Section II

Developing Projects For Intervention

Chapter 3: Theoretical Bases For Demonstration Projects

Introduction

The demonstration projects represent a new stage in the Master's Project. During the audit we had collected data on the University's energy and waste streams. Now we would be actively intervening within different University departments to implement strategies to target those streams. To facilitate our work with these different departments, we relied upon several theoretical paradigms: action research, community participation, and behavior change. These theories and their relevance to our projects are discussed in this chapter.

Action research represents a dynamic approach to social planning and change. Practitioners of action research do not impose a fully formed action plan upon a community, but develop it within that community through a repeated process of action, evaluation, and refinement.

Our demonstration projects were located in the Business School, Department of Occupational Safety and Environmental Health (OSEH), and the Chemistry Department. Consequently, we were "outsiders" in the communities which would be affected by our projects. It was therefore essential to involve community members in the planning process, to ensure that their needs were adequately addressed and their expertise utilized. To elicit this involvement we drew from principles of community participation.

Both action research and community participation theories helped us to develop our projects and to establish a cooperative partnership with the communities involved. However, by April we had reached the stage for implementing our demonstration projects. In both the Business School and Chemistry Department, our projects would necessitate altering people's

existing behavior patterns; the projects' success therefore depends upon utilizing effective behavior change strategies. For this reason we have also included a discussion of behavior change techniques in the theory chapter.

Action Research

Action research provides a *methodology* for conducting research and is used most frequently in planning social interventions. In the United States, action research is associated with Kurt Lewin, who began publishing on this topic in the 1940s. Lewin (1946) described action research as proceeding "in a spiral of steps each of which is composed of a circle of planning, action, and fact-finding about the result of the action." (See Figure 1.) This ongoing process of setting goals, taking action, and stepping back to evaluate progress helps the practitioner to refine the research effort. Each step requires the researcher to clarify his or her goals and to adjust the strategies for achieving those goals. It calls for flexibility and emphasizes readjusting research in order to work toward continually more focused goals. Because action research is often between a researcher and the targeted community, it can be a means to include the community in the decision-making process. Indeed, "Lewin highly emphasized democratic decision making, a more equitable distribution of power, and the practical utilization of knowledge" (Wals and Stapp, 1989).

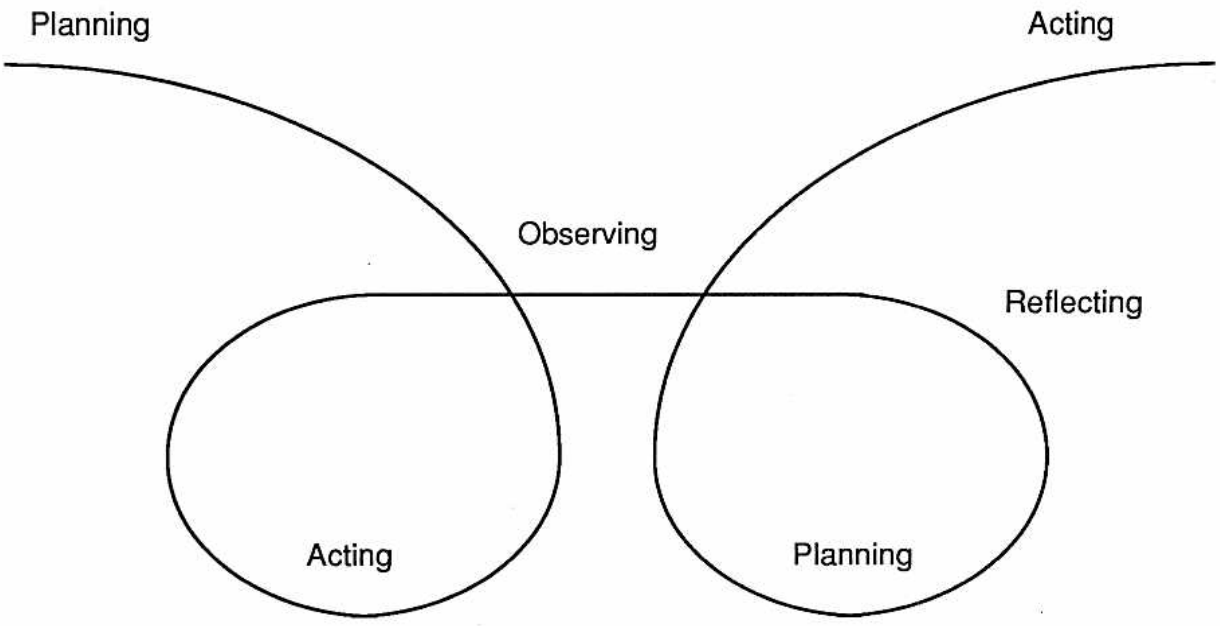

Figure 1

Action research can be viewed not only as a more democratic approach to planning, but also as a more practical one. By including community members in plan development, it allows them to understand the resultant project as the logical outcome of a long planning process rather than as a preconceived program imposed by outsiders. Furthermore, when a community has followed a project from its inception through various philosophical and physical transformations the final product is familiar to them. People who are involved in plan formation are thus more likely to feel competent to implement that plan (Kaplan and Kaplan, 1981).

