTRODUCTION

INTRODUCTION TO SUSTAINABLE ARCHITECTURE

Introduces the concept of sustainable architecture; explains the need to teach it; and describes this compendium's resources. Appendices report on surveys of educators, manufacturers and NAAB criteria. \$3.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

COMBINED BIBLIOGRAPHY

Lists over 300 publications cited in this compendium. Tells how to obtain cited materials not commonly available from your university library or local bookstore, including free U.S. government publications. Arranged by topic. \$2.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

COMBINED ANNOTATED BIBLIOGRAPHY

Describes 18 resources cited in the "Combined Bibliography." Alphabetical. \$2.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

RESOURCE LIST

This website links you directly to 19 of the best architecture education websites we know of (besides our own!) for publications, computer software, slides, videos and other resources. Alphabetical listing includes keywords, descriptions and contact information. [Due to the nature of this resource, it is not available by mail]

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

SAMPLE SYLLABI

A collection of 14 syllabi by architecture faculty from across the U.S. and Canada. Featured are lecture schedules, homework assignments, lab experiments, studio design projects and essay questions on sustainable architecture. \$11

MODULE TWO: SUSTAINABLE DESIGN

Coming in 2001: "Fundamentals and Methods of Sustainable Design" plus a related bibliography.

MODULE THREE: SUSTAINABLE BUILDING MATERIALS

QUALITIES, USE AND EXAMPLES OF SUSTAINABLE BUILDING MATERIALS

This paper can be used as a coursepack or supplemental reading for architecture courses at the undergraduate and graduate levels. Rich with illustrations, it examines the source of common building materials and the environmental costs of their production. The authors describe and discuss examples of environmentally-friendly materials (such as adobe and recycled aluminum) and products (such as recycled-content insulation and triple-paned windows). General principles of life

cycle analysis are applied to all phases of construction (pre-building, building and post-building). \$5

BIBLIOGRAPHY

Topical listing of nearly 70 books and journals specifically about producing and using sustainable building materials. \$1

ANNOTATED BIBLIOGRAPHY

Alphabetical list which describes 7 publications from the Bibliography. \$1

MODULE FOUR: RECYCLING AND REUSE OF BUILDING MATERIALS

LEARNING UNITS AND BIBLIOGRAPHIES

Designed for use as either a coursepack or supplemental reading for undergrad or grad architecture students, this module is lengthy (100+ pp.) and richly illustrated. It is composed of discussions, case studies and exercises in four Learning Units:

- Waste Prevention
- Construction and Demolition Recycling
- Architectural Reuse
- Design for Materials Recovery

This module also includes a bibliography of 100 books and journals on this topic; 30 are annotated. \$11

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

MODULE FIVE: CASE STUDIES

Coming in 2001:

*"Case Studies in Sustainable Design" (3)
"Case Studies in Sustainable Building" (3)
A set of slides.*

BUSINESS LAW

INTRODUCTION

Briefly explains legal advantages of comprehensive pollution-prevention strategies; suggests how to integrate them into law curricula. \$1

Business Law Continued on Page 4

EMAIL US AT:
CSS.INFO@UMICH.EDU

RESOURCE LIST

Educational Tools: Six articles and three statutes. Reference Materials: 16 books and reports, 42 articles, 13 government reports and hearings, one federal statute, 27 state statutes and 3 works by faculty active in pollution prevention education. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

Alphabetical lists which describes 93 relevant publications, all of which appear in the Resource List. \$1.50

SELECTED READING MATERIAL

A collection of key documents. \$17

- Clearwater, Scott W., & Joanne M. Scanlon, *Legal Incentives for Minimizing Waste*, 10 ENVTL. PROGRESS, August 1991 at 169.
- Grayson, Lynn E., *The Pollution Prevention Act of 1990: Emergence of a New Environmental Policy*, 22 ENVTL. L. REP. (ENVTL. L. INST.) 10,392 (1992).
- Guruswamy, Lakshman, *Integrated Thoughtways: Re-Opening of the Environmental Mind?* 1989 WIS. L. REV. 463.
- Johnson, Stephen M., *From Reaction to Proaction: The 1990 Pollution Prevention Act*, 17 COLUM. J. ENVTL. L. 153 (1992).
- Pollution Prevention Act of 1990, 42 U.S.C. Sec. 13101-13109. The Federal statute.
- Connecticut Environmental Assistance to Business Act, Conn. Gen. Statute Ann. App. Pamphlet, PA 91-376 (1992). Voluntary state statute.
- Massachusetts Toxics Use Reduction Act, Mass. Ann. Laws Ch. 211 Sec. 1-23 (Law. Co-op Supp. 1992). Mandatory state statute.

