

Chapter 1: Introduction

Whether recycled or landfilled, once waste is generated it must be managed, collected, and transported at considerable and rising expense to the University. Any effort to reduce the generation of waste at its source would be the most prudent approach . . . The potential benefits . . . are enough to justify the effort.

— University of Michigan Environmental Task Force Report, 1990

As asserted by the above quotation, source reduction of waste merits serious attention as a focus for effective environmental initiatives. Following this paradigm, the University of Michigan Pollution Prevention Master's Team (PolPrev) has completed a project intended to encourage pollution prevention at U-M's Ann Arbor campus. This goal has been fulfilled, in part, by completion of a campus-wide environmental audit and two subsequent demonstration projects.

Document Scope and Format

Having implemented these demonstration projects, we wished to present our experience as a guide for pollution prevention efforts at any university. Therefore, in this document PolPrev shares its experiences at U-M and provides a framework for future initiatives.

In Section I, we describe our audit methodology and present the general questions we formulated for our university-wide audit. We also describe our criteria for selecting the two demonstration projects: a pollution prevention initiative at the U-M School of Business Administration and a program to institute a university-wide chemical tracking system (CTS).

In Section II, we discuss these two demonstration projects in detail. To be more effective in our role as "outside consultant" in each project, we drew upon the theoretical principles of action research, community participation, and behavior change. Discussion of the projects is prefaced by a description of this theoretical grounding.

Our two demonstration projects are presented in a somewhat unusual format: story-like chronologies. This format best illustrates the evolution of our ideas and critical decision points; we also believe that it is most effective for giving readers a vicarious experience on which to base their pollution prevention projects.

Lastly, in Section III the group draws upon its experiences to provide an overall strategy for university pollution prevention. This section should not be viewed as a “laundry list” of potential projects, but rather as an integrated approach to such initiatives. Detailed recommendations for conducting audits, locating an area for useful intervention, and completing the implementation phase are included. We also discuss the contributions that students, staff, and university officials can make to a project’s success.

Section I	Section II	Section III
Environmental Audit	Methodology Business School Case Study Chemical Tracking Case Study	Recommendations and Strategies for Pollution Prevention at Universities

The Pollution Prevention Concept

As defined by the U.S. Pollution Prevention Act of 1990, pollution prevention is the maximum feasible reduction of all wastes generated at production sites. Resource consumption is decreased through source reduction, energy efficiency, reuse of input materials during production, and reduced water consumption. There are two methods of achieving such reductions:

- Changes in processes (e.g., changing technology or input-material choices) and improvements in operating practices such as housekeeping, maintenance, training, and inventory control
- Redesign of products, including changing their composition or changing the use of the intermediate or end products

Federal policy further governs waste reduction efforts through the 1980 and 1984 Hazardous and Solid Waste Amendments to the 1976 Resource Conservation and Recovery Act (RCRA). As of 1992, waste minimization legislation had also been passed in 26 states. Additionally, Carol Browner, the newly appointed administrator of the U.S. EPA, has expressed a desire to shift the government’s emphasis from pollution regulation to pollution prevention.

Benefits of Pollution Prevention

The positive impacts of multi-media¹ pollution prevention initiatives range in scale from local to global. From a business perspective, benefits include cost-avoidance in the areas of production, materials, energy consumption, and disposal. Also, reductions in pollution generation rates, and other improvements, can bolster an organization's image.

Of greater importance to the general populace are the benefits that pollution prevention can have on public health. Reductions in effluents, in air emissions, and in landfilling of solid and hazardous waste should reduce the incidence of cancer and lung related illnesses as well as health disorders caused by water-borne contaminants. Furthermore, reduced consumption of natural resources coupled with a reduction in sulfur, carbon, and nitrogen air emissions will slow the buildup of greenhouse gases and thus decrease the risk of global warming.

Origin of the Project

As part of the EPA's overall commitment to pollution prevention endeavors, the National Pollution Prevention Center for Higher Education (NPPC) was created in October 1991. Sited at the U-M School of Natural Resources and Environment, the NPPC's mission is to develop materials that incorporate pollution prevention into higher-education curricula. The NPPC will offer curriculum modules, short courses, internships, and seminars for a variety of academic disciplines including business, engineering, industrial design, natural resources, public health, and law.