Perry and Ortun Zuber-Skerritt (1992) summarize the main aspects of Altrichter's discussion of action research as: a group of people at work together, who are involved in the cycle of planning, acting, observing and reflecting on their work more deliberately and systematically than usual; and a public report of this experience (Altrichter, 1991, cited in Perry and Ortun Zuber-Skerritt, 1992). The evolution of the Business School and Chemical Tracking projects followed this spiral process of planning, acting, observing and reflecting and was enacted through meetings between the project groups and members of the targeted communities.

Wisner et al. (1991) emphasize the importance of effective communication in any action research that involves participation. They cite the jargon of different professional subgroups as a potential source of misunderstanding and an obstacle to project implementation. The Business School group, in particular, found it necessary to learn a new vocabulary in order to communicate effectively. For example, after the group had written a mission statement for the School, we worked with a member of that community to translate it into terms which would be acceptable and meaningful. Our group's long description of the greening mission became a systematic list of goals and strategies.

Community Participation

Numerous strategies exist for affecting community change. They range from mobilizing community members to take action, to involving them in the planning process, to developing community services (Checkoway, 1990). Typically, community participation is associated with work in low-income and other disadvantaged communities. However, the principles of involving the affected group in the planning and decision-making process of a project

are appropriate to any intervention. Such involvement better ensures that the group's needs will be met and that their expertise and resources will be utilized. In light of this, PolPrev relied upon community participation as one of its main tactics for implementing the demonstration projects.

Facilitating community participation from start to finish involves defining the community, eliciting participation, assessing the needs of the community, creating plans of action, reflecting on the experience, and creating new plans of action based on that reflection.

Furthermore, participation has been shown to increase the degree to which environmental changes meet participants' needs, values, and perceived control over their environment (Wandersman, 1979, Kaplan and Kaplan, 1981). Involving community members in the planning, implementation, and evaluation stages of a project often provides participants with a sense of ownership over the project, which in turn, can lead to a greater acceptance of the intervention within the community—especially if the participation stresses partnership (Arnstein, 1967; Brown, 1983a and 1983b).

If community participation is to occur, the community must have a certain level of competence—that is, feel that it is capable of tackling a task (Goeppinger and Baglioni, 1985). Iscoe (1974) noted:

> *the development of the competent community involves the provision and utilization of resources in a geographical and psychological community so that members of the community may make reasoned decisions about issues confronting them, leading to the most competent coping with these problems.*

Rappaport (1977) and Sarason (1972, 1974), among many others, have proposed similar definitions of the competent community. A common theme in these definitions is the notion that parts of the community develop congruent perceptions of one another through social interaction—in other words, people need to interact with one another to better appreciate the talents that each community member possesses. Congruent perceptions are necessary for the identification and resolution of community issues.

Eng (1988) has developed one model for community participation. In her article, *Extending the Unit of Practice from the Individual to the Community*, she maps out the following process for eliciting meaningful community participation. Defining the community comes first in order to diagnose the degree to which the community is capable of solving the situation at hand. It also helps to clarify the community's problem-solving and decision-making

structures. Initiating community action early in the intervention process by asking community members to join a core team helps the interveners in carrying out the assessment. Finally, defining the community gives the interveners a method for establishing rapport with influential people in the community and enables them to ask for their advice and assistance.

At this stage, a rudimentary needs assessment can also take place to study the problems identified by the community and to better determine members' present needs. Meetings, interviews, and surveys are among the more common needs assessment techniques, and were utilized by both the Business School and Chemical Tracking groups. Needs assessments can be a powerful tool for helping to bring a community together, and for developing support within the community for an intervention project.

The results of the assessment can then be used to plan action. As a part of this, it is helpful to form a core group of interveners and community members to determine the goals and objectives of an intervention. The goals and objectives should reflect the changes desired by the community.

The next step in the process is to select from the range of possible activities which could potentially achieve the goals and objectives. The sum of these activities represents the intervention which will address and resolve the problem identified earlier (Eng, 1988). Finally, evaluation of the intervention and the intervention process is critical to complete the experience: (1) Did we reach our goal? (2) What positive and negative effects are our interventions having?

The community participation model put forth by Marti-Costa and Serrano-Garcia (1987) is similar to Eng's. It includes four phases. The first of these phases includes familiarizing oneself with the community (e.g., seeking knowledge of its history and structure and the processes that would facilitate entry into it). Key persons in the community who are likely to support the intervention are also identified at this stage.