A POLLUTION PREVENTION PRIMER FOR LAW TEACHERS

Discusses pollution prevention vs media-specific regulations and laws. Also describes current acts and federal and state programs. \$1.50

A CHEMICAL ENGINEER'S GUIDE TO ENVIRONMENTAL LAW AND REGULATION

(See "Chemical Engineering") \$13

CHEMICAL ENGINEERING

INTRODUCTION

Justifies pollution prevention on the basis of environmental protection, as well as "bottom-line, business-minded thinking." Highlights educational resources to assist chemical engineering faculty in incorporating key pollution prevention concepts into courses. \$1

RESOURCE LIST

Educational Tools: One annotated bibliography, 2 case studies, 2 books, 2 collections of problem sets, 19 syllabi and curricula and 6 videos. Reference Materials: 30 books, 45 reports/guides, 91 articles, 7 case studies, 6 organizations and 50 faculty involved in pollution prevention education. \$2.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

Alphabetical list which describes 120 publications, all of which appear in the Resource List. \$1.50

COURSE SYLLABI

Syllabi from 12 pollution prevention courses involving chemical engineering taught by William Budd (Washington State); Pete Counce (Tennessee); Dale Denny, Michael Overcash, Christine S. Grant (NCSU); Marvin Fleischman (Louisville); David Kidd (Alaska); Robert Pojasek (Tufts); Ronald Minet (USC); and Margrit von Braun (Idaho). \$10

A CHEMICAL ENGINEER'S GUIDE TO ENVIRONMENTAL LAW & REGULATION

This 100-page guide gives chemical engineers a general overview of the field of environmental law. Main sections discuss (1) the specific reasons why chemical engineers should understand environmental laws and regulations; (2) the roles of legislatures, administrative agencies and courts in environmental law; (3) the interaction of environmental laws at federal, state and local levels; and (4) relevant provisions of nine Federal Acts:

- Toxic Substances Control Act
- Federal Insecticide, Rodenticide and Fungicide Act
- Occupational Safety and Health Act
- Clean Air Act
- Clean Water Act

- Resource Conservation and Recovery Act
- Comprehensive Environmental Response, Compensation & Liability Act
- Emergency Planning and Community Right-to-Know Act
- Pollution Prevention Act

\$13

OPEN-ENDED PROBLEM: DETERMINING MASS BALANCES IN FORD-WIXOM'S PHOSPHATE COATING SYSTEM (includes CD-ROM)

This assignment exposes materials-balance students to actual processes. Student groups are asked to develop a flowchart for the Phosphate Coating System of Ford Motor Company's Wixom Assembly Plant and suggest reconfigurations that would minimize the amount of waste generated.

The main source of information is a multimedia tour of the phosphate coating system. The tour, on CD-ROM, has video clips from the actual system, a short description of each of the system's 12 stages, and supplementary explanations. Students can explore the system at their own pace and in any order they wish. The CD-ROM runs on Macintosh and Windows systems. \$21

- For the Mac, you will need at least a Mac II – a 68020 chip is the minimum; a 68030 or higher chip is preferred. You will also need at least 8 MB RAM, System 7.0.1 and QuickTime 1.5 or higher.
- The Windows version requires a 386 or higher with 8MB RAM, DOS 6.0, Windows 3.0, QuickTime for Windows 1.1.1 and screen resolution of at least 640x480.