Colleges and universities can play a major role in the development of public policy, but they also consume vast quantities of energy and resources and generate substantial amounts of waste. As businesses and other institutions look to academia for policy guidance, it is incumbent upon universities to provide leadership and develop innovative initiatives in the environmental arena. In light of this, in 1991, Gerald Kotas (then Director of the U.S. EPA Pollution Prevention Division) challenged NPPC Director Jonathan Bulkley to establish a pollution prevention strategy for the University of Michigan. This challenge is addressed in part in this document by the members of PolPrev, whose fields of study include resource policy, environmental education, environmental advocacy, and urban planning.

¹Multi-media indicates a variety of waste types (water, air, solid waste, hazardous waste).

Section I
The Audit

Chapter 2: Environmental Audit

Introduction

In this chapter, we provide background on campus environmental audits, explain how we designed our own audit for U-M's Ann Arbor campus, and list the detailed questions that we used. The actual results of the audit can be found in Appendix I. In closing, we discuss how the audit served as a springboard for choosing our demonstration projects and intervention strategies.

Audits as Resources and Starting Points

The information from an environmental audit can be a starting point for researching pollution issues at any institution. Such an assessment of waste generation and energy consumption can highlight areas for potential intervention and provide a baseline for comparing subsequent increases or decreases in a specific waste stream. Performing an audit can also help facilitate the intervention process. For example, while PolPrev was conducting the 1992 U-M audit, the University community became aware of and interested in our Project. This, in turn, helped us establish credibility within the community. As a result, we developed important contacts throughout many U-M departments and were presented with a variety of opportunities for interventions.

To assess the impacts a school has on the environment, research can begin with the identification and evaluation of any previous audits or related studies of the campus. At the very least, an existing audit can help in developing criteria and questions for the current audit.

The first audit PolPrev had access to was one conducted at the University of California at Los Angeles (UCLA) in 1990. Although it was detailed

and informative, we wanted to research as many audits as possible to ensure that we were not overlooking any possible areas of concern. In attempting to locate any previous audits conducted at U-M, we contacted the National Wildlife Federation's "Cool It!" project office in Washington, D.C. Although no audit of U-M could be located, Cool It! gave us copies of audits conducted at the University of Georgia, Central Michigan University, Pennsylvania State University's Wilkes-Barre campus, and the University of Illinois at Champaign-Urbana. These audits covered a range of areas, including solid waste, radioactive waste, medical waste, pesticides use, transportation, water use, energy consumption and procurement policies.

It should be noted that no audit is comprehensive, nor should the results from an audit at one university be considered representative of all universities. Campuses vary in size, population, research and study topics, and location; many also differ widely in the ways they operate or handle environmental issues.

Audit Methodology

PolPrev developed objectives and a methodology to be completed in phases to identify waste streams, energy usage, and the individuals knowledgeable about them. Phase I entailed developing the U-M audit—the questions, framework, and methodology for collecting the information. Phase II involved conducting the campus-wide audit, and Phase III required evaluating the information that had been collected and choosing a focus for our demonstration projects.

Developing The Audit

PolPrev began the audit process by researching a variety of environmental audits from other campuses to determine:

- general pollution problems encountered at other universities
- methods for auditing amounts and sources of that pollution
- barriers to reducing those wastes
- intervention strategies adopted by universities
- successes.

Believing ourselves to be the first group to perform such work at U-M, we saw the need to gather as much general information on as many campus

waste and energy streams as possible. This would help us decide which streams and policies to target with our demonstration projects; it would also provide valuable baseline data for subsequent pollution-prevention work at U-M. Hence, we decided to develop an audit with greater breadth than depth.

Based on a review of other audits and the EPA's *Guides to Pollution Prevention: Research and Educational Institutions*, a sub-group of PolPrev members formulated audit questions, objectives, and a methodology for PolPrev "auditors." As the sub-group developed the audit framework, it concerned itself with the following questions:

1. *Should PolPrev look at the entire University of Michigan, including the Flint and Dearborn campuses, or should we just look at the Ann Arbor campus?*

Based on time and resource constraints, we would limit our research and demonstration projects to U-M's Ann Arbor campus.

2. *What time-frame will we look at? Do we want to gather information from the last one, two, or five years?*

We wanted the most recent information available, but we would also gather as much relevant information from the past as we could.

3. *Can we develop some standard unit of measurement (e.g., electricity consumed per registered student credit hour) for the sake of comparisons with other universities?*

The sub-group outlined specific units of measure for each waste and energy stream to be investigated.

4. *Do we want an approach geared toward the administration? Staff? Students? Vendors? Everyone?*

Our focus would be toward the U-M administration and staff. Their involvement in the planning, decision-making, and operational processes of the University cast them as valuable and informative contacts.