The second phase is characterized by the formation of a core group that ought to include both key community persons and interveners. This group directs and coordinates the needs assessment, and chooses the assessment techniques that will be most applicable to their particular situation.

In the third phase, the core group should publicize to the community the results of the needs assessment in order to let members know what needs

were identified. The final phase involves the formation of task groups to define long- and short-term goals and to develop further action plans.

For maximum effectiveness, group tasks should emphasize cohesiveness, not hierarchical splintering (Marti Costa and Serrano-Garcia, 1987). By doing so, the community will feel more involved and more empowered to implement change. As Robert H. Hayes (1985) said, "Do not develop plans and then seek capabilities; instead, build capabilities and then encourage the development of plans for exploiting them."

Behavior Change

Although we have not specifically utilized behavior-change techniques up to this point, they will be invaluable to the groups who will continue the projects we have begun. Therefore, what follows is a brief discussion of behavior change research, which provides a basis for understanding these future change agents.

The concept of conservation behavior refers to the wise use of our available resources. With the vast majority of American society being lured into the "consumption=happiness" lifestyle, the attempt to change people's behavior and to induce habits which support conservation can be a daunting prospect. However, researchers have studied the various techniques for behavior change and have identified those which work most effectively to induce change.

Cook and Berrenberg (1981) describe seven commonly used approaches to conservation behavior change:

- Using material incentives, such as cash rewards, and disincentives, such as fines.
- Evoking attitude-consistent behavior—"Am I doing what I believe to be right?"
- Facilitating implementation of conservation behavior (e.g., giving people the information they need to participate in recycling programs).
- Providing feedback on the effectiveness of conservation efforts.
- Communicating persuasively.
- Using social incentives (e.g., recognizing those in the community for environmentally sound behavior) and disincentives (e.g., calling

attention to those who are not engaged in environmentally sound behavior).

- Providing models of conservation behavior (e.g., endorsements from movie stars, the Dean, the President).

Studies have shown that these seven approaches are not all equally reliable and may not all be appropriate in a given situation. While the positive effect of information feedback on performance is well documented (Becker, 1978), the two most often-used behavior change techniques, the "economic" and "attitude-behavior" models, have been found unreliable (DeYoung, 1988). For instance, studies of efforts to apply the economic model to energy conservation policies have shown that people are slow to install cost saving devices in their homes. (It should be noted, however, that there is another possible explanation for this difficulty: a high initial capital cost to such projects, which could act as a disincentive). Such a contradiction of expectations demonstrates that human behavior is much more complex than the "rational actor" theory espouses (Yates and Aronson, 1983; Kaplan and Kaplan, 1981).

Other studies suggest that economic incentives may actually be counterproductive. Although people may adopt conservation behavior when a reward is offered, they come to associate environmentally positive behavior with this reward: once the reward is removed, they no longer practice the behavior. Even those individuals who had practiced recycling *before* economic incentives were offered, may come to associate this activity with a reward and will stop recycling once the reward is withdrawn (DeYoung, 1988). Thus, economic rewards are not durable.

The more effective behavior change strategies allow for the participant's involvement and cognitive engagement. When DeYoung investigated the attitudes of recyclers and non-recyclers, he found that one of the main differences between the two was not their attitude toward recycling but the amount of procedural knowledge they had of the activity (how to recycle cardboard, where to take it, on which days). This suggests that providing information may be an important strategy for encouraging conservation behavior, and that attitude change should not be the only focus of efforts. If conservation programs are to be effective, people need accurate information about how to carry

out conservation activities—exactly how does one recycle, for example—and not just familiarity with recycling in general (De Young, 1986).

Other studies have shown that different psychological and positional factors interact to determine an individual's actions ("positional factors" being those factors which restrict or facilitate a person's action.) According to Costanzo, Archer, et al. (1986), the following conditions must be met if information is to be effective in prompting action: "the information must be perceived, the individual must favorably evaluate the information, the information must be understood and remembered." Further, they found that the most compelling information is vivid and concrete, comes in the form of a personal story (as from an acquaintance), it comes from a credible source, and it is relevant to the recipient.

Another common behavior change technique is the use of prompts, such as a sign proclaiming "Turn off the Lights" next to a light switch. According to Katzev and Johnson (1987), however, research has not shown prompts to be very effective as the sole behavior change strategy. Although they may have an immediate effect, they lose their impact rapidly and do not create durable or long-lasting behavior change. The authors suggest that prompts might be more effective if they are combined with other techniques. A water conservation study conducted by Aronson and O'Leary (1983) examined the rate of compliance when prompts and models were used. People taking a shower were asked to turn off the water while lathering their hair and body. The compliance rate was 19% when a prompt was used. However, that figure jumped to 49% when one person modeled the behavior, and two models increased compliance to 67%. Such social influence techniques appear to be most effective if they request incremental changes from people. This is a "foot-in-the-door" approach which allows people to adopt new habits gradually rather than asking them to commit to a major change.