Chemical Engineering Continued on Page 5



**OPEN-ENDED PROBLEM:
DESIGN OF A CFC-FREE, ENERGY
-EFFICIENT REFRIGERATOR**

This 145-page case challenges students to design a household refrigerator that uses a non-ozone-depleting refrigerant and is also energy-efficient. Includes short discussions of issues related to the evolution of the refrigerator and the subsequent environmental threat. The proposed solution leads from thermo-dynamic calculations to a choice of refrigerants that, when combined with the refrigerator's specifications, will meet the design requirements. Appendices include refrigerant manufacturer data and output from a thermodynamic calculation computer program. \$15.50

CASE STUDIES

MCDONALD'S

(See "Corporate Strategy.") \$11

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

**AGENT REGENERATION AND
HAZARDOUS WASTE MINIMIZA-
TION AT IBM**

(See "Operations Management.") \$1.50

**DEGREASER REPLACEMENT AT
FORD**

(See "Environmental Engineering") \$2.50

VIDEOS

SECOND VICTORY AT YORKTOWN

This 31-minute video examines the joint Amoco/EPA project that addressed the reduction of pollution from a petroleum refinery. The video explains pollution prevention, risk analysis and decision-making, and then goes on to describe the expectations and concerns of each of the participants. Finally, the results of the project are presented. The material is intended for survey courses on environmental issues, chemical and industrial engineering classes and business classes on operations management and business law (voluntary vs mandatory programs). It is also suitable for managers and engineers. \$22

MCDONALD'S

(See "Corporate Strategy.") \$16

CHEMISTRY

**INCORPORATION OF POLLUTION
PREVENTION PRINCIPLES INTO
CHEMICAL SCIENCE EDUCATION**

This 84-page thesis was written by a graduate student in Environmental and Industrial Health. It begins with a review of the literature on "green chemistry" and chemical science education. Next, the author proposes a methodology for chemical life cycle analyses that can be incorporated into university-level chemistry curricula. The main section of this document is a case study applying that methodology in a comparison of the environmental impacts of producing and using ethylene glycol-based antifreeze vs a similar product made of propylene glycol. Includes numerous tables, figures and appendices. \$13

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

RESOURCE LIST

Educational Tools: Three articles.
Reference Materials: (Grouped under five P2-in-Chemistry themes): 146 articles, 3 books, 3 reports, 5 publishers, 5 online services, 4 faculty involved in pollution prevention education and 5 organizations. Includes matrix that summarizes all materials within specific categories and subcategories while also showing the intended audience level for each document. \$2.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

Alphabetical list describes all materials cited in the Resource List. \$2.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

COASTAL ZONE MANAGEMENT

INTRODUCTION

This overview defines pollution prevention (P2), states its relevance in general and also for the coastal zone, and describes how economists and marine policy analysts view P2. After presenting an overview of major legislation, the authors sum up this compendium's 4 case studies and generalize the lessons applicable to P2 in the coastal zone. \$2

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

RESOURCE LIST

Organized by topic, this list cites 56 publications (several of which are available free on the Web) and several related organizations. In addition to covering general coastal/marine/ aquatic pollution prevention, the list includes resources on specific locales (i.e. Boston Harbor and Chesapeake Bay) and industries (marinas and cruise lines). Contact information for publishers is included wherever possible. \$1

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

**ANNOTATED BIBLIOGRAPHY OF
COASTAL POLLUTION
PREVENTION SOURCES**

Arranged alphabetically, this bibliography describes all materials cited in the Resource List. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

**CASE STUDY:
P2 STRATEGIES ON CRUISE
LINES**

Examines how and why the Miami-based cruise line industry is using land disposal, source reduction and recycling to avoid dumping in the oceans. Incentives include stricter national and international legislation, greater public scrutiny and growing industry awareness. With discussion questions. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

**CASE STUDY:
SEWAGE SLUDGE PELLETIZATION
(Boston)**

The sheer scale of the Boston Harbor Cleanup Project makes it an important subject of coastal policy. This case looks at the issues surrounding pelletization of sludge; describes source reduction through removal of leaded solder and industrial pre-treatment of sewage; and, describes efforts to upgrade treatment, extend it to more of Boston's wastewater and promote external reuse of sewage sludge. Includes discussion questions. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