5. *Are we interested in conducting a survey along with the audit? Is a survey feasible?*

PolPrev would wait until we had chosen our demonstration projects before conducting surveys. This way, the surveys would be more specific and tailored toward the needs and interests of the smaller groups.

6. *Is the audit intended to be purely descriptive, or will it also contain recommendations?*

It would be purely descriptive in nature, providing us with a picture of the various waste and energy streams as well as other areas of concern at the University. Instead of using a life-cycle approach to the U-M processes and procedures, we chose a “materials-balance” approach. A life-cycle approach looks at all aspects of materials and processes and their impacts including purchases, use and disposal, and full-cost accounting. A “materials-balance” approach, however, limits the scope of analysis to inputs and outputs as seen in Figure 1.

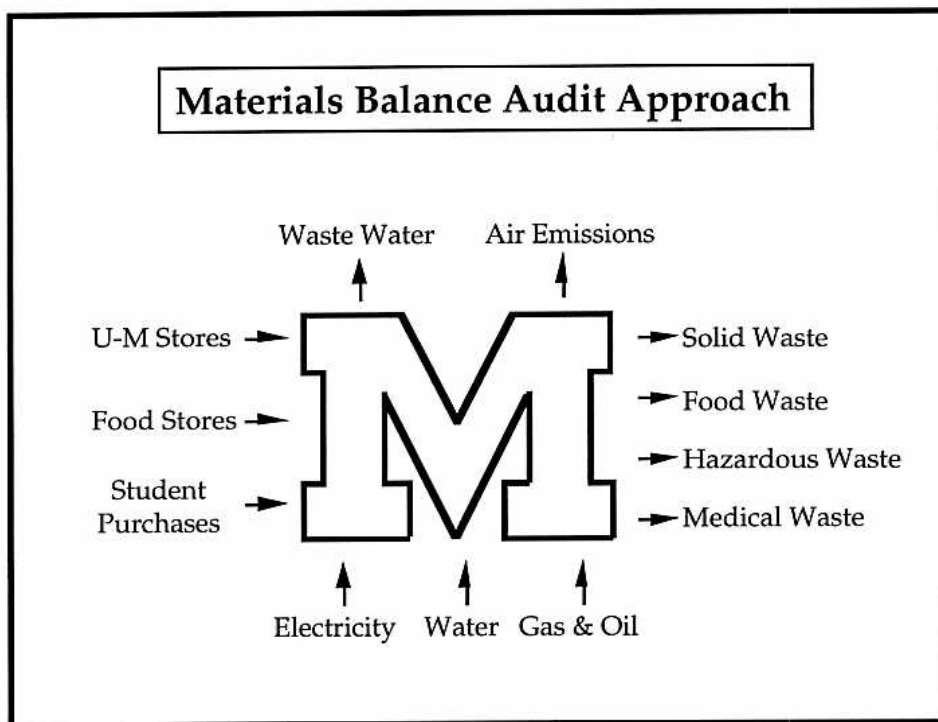


Figure 1

Finally, after researching the other campus audits and reaching a consensus on these questions, we chose 12 areas to investigate: solid, hazardous, radioactive, and medical waste; air and water emissions; food, energy, water and pesticide and herbicide use; procurement policies; and transportation.

Simultaneously, we made note of the contact people referred to in the other universities' audits and generated a list of possible U-M contacts whom we believed could either answer our questions or at least point us in the appropriate direction.

Conducting The Audit

Once we developed our audit questions and framework, we faced the task of actually collecting the information. Because of our one-year time constraint, four PolPrev members remained in Ann Arbor over the summer to perform the audit. Each individual assumed responsibility for three of the 12 categories to be researched.

The audit process was very time-consuming. It involved making repeated telephone calls to different offices, playing "phone tag," hunting for alternative sources of information, and conducting many personal interviews. Chapter Six, "Strategies for University Pollution Reduction," describes some of the barriers we encountered along with strategies for overcoming these obstacles. In Appendix I, we present our audit findings. We hope they provide an understanding of the University's impact on the environment. For clarity, a brief glossary follows the audit results.

Questions for Campus Environmental Audits

General Campus Information

1. name and address of school
2. # schools and colleges
3. public or private
4. urban or rural
5. # students (undergraduate, grad, part-time, full-time)
6. # faculty and non-faculty staff
7. physical plant (# buildings)

Solid Waste (cubic yards/year; tons/year)

- How much total solid waste does your campus generate annually?