De Young's 1986 study of recycling attitudes suggests that social disincentives may hold some potential for promoting conservation behavior. The study indicated that some people were recycling even though they did not have positive attitudes towards recycling. It is possible that these grudging recyclers were motivated by social pressures and did not want to be conspicuous as the only ones on the block who were not recycling.

A promising approach to conservation behavior which has yet to receive much attention is the use of intrinsic motivation. "Intrinsic motivation"

refers to an open system of behavior, with emergent or intrinsic rather than promised or extrinsic goals. Such motivation comes from within a person, such as the belief that an action should be performed because it is the *right* thing to do, rather than because of social rewards or punishments. DeYoung (1988), drawing upon his research on intrinsic motivation, postulates that much of human behavior can be explained "in terms of goals and rewards that arise out of participation in an ongoing activity" (p. 282). Because intrinsic motivation is not dependent upon outside agents, it may be a reliable technique for fostering long-term, sustained conservation behavior.

Documenting an Action Research Project

The action research section in this chapter describes the dynamic approach of planning, acting and refining which we used to develop our projects. To best reflect this approach, we have documented our projects in a chronology form which allows us to present the evolution of the project and to highlight major decision points and periods of transition.

The chronologies serve an additional purpose. When we undertook our Project, our intention was to present our demonstration projects as guides and learning tools for others undertaking similar projects. We believe that others can best learn from our experiences if we present them in the form of case studies. Research has found stories can provide a form of vicarious experience. These new experiences are effective teaching tools and means of making people feel competent to act in situations similar to those presented in the stories (Bardwell, 1991; Freeman and Levstik, 1988; Monroe and Kaplan, 1988). We hope that the stories will provide a map for others wanting to travel a similar route, including those places to seek out and those places to avoid.

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Chapter 4:
Case Study at the Business School

Introduction: Rationale for Choosing the Business School

While reviewing our audit of the University in the fall and discussing the types of projects PolPrev could undertake, we recalled a message sent to us during the summer by Professor Jonathan Bulkley, our advisor.

> *Project Team: I had a meeting with Joe White, Dean of the Business School. He is very interested in involving MBA students in an audit of the waste generation at the Business School. He basically offered the B-School as a focal point for your work. He pointed out that it would have all of the components except toxic labs. We can talk about this—it might be very helpful. Prof. Hart is the key contact in the B-School.*

Once we met with Hart, assistant professor of corporate strategy at the Business School, we discovered that the Dean not only wanted an audit but also wanted us to create a model for a "Green Business School." We realized that a pollution prevention project focused on the Business School would provide the opportunity to study an entire, essentially self-contained, unit. The Business School produces each type of waste stream existing at the University, with the exception of hazardous waste, and thus represents a microcosm of the University of Michigan as well as universities and colleges in general. We therefore believed that change implemented at the Business School could serve as a model for other institutions.

By offering the Business School as a site for a demonstration project, Dean White was giving us institutional support. Because the project calls for a fundamental change in many of the School's operating procedures, such support from

a top administrator was essential. According to Waterman in his book *Adhocracy: The Power to Change* (1992),

> *[top management support is] an important perk. Ad hoc work is difficult and stressful for most people.... People will not spend the time, take the work seriously, or feel good about what they're doing unless top executives are involved and perceived as sharing the sense that the project is a top priority.* (p. 31)

A further reason we found the Business School appealing was that business and environmental concerns have traditionally been viewed as being at odds with each other. Our project would provide an opportunity to demonstrate the possibility of cooperation between the two. Furthermore, if the Business School can engender an environmental business ethic through its curricula and operations, graduates of the school can help to spread this new ethos to corporations and other entities throughout the world.

Because of these possibilities for change, the Business School represented an exciting challenge for us. Five of PolPrev's members therefore chose to work with the Business School to encourage it to be more environmentally responsible.

Profile of the Business School

To give an idea of the size of the school, we have provided a profile of the school buildings, facilities, and population. We also include a description of innovations in curricula, since these illustrate the dynamic quality of the Business School and the potential for including an environmental component in the curriculum.

The Business School is housed in four adjoining buildings, occupying a total of 331,264 square feet. The oldest building, Business Administration, was erected in 1947. This unit contains many administrative and faculty offices as well as classrooms, auditoria, and support services such as a photocopy center. Assembly Hall holds administrative offices, several larger classrooms, and an Auditorium. Paton Accounting Center houses several classrooms, the extensive three-floor Kresge library (211,000 volumes, 400,000 microforms and 3,200 periodicals and serials), a two-tier student lounge and snack bar, and a 500,000 square-foot computing center with 119 microcomputers. Finally, the Executive Education Center maintains several lecture halls, conference and meeting rooms, a restaurant, and a hotel.