Coastal Zone Management

Continued on Page 6

CASE STUDY:
THE ROLE OF P2 IN REDUCING NUTRIENT ENRICHMENT (CHESAPEAKE BAY)

This case examines the role of P2 in a large, multi-jurisdictional effort to reduce nutrient enrichment from fertilizer runoff, air pollution, sewage and industrial outfalls, deforestation and urban development. The largely voluntary source reduction strategies include banning phosphates, controlling coastal development and establishing riparian buffers along rivers and streams. Includes discussion questions. \$2

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CASE STUDY:
P2 IN MARINAS

(BROWARD COUNTY, FLORIDA)
Boat maintenance and servicing activities are sources of sewage, toxic substances, and petroleum hydro-carbons in coastal waters. To reduce this pollution, county environmental regulators and marina industry representatives cooperatively developed "Best Management Practices" to encourage activities ranging throughout the P2 hierarchy. Includes discussion questions. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CORPORATE STRATEGY

CASE STUDIES: (INCLUDES 3 McDONALD'S CASE STUDIES)

- McDonald's Environmental Strategy
- The Clamshell Controversy & McDonald's Decision
- Sustaining McDonald's Environmental Success

The first two cases focus on the work of a joint task force developed by McDonald's Corporation and the Environmental Defense Fund. Members addressed McDonald's solid waste management strategy and the question of whether to replace poly-styrene packaging with paper wrap. The third case examines the Company's reaction to public concern about the sustainability of beef production and consumption. Included are teaching notes, as well as notes on life cycle analysis and solid waste issues. \$11

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

VIDEO:
McDONALD'S/EDF ENVIRONMENTAL TASK FORCE

This 16-minute video accompanies the written case studies. Robert Langert, McDonald's Director of Environmental Affairs, and Jackie Prince, Environmental Defense Fund staff scientist, present different perspectives on the joint project. Issues discussed include reasons for, and reservations about, participating; organizational goals of the project; results; and, advice for others thinking of pursuing similar projects. \$16

VIDEO: YORKTOWN
(See "Chemical Engineering.") \$22

ENVIRONMENTAL ENGINEERING

CASE STUDY:
DEGREASER REPLACEMENT AT FORD MOTOR COMPANY'S CLIMATE CONTROL DIVISION

This case analyzes Ford's pilot study of aqueous degreaser units as an alternative to trichloroethylene (TCE). Includes discussion questions and problem sets. \$2.50

ENVIRONMENTAL STUDIES

INTRODUCTION

This brief introduction provides imagery to answer the question, "Why teach pollution prevention in an environmental studies class?" \$1

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

RESOURCE LIST

Lists 47 books, 24 reports, 99 articles, 6 videos and 13 syllabi arranged by topics that correspond to the Bibliographic Teaching Outline. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

Alphabetical list which describes all materials in the Resource List. \$3.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

SELECTED READING MATERIAL

A collection of key documents.

- Mary Ann Curran: "Broad-Based Environmental Life Cycle Assessment"
- Dale Jamieson, Klasina VanderWerf: "Cultural Barriers to Behavior Change: General Recommendations and Resources for State Pollution Prevention Programs."
- John Wise: "Challenges for the Future." \$19

BIBLIOGRAPHIC TEACHING OUTLINE

Outline covers pollution prevention topics ranging from fundamental concepts to everyday applications. Written in narrative form, it follows the structure of the Resource List to which it makes numerous references. Serves as a teaching guide for integrating pollution prevention into environmental studies courses. It also helps teachers locate resources. Includes the following brief documents:

- Suggested Course Structures: Highlights major topics in the Bibliographic Teaching Outline to suggest how long to spend on the topics. Depending on the amount of classroom time available, this may be one day or an entire semester.
- References by Academic Discipline: Illustrates the relevance of Resource List materials to seven liberal arts disciplines –
 - 1 biology and natural resources
 - 2 chemistry, physics, mathematics and geology
 - 3 economics
 - 4 education
 - 5 humanities
 - 6 political science/policy studies
 - 7 sociology, psychology and anthropology