(This may need to be broken down by dorms, departments, administration, etc.)

- For the ____ year, how much was landfilled?

 how much was incinerated?

 how much was recycled?

 how much was composted?

- Who is in charge of solid waste disposal contracts?
- Does your campus have a recycling program? Is the program run by students or by the university administration?

If yes, how many tons of each material did your campus recycle for the ____ year?

white paper _____ newsprint _____

colored paper _____ glass _____

computer paper _____ aluminum _____

cardboard _____ other _____

- Does the city operate a recycling program? Is it voluntary or mandatory? How does this affect the university's recycling program?
- What were the costs of solid waste disposal for ____ year?
- What was the cost of the recycling program?
- As a result of recycling how much have disposal costs decreased?
- What percentage of the total waste stream is yard waste? Are landscape clippings mixed or kept separate from other campus wastes? Does your campus use landscape clippings as compost or mulch?
- What percentage of the total waste stream is food waste? Is food waste kept separate from other campus waste? Is it composted?
- Please describe any programs your campus has implemented to promote source reduction.

Hazardous Waste (kg/year; lbs/year)

- What are the departments and research facilities on campus that use hazardous substances and generate chemical wastes (laboratories: chemistry, biology, physics, art, architecture, photography, theater, grounds and maintenance)? What types of wastes are generated?
- How much hazardous waste does your campus generate annually?
- Where and how are hazardous wastes stored?
- How is the hazardous waste disposed of? How much waste is disposed of by each of these means: recycling, incineration, landfilling, etc?
- How many incinerators are located on campus?
- What are the total costs for disposal contracts for the ____ year?
- Which waste disposal company collects hazardous materials from campus?
- Does your campus have a history of violating hazardous waste disposal regulations?
- Has your campus initiated a hazardous waste reduction program? Have microscale chemistry techniques or hazardous waste exchange programs been initiated? If not why?

Radioactive Waste (gallons)

- What activities on your campus (bio-medical research, medical therapies, energy and scientific research) generate radioactive waste? Who has access to radioactive materials?
- How much radioactive waste does your campus generate annually?
- What sorts of radioactive materials are used in campus facilities? Which isotopes?
- What are the terms and conditions of the university's license for handling radioactive substances? Who are the persons named on the license and responsible for campus safety?
- Is there a campus office in charge of radiation safety? Are there safety guidelines? A safety handbook? Is the official institutional policy regarding radioactive materials ALARA?

- How is the radioactive waste disposed of? Are different wastes handled differently? Where is the disposal site? Does your school have an on-site radioactive waste incinerator?
- What are the total costs for disposal contracts for ____year? Who pays for the disposal of radioactive wastes?
- Do we accept radioactive waste from outside sources, for incineration or otherwise?
- Has your campus initiated a radioactive waste reduction program? Please describe.

Medical Waste (lb/year)

- Where is the medical waste produced on campus?
- How much medical waste does your campus generate annually?
- How is the medical waste disposed of? Is it bagged separately and labeled appropriately?
- What are the total costs of disposal contracts for the ____year?
- Approximately what percentage of the medical waste generated is recyclable?
- Has your campus initiated a medical waste reduction program? Please describe.

Wastewater (gallons/day)

- How much wastewater does your campus generate annually? How is the amount estimated, or is it metered?
- Where does your wastewater go?
- What percentage of the capacity of your community's wastewater treatment facility is used to process campus generated wastewater? What kind of treatment does it receive?
- What costs are associated with treating wastewater?
- Has your campus been identified as a source of pollution for a local body of water?
- Has your campus initiated a wastewater reduction program? Please describe.

Pest Control (gallons)

- Does your campus have a pest control staff? Or are services contracted to a private firm?
- What are the most commonly used pesticides on your campus? Are more pesticides used indoors or outdoors?
- What is the total volume of pesticides used on your campus?
- Are warning signs posted when pesticides are applied? Do they meet or exceed regulations? How are excess pesticides disposed of?
- What are the total costs for contracts and purchases related to pest control?
- Are non-chemical pest control methods used on campus?
- Has your campus initiated an Integrated Pest Management program? Please describe.

Air Quality (cubic pounds)

- What is the ambient air quality for criteria pollutants in the area? Are federal or state standards exceeded? How often?
- What sources on campus emit air pollutants (steam plants, incinerators, laboratory fume hoods, paint booths, fuel dispensing, fleet and private vehicles)?
- How much of each pollutant is emitted?
- How much air pollution does your campus generate annually? Most common pollutants?
- Has your campus initiated an air pollution reduction program? Please describe.