During the 1991-92 academic year, this institution employed 138 faculty and 210 staff members. Faculty conduct research in 11 disciplines.

For the 1992-93 academic year, student enrollment consisted of: 536 BBA candidates, 33 dual-degree Bachelor's/Master's in Accounting candidates, 867 full-time MBA, 1029 part-time MBA, and 90 Ph.D. As the largest segment of the school, the MBA students are divided into six sections. In general, members of each section attend classes together over the course of the two-year program.

Several notable curriculum innovations deserve mention. The Business School blends 7- and 14-week courses so that new courses may be introduced. One such course, "Corporate Environmental Strategy," was team-taught by Stu Hart, assistant professor of corporate strategy, and Garry Brewer, dean of the School of Natural Resources and Environment. The recently introduced Multidisciplinary Action Project (MAP) allows student teams to work with companies on core operating processes. Within this setting, they describe and analyze problems, identify improvements, outline measurements, and enumerate costs and benefits.

Another curriculum innovation parallels the format of successful executive seminars. Students are offered a range of non-credit workshops conducted by external consultants and corporate training specialists. Executive education is used as a tool for innovation and enlivenment of the curriculum. Students solve "real life" problems, particularly in the areas of Managing Critical Issues and Strategic Quality Management in which organization-wide efforts are formalized.

The recently revamped orientation program includes a two-day "Global Citizenship" module that places students in community action settings. Through this, students form ties with local non-profit organizations and continue to work with them while enrolled in the MBA program. This experience highlights the interdependence of business and society. In 1992-93, one Global Citizenship curriculum focused on the environment.

Project Overview

As described in Chapter Three, our demonstration projects were influenced by the principles of action research and community participation.

The community participation approach proved important at the Business School, where our group was an outside force. It was essential to include members of the Business School community within the planning process to ensure that the any plan we conceived would be appropriate to the needs of that

community. Our group had previously had little contact with the Business School and we now found it necessary to learn new ways of framing problems and to familiarize ourselves with a new vocabulary. Since we needed to orient ourselves to the School, we allotted much of our time to gathering information about the School and surveying existing attitudes.

Our partnership with members of the Business School community was very influential in the development of our project. Initially, we envisioned the greening project as a series of pollution prevention strategies that *we* would initiate. After a semester of meetings with our contacts at the School, however, we realized that we did not possess enough inside information to be the primary change agents. If the greening of the School was to be a continuing process, we would have to create a structure within the Business School which could initiate pollution prevention efforts itself. We therefore decided to create a core committee, the Green Team, comprised of students, faculty and staff at the School.

The following chronology outlines the development of our project, highlighting the importance of our contacts in the Business School, our efforts to familiarize ourselves with the community, and the problems we faced as outsiders. In closing, we provide a list of recommendations that we believe will help to establish the Green Team as a permanent committee within the Business School.

Chronology

October 8, 1992: First Meeting at Business School

The Business School group met for the first time with Stu Hart, our Business School liaison. Hart, assistant professor of corporate strategy, has been working to promote the concept of environmentally responsible corporations. Our contact with Hart was important throughout the project. As an insider, he was able to listen to our proposals and ideas and then translate them into business terms; in one of our first meetings he reminded us that the Dean was now our "client."

From Hart, we learned that Dean White was committed to "greening the school." However, the Dean did not want a "laundry list" of different intervention projects, but rather wanted us to create a model for a "green school." He requested lists of recommendations, curriculum changes, issues to consider when remodeling the building, and other factors which should be considered when cre-

ating an environmentally responsible institution. Hart also mentioned that White was willing to invest money in greening projects that fell within his jurisdiction.

We agreed that, in order to look to the future, we needed to assess the current situation and obtain baseline data for the Business School. We therefore decided to come to the next meeting with a list of contact people and a first draft of a Business School audit. (See Appendix II for audit results.)

At a Business group meeting, we divided the responsibilities for conducting a preliminary audit. The areas we investigated included:

- Physical Waste Streams: solid waste, utilities (water, electricity, heat, gas, oil), food, cleaning chemicals;
- Operations: landscaping, parking, purchasing, standard operating procedures, organizational structure.

While we understood that we were to create a model, we still envisioned implementing specific pollution prevention strategies as part of that model. Our group's goal was to institute several technical changes along with the behavioral changes that might be required to make those technical changes effective. We also planned to continually solicit input and recommendations from students, staff and faculty.

November 4: Genesis of the Business School Survey

During our weekly group meeting we decided that, since we were unfamiliar with the Business School community, we should conduct a survey to help us gauge attitudes. We wanted to learn to what extent the community was aware of, interested in, and concerned about environmental practices at the school. The survey would also provide an opportunity to solicit suggestions and observations from those in the school. This information would augment our baseline data and help us shape an appropriate intervention for the School.