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

Check out our Website at
css.snre.umich.edu/index

FINANCE

ENVIRONMENTAL FINANCE: VALUE AND RISK IN AN AGE OF ECOLOGY

Introduces the concept of environmental finance. This compendia reviews how organizations "respond to environmental threats and opportunities" in investments, corporate finance and financial institutions. \$1.50

RESOURCE LIST

Cites 12 case studies, 90 articles, 46 books, one exercise, five Internet sites and 4 faculty who are involved in pollution prevention education. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

Alphabetical list which describes all materials in the Resource List. \$2.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CASE STUDY:

CROTALUS CIRCUITS

Sets up a situation where a bank must decide whether to increase a loan for a company considering a more environmentally sound method of production. Allows students to analyze a pollution prevention project from several different perspectives – those of the company, the bank and society. Includes teaching note. \$2

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CASE STUDY:

REPLACING OZONE-DEPLETING CHEMICALS: TAXES AND DECISIONS FOR A MANUFACTURER

Asks the student, as financial analyst, to analyze options and recommend a strategy for handling a manufacturer's current inventory of ozone-depleting chemicals. Includes discussion questions, teaching note, answer key and financial tables. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CASE STUDY:

GREEN LIGHTS: GRAPHIC DESIGN CONSIDERS A LIGHTING UPGRADE

A small-business owner is approached by an EPA-trained energy specialist about upgrading his 5-year-old lighting system to a more energy-efficient system. Students

must decide whether this is worthwhile financially, and otherwise. Case includes financial tables, discussion questions, teaching note and answer key. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

CASE STUDY:

CHRYSLER CORPORATION: JEFFERSON NORTH ASSEMBLY PLANT

(See "Operations Management.") \$2

INDUSTRIAL ECOLOGY

INTRODUCTION

Describes the background of Industrial Ecology, defines its main attributes and puts it in the perspective of an academic discipline and the field of ecology. Covers goals, key concepts, sustainable development, system tools (i.e. life cycle design, life cycle assessment and design for environment) and future needs. \$4

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

RESOURCE LIST

List of 153 books and articles, 2 collections of problem sets, 2 videos, 8 syllabi and 19 faculty in I.E. education. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

Describes 41 relevant publications which appear in the Resource List. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

SELECTED READING MATERIAL

A collection of key documents:

- Braden R. Allenby: "Achieving Sustainable Development through Industrial Ecology."
- Robert U. Ayres: "Industrial Metabolism: Theory & Policy."
- Robert A. Frosch: "Industrial Ecology: A Philosophical Introduction."
- Greg Keoleian and Dan Meneray: "Sustainable Development by Design: Review of Life Cycle Design and Related Approaches." \$3.50

COURSE SYLLABI

A collection of syllabi from six university courses involving Industrial Ecology taught by Clinton Andrews (Princeton); Garry Brewer, Stuart Hart and Gregory Keoleian

(Michigan); William Clark, Robert Frosch and R.H. Socolow (Harvard); and Faye Duchin (NYU). \$9

CASE STUDY: MCDONALD'S

(See "Corporate Strategy.") \$11

VIDEO: MCDONALD'S/EDF

(See "Corporate Strategy.") \$16

VIDEO:

SECOND VICTORY AT YORKTOWN

(See "Chemical Engineering.") \$22

INDUSTRIAL ENGINEERING & OPERATIONS RESEARCH

INTRODUCTION

Describes the inherent and critical role industrial engineers must play in developing successful pollution prevention programs. Illustrates how the compendia contents relate to the seven Industrial Engineering and Operations Research topics: (1) Capital Budgeting, (2) Decision Analysis, (3) Facilities Planning, (4) Operations Research, (5) Organizational Design/Management of Change, (6) Production Control, and (7) Total Quality Management. \$1.50

RESOURCE LIST

Educational Tools: Four case studies, 3 articles with discussion questions, 1 problem set, 4 course syllabi and 1 video. Reference Materials: Fifteen books, 42 articles, 4 organizations and 11 faculty involved in pollution prevention education. Includes matrix showing which resources are relevant to each of the seven Industrial Engineering and Operations Research topics. \$1.50