Energy Consumption (KWH electricity; BTU natural gas; BTU fuel oil; other)

- How much energy did your campus consume in the ____ year, and what were the costs associated with each type of fuel?

_____ KWH electricity

_____ BTU natural gas

_____ BTU fuel oil

_____ Other (wood chips...)

- Does your campus have an energy conservation program? Please describe.
- Does your campus have a plan to encourage the use of renewable energy sources? Please describe.

Transportation (#cars registered/day = # cars on campus/day)

- How many vehicles travel onto campus daily?
- How many fleet vehicles does your campus operate? How and where are they serviced and fueled?
- How much waste oil and solvents are produced from the campus garage? How is it disposed?
- Are any campus fleet vehicles operated using alternative fuels? Describe.
- What percentage of your campus area is devoted to roads and parking lots?
- Has your campus initiated a program to encourage alternatives to the single occupant vehicle? Ride-sharing programs? Bike lanes? Public transportation? If so, please describe.

Water Consumption (gallons)

- How much water did your campus consume for the _____year?

_____ (gallons)

_____ (gallons per square foot)

- What percentage of water is used indoors versus outdoors?
- Is water use metered separately for individual buildings? Is the irrigation system metered?
- What types of irrigation system does your campus use?
- Does your campus have a system to monitor for leaks or water efficiency?
- Please describe any water conservation programs on your campus, include the date of implementation.

- What were the utility costs for the university for the ____ year? Are water utility costs for the campus increasing or decreasing? Why?
- Do campus buildings have low-flow water devices? Have older buildings been retrofitted?
- Is reclaimed water being used in any facilities or for landscaping purposes?
- Who pays for water use? Is each department billed or is there one water bill for campus?

Food

- Who operates campus food services?
- Who is responsible for making decisions about menu planning?
- What are your food services' purchasing criteria? What kind of food items are purchased, when, in what volume and at what cost?
- To what extent does your campus buy from local producers and processors?
- Do your food services purchase any certified organic produce, dairy or meat products?
- What is the current practice for disposing of food waste? Have any food recovery or food compost programs been initiated?
- Have food services discontinued the purchase of any food products for environmental reasons?

Procurement Policies

- Does your campus buy recycled paper?
- What types of recycled paper does your campus purchase?
- What is the price difference between recycled and non-recycled paper?
- How many tons of high-quality paper did your campus purchase for the ____ year?
- What programs and policies have been established on your campus to promote the use of ecologically sound products?
- Does your campus purchase other recycled products such as oil or tires?

- Does the campus, one or more departments, or student association/governments have a policy of preferentially buying products made from recycled materials instead of virgin materials? Please describe the policy.

Audit Results

To see how we answered these questions as well as what the U-M data were, please refer to Appendix I in the back of this document.

How We used the Audit Results

After completing the audit, PolPrev assembled to evaluate the data. We were now ready to target particular waste streams for our demonstration projects. The first step was to eliminate those streams that appeared to have little chance for successful intervention. The following questions served as guiding criteria during our decision-making process:

- Do the numbers suggest that the waste stream is “significant”?
- Is intervention feasible given our short time line?
- Were the contact people easy to work with?
- Did contact people express interest in PolPrev’s project and goals?
- Does there seem to be interest and support from the University administration in targeting this waste stream?
- What are the University’s policies regarding this waste stream?
- Is this area too politically sensitive to allow for a meaningful intervention?

It should be noted that we were the first to conduct such a study at U-M and therefore generated only baseline data. Because we had no previous data for comparison, we could not use our data to assess the severity of the waste stream. Our data’s importance in our decisionmaking was, therefore, reduced.

After narrowing down the waste streams to approximately six, PolPrev decided that we would only be able to focus on two intervention projects. Next we took a vote to decide which two streams we would target for intervention. Because valuable contacts had been made within the Business

School and OSEH during the audit, the two projects we chose centered on the Business School and hazardous waste reduction. Enthusiastic support from these two departments also strongly influenced our choice.

In addition, these two projects seemed to complement each other. During the summer, the Dean of the School of Business Administration, Joseph B. White, had invited us to "green" the Business School. Such an opportunity would allow us to investigate and target all waste streams within one setting. On the other hand, the hazardous waste project would allow us to target one waste stream occurring throughout most of the University.

These demonstration projects are described in more detail in the next section, "Developing Projects for Intervention."