November 6: Meeting with the Business School's Environmental Club

In order to increase our knowledge of attitudes at the Business School and to continue soliciting ideas, opinions, and impressions from the community, the Business group scheduled a meeting with the Business School Environmental Society. Our conversation with students in the club gave us some insights into potential interventions and the barriers to success. The students had themselves instituted several intervention projects and were somewhat skeptical about the chances for effective behavior change. However, their lack of success may have

occurred because they worked alone without administrative support or recognition. Their experience emphasized the need for such support.

November 15: A Model Begins to Emerge

The Business group met to review each member's vision of an environmentally sound Business School. Ideas ranged from the practical issues to consider when creating this type of school to a vision of the "ideal green school," at which, for example, companies with poor environmental records would be banned from recruiting. We then began to build a framework for the model, incorporating these different perspectives: a strategic plan, an outline of the philosophy behind the model, a diagram of "The Green Business School," and a list of the policies, behaviors, and tenets that should be encompassed in a "Green Business School."

November 18: Draft Model Reviewed

In a meeting with Hart, we discussed the first draft of the model. We had broken our model of the "Green School" into three components: a diagram mapping out the different areas of the School that would need to become environmentally responsible if the School itself were to be called "green" (policy, operations, and curricula); criteria for a strategic planning process that could lead to such a School; and a list of the specific goals and objectives which could guide the planning process. (For first draft models see Appendix III.)

After examining the plans, Hart helped us reframe them in terms more suited for the Business School. For example, our list of goals included the term "low-impact school," but he informed us that this phrase would not be well received: while the term "low impact" has positive connotations in the environmental context (suggesting that an activity causes minimal disturbance to the environment), in the business context it means "ineffectual"! Working with Hart, we translated our model from a list of goals and objectives into a mission statement and goals. The mission is a long-term vision that is potentially achievable; goals are more specific and have a short-term timeframe.

At this meeting, we gained a better idea of strategic planning in the business world. Hart advised us that, once our goals had been set, the first strategies to be implemented should be the "low-hanging fruit"—strategies that are easily accomplished and have a high return rate (e.g., installing new energy-saving light fixtures). Such strategies would create momentum for projects which will take longer to complete.

November 19–December 19: Toward A Clearer Model

Through a series of meetings and planning sessions, a coherent model for an environmentally responsible Business School emerged. This model represented a *process* through which the "Green School" might be created. First we provided a mission statement, the ultimate goal. This was followed by a list of shorter term goals which would achieve that mission. In order to accomplish each goal, the team developed strategies and then smaller projects which would work toward accomplishing the strategies.

A major goal was to encourage students, faculty and staff to value environmental responsibility. One of the strategies for achieving this goal was to provide experiential opportunities for increasing environmental awareness; a project that would help promote this strategy was incorporating environmental advocacy into the Global Citizenship module. Another strategy to achieve the same goal of environmental responsibility was to educate and motivate students, faculty and staff with informational prompts. A project included in this strategy could be to post "turn off the lights—conserve energy!" prompts by light switches. Clearly, the effects of one project would go beyond the specific strategy for which it was intended, but we arranged projects, strategies and goals in separate groupings in order to clarify the greening process.

After lengthy deliberation over the tone of the mission, we decided to write a bold, all-encompassing statement that would incite feedback and comments. We debated each word, knowing each was important, but fearing that these powerful words might be a tough veneer for an ineffectual policy and no change. Each word of the mission statement was ultimately agreed upon by consensus. It read as follows:

> *The University of Michigan Business School will become environmentally responsible in every aspect of its operation, including administrative policy, physical operations and curriculum. The Business School will provide students and executive education participants with direct experience in an environmentally sensitive culture, which will influence their decisions and actions throughout their careers. Other universities and University of Michigan departments will look to this ethos as a model for their own operations.* (See Appendix IV for the complete model.)

Assessment of Project

After almost a semester of meetings with members of the Business School community, our vision of the project had shifted considerably. Initially, we had

envisioned group members as instituting pollution prevention strategies while enlisting support and input from within the Business School. We now realized that the dramatic changes involved in creating a "Green School" could barely begin within the next four months. In addition, we no longer felt that it was appropriate to choose which strategies should be implemented. As Kaplan and Kaplan (1981) assert, "[t]he degree to which an individual comprehends a situation and understands what can be done is often crucial. The very perception an individual has of a situation may create or destroy the opportunity for participation." People within the Business School had an intimate knowledge of the institution, while we were outsiders and lacked such knowledge.

During this time of transition, we conceived of the idea for an environmental advisory committee. This would become the group's major contribution to the "greening of the Business School." This committee, or Green Team, would be comprised of Business School students, staff, and faculty, and would promote the greening process from within the School. At this time, we still planned to implement some pollution prevention strategies in addition to forming the Green Team; it was not until the middle of January that the Green Team became our primary focus.