AVAILABLE FREE OF CHARGE ON OUR WEBSITE

ANNOTATED BIBLIOGRAPHY

Alphabetical list which describes all books, articles and case studies appearing in the Resource List. Includes matrix showing which resources are relevant to each of the seven Industrial Engineering and Operations Research topics. \$1.50

SELECTED READING MATERIAL

A collection of key documents:

- R.A. Frosch, and N.E. Gallopoulos, "Strategies for Manufacturing"
- H.C. Haynsworth and R. Tim Lyons, "Remanufacturing By Design"
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Strategic Environmental Management syllabi by Stuart Hart (Michigan), Doug Lober (Duke), Alfie Marcus (Minnesota), and Forest Reinhardt (Harvard). \$6

Strategic Environmental Management Continued on Page 9

CASE STUDIES:

RINGER, DELUXE AND OSMONICS

These cases illustrate the "high-value" strategy in businesses with environmental aspects: Ringer produces alternative lawn-and-garden products; Deluxe is a printer that creates a pollution-free ink; and, Osmonics manufactures water-quality filtration devices. All have developed environmentally superior products or services but achieve different levels of success. Students can analyze the "green" vs "black" aspects of these businesses' portfolios and suggest a course of action for each. Discussion questions and teaching notes included. \$3.50

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STUDENT ASSIGNMENTS

1. "Reducing Resource Use and Waste per Unit of Production: Comparing P2 at 3M, Dow and Polaroid"
2. "The Seven S's" Further Analysis of the Dow Case."
3. "Analyzing Environmental Aspects of Business: Ringer, Deluxe and Osmonics"
4. "Eco-Integrated Portfolio Analysis" \$2

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OTHER NPPC/CSS RESOURCES

DIRECTORY OF POLLUTION PREVENTION IN HIGHER EDUCATION: FACULTY AND PROGRAMS, 1997

Updates the 1994 edition to list more than 400 faculty. Describes activities of people currently involved in integrating pollution prevention concepts into curricula. The Directory provides extensive contact information. \$20

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NPPC/CSS RESEARCH PUBLICATIONS

FRAMEWORK & METHODOLOGY

LIFE CYCLE DESIGN

Keoleian, G. "Life Cycle Design." Ch. 6 in *Life Cycle Assessment*, ed. M. Curran, 6.1-6.34. New York: McGraw-Hill, 1996.

_____. "Pollution Prevention through Life Cycle Design." Ch. 18 in *Pollution Prevention Handbook*, ed. H. Freeman, 253-292. New York: McGraw-Hill, 1995.

Keoleian, G., J. Koch, and D. Menerey. *Life Cycle Design Framework and Demonstration Projects: Profiles of AT&T and AlliedSignal*. Cincinnati: National Risk Management Research Laboratory, ORD, U.S. EPA, 1995. **Available from NCEPI (as EPA/600/R-95/107) while supplies last, or from NTIS (as #PB95-268033INZ).**

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Keoleian, G., and D. Menerey. *Life Cycle Design Guidance Manual: Environmental Requirements and the Product System*. Cincinnati: Risk Reduction Engineering Laboratory, ORD, U.S. EPA, 1993.

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Keoleian, G. "The Application of Life Cycle Assessment to Design." *Journal of Cleaner Production* 1, no. 3/4 (1993): 143-149.*

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DEMO PROJECTS/CASE STUDIES

AUTOMOTIVE

Kar, K., and G. Keoleian. "Application of Life Cycle Design to an Intake Manifold." SAE Technical Paper Series 960410. 16 pp. Warrendale, PA: SAE International, 1996.

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Keoleian, G., and J. McDaniel. *Life Cycle Assessment and Design of Instrument Panels: A Common Sense Approach*. SAE Technical Paper Series 970695. Warrendale, PA: SAE International, 1997. Reprinted from SAE's *Design for Environmentally Safe Automotive Products and Processes*, 75-86.

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* Limited copies of documents marked with an asterisk (*) are available from Greg Keoleian. You may contact him through CSS via email: css.info@umich.edu

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