To inform the Dean of our project's evolvement, we wrote him a letter describing accomplishments to date and outlining our plans for the future.

January 11: Meeting with Deans of Business and Natural Resources

Dean White, Professor Hart, the Business group, Professor Bulkley, and Garry Brewer, dean of the School of Natural Resources and Environment (SNRE), were present. Brewer was invited to this meeting because he was co-teaching a course in the Business School.

This was the team's first meeting with our client. Having sent out all meeting materials well in advance, we expected White and Brewer to have read them. When it became apparent that we needed to give a brief summary of PolPrev and our demonstration project, both deans explained how many pieces of paper pass their desks each day. We then understood that we could not expect them to remember (or even read) the materials we sent them—it was necessary to remind them of what we were doing.

After hearing about our Green Team idea, White expressed enthusiasm. He said that it would be a major new committee in the structure of the school—a steering group that would feed into existing systems. We were beginning to feel

some success. Then the conversation took an unexpected turn: White asked Brewer, "Is there something like this going on in your school, Garry?"

While seemingly asked in jest, this put Brewer somewhat on the defensive. He replied, "No, but there ought to be!" We suddenly found ourselves agreeing to take on another project: the greening of our own school. Being somewhat intimidated by the presence of two deans (most of us had never even spoken with them before this meeting), none of us felt able to disagree.

After the meeting, our group discussed how to handle this new development. After re-evaluating our time-frame and seeking Professor Bulkley's advice, we sent Brewer a memo explaining that we would be unable to carry out his suggested project. The next week we met with him to confirm our answer. He was adamant about the need to "green" the School of Natural Resources and Environment, so we offered to recruit new graduate students to work on that project. (See Appendix XIV, "Conference Presentations.")

We learned that we needed to have as clear an idea as possible about how much we could reasonably accomplish in our timeframe—and that we should not be afraid to decline other projects, no matter how exciting they might sound.

January 19–21: Survey of the Business School

We postponed our survey of the Business School until the beginning of the winter semester, when students would be less preoccupied with exams and assignments. Our purpose for this survey was threefold: (1) to assess the current situation by learning the problems and solutions that people have already considered, (2) to gain a clearer picture of the attitudes of people in the Business School, and (3) to provide an initial method of involving the Business School community in the greening of the institution. We conducted the survey in the Business School student lounge 10:00 a.m – 2:00 p.m. on two consecutive days, and then for an hour during the break in night school classes.

Because U-M Business School students are over-surveyed, we decided to provide them with a material incentive. Two signs reading "Food for Thoughts: Fill out a short questionnaire for a *free* bagel" were posted, one at the entrance to the lounge and one at the survey table inside. Because we did not want to only target individuals interested in environmental issues, our signs did not divulge the survey topic. The team solicited staff respondents from the Offices of Admissions, the Dean, and Research Administration; the Library; the Cognitive Science

and Machine Intelligence Laboratory; Plant Building Services; and the Executive Residence. The survey consisted of the three questions listed below:

1. *"Have you ever noticed energy or materials being used inefficiently in this building? Please give examples."*

2. *"What strategies could help the Business School use energy and materials more efficiently?"*

3. *"What do you think Business School students, faculty, staff, and administrators could do to save energy and materials in this building?"*

The surveys were copied on the blank sides of paper recovered from the recycling bins. The words "This survey is printed on 100% reused paper" were printed on the bottom. It seemed appropriate to use this opportunity to model conservation behavior.

A total of 77 students responded to the survey. The response rate was quite low during the night school classes, because people were in a hurry, and free bagels were not offered. Of the 36 staff members we solicited, 32 responded, many writing several sentences for each survey question. Sixteen staff and students expressed interest in finding out more about the Green Team and gave us their names and addresses.

The responses were quite consistent. Students and staff cited two major problem areas: energy (lights, heating and cooling, electricity) and solid waste (paper consumption, recycling, disposable items). Solutions were creative and pragmatic, covering behavioral and information strategies as well as policy changes. The students had ideas such as: "replace most paper flyers with information on TV monitors and e-mail," "recycle more paper," and "turn off lights/ turn down the heat." One general comment was that "too much money is spent on providing redundant information." Other responses are listed below.

"Ask for input from staff and faculty and listen to it. There is a large amount of experience you're not relying upon."

"Students don't look for ways to recycle but will likely participate if it is handed to them."

"Make everyone aware of the inefficiencies and ask for everyone's help in implementing change."

"Put can and bottle recycling containers in more places."

"Make recycling mandatory for all people at the business school (professors as well as staff people)."

"I am not sure but I think lights are left on too long."

"More careful planning or utilization of existing school resources."

"Encourage people to take more pride in facilities or more consideration for their peers."

"[Give] feedback as to good efforts we've done."

(For more detailed survey results and a copy of some completed surveys, see Appendix V, and Appendix VI, respectively.)

January 29–February 8: Meeting with Dean White; Constructing the "Green Team"

We met with Dean White, Professor Bulkley, and Susan Svoboda, an MBA graduate working as a business-environmental consultant. All three provided us with useful suggestions and insights for the formation of the team.

We were advised to identify the areas of expertise needed in the Green Team and to write a charter which would help team members visualize their mission. In addition, the Green Team would need clear goals, which could provide motivation, and measures with which they could assess their success in achieving these goals. The initial Business School audit, for example, could provide the baseline data for setting waste reduction goals.

During the week following this meeting, the Business group drafted the charter. It included a mission statement and described the Green Team's role in fulfilling it. It also suggested operating procedures and criteria for membership. To reflect the composition of the School, we suggested a membership of two students, two faculty and four staff. (See Green Team Charter, Appendix VII)

February 18: Presenting the Project to Targeted Students

We gave a 20 minute presentation in which we described our project to the Corporate Environmental Strategy class. This class seemed a likely source for potential Green Team applicants. After the presentation, six students expressed interest in joining the team.

March 3: Evaluation of Green Team Formation

The Green Team had now become our primary goal in the greening of the Business School, and we met to evaluate the progress of its formation. In our revised approach, the Green Team would be the sole implementor of the demanding task of "greening" of the School. It was essential to provide as much support as possible. We decided to compile a resource folder for the Green Team; this would contain the information we had already gathered. This folder would include a copy of the baseline audit, a list of University members with a range of expertise who have agreed to serve as resources for the Green Team, copies of the survey results, the mission statement and model, the Green Team charter, a copy of this report, and selected bibliographical material. We would also provide the Green Team with suggestions as to where they should be able to effect change that is: (1) easy and visible, (2) money-saving in the short term, (3) money-saving in the long term, and (4) not money-saving but still environmentally important.

We hoped this information would help the team target the most promising areas for interventions and would provide the resources that would facilitate their work. Such information is important because often both procedural and declarative knowledge are needed before people feel comfortable and confident to make behavioral changes (DeYoung, 1989). Specific data and directions for where to obtain expert advice would help guide the Green Team in choosing intervention strategies.

March 8: Preparation for the Initial Meetings

While the group wanted the Green Team members to plan their own meetings, we also wanted to ensure that key content areas were discussed in the first few meetings. We identified all the issues which we thought should be addressed and then prioritized them. Most crucial was that Green Team members gain a clear idea of the group's purpose. Although a draft charter would have been distributed to all members, further discussion and refinement of the charter would be necessary. Green Team members need the opportunity to react to the charter and tailor it to their situation. (See agendas in Appendix VIII.)

March 11: Facilitating the Green Team Formation

We met with Hart who suggested that we facilitate the Green Team formation by drafting an invitation letter for White to send out. It had become clear to us that "dean as manager" was not the same as "dean as active participant." The team now recognized that through him the process of team formation could

occur, but only in the sense of a door being open. An open door allows people to pass through, but does not help them through. Again, we re-evaluated our approach, and realized that we would have to take a more active stance if we were to ensure that the Green Team could meet enough times to be comfortable with its charge by the end of the semester.

We also discussed Green Team leadership, and decided that the leader should be allowed to emerge rather than being chosen from the outset. After a meeting or two, it should become clear who is enthusiastic and has initiative.

March 12: Initial Intervention —Energy Audit

Although we believed that the Green Team should identify its own areas of concern and enjoy its own success, we also thought it important to provide Team members with some momentum in the process of making the Business School more environmentally responsible.

Yoshiko Hill, Utilities Engineer at the Plant Department, had agreed to perform an in-depth audit of electricity use at the Business School and to recommend energy-saving strategies. The team helped with the audit, describing our project to the staff we encountered. The reception was generally favorable.

When the Green Team meets, it will already have a project underway at the School which should serve as inspiration for further projects. (For lighting audit worksheet, see Appendix IX.)

March 14–16: Student Green Team Members Recruited; Groundwork Laid

Having drafted a charter and an invitation letter, we were ready to recruit members for the Green Team. Time did not allow a wider search, so we chose members from the lists of people who had already expressed interest. Hart was better acquainted with the Business School community than we were, so we asked him to make the selections. Although potential team members had already been chosen, there was a delay in the proceedings: the Dean, who was to send out the invitations, was away for the week. We decided to meet with the student members to get them involved as soon as possible.

March 23: First Meeting with Potential Green Team Member

We met with Jim Hanley, one of the potential student members of the Green Team, and presented him with the Green Team charter and the mission statement for an environmentally responsible Business School. He expressed enthusiasm about most of the plans but was concerned that Green Team

members would not know the right questions to ask or the right people to consult for advice. We told him about the resource folder and he agreed that this would be helpful. At the end of the meeting, he said that he would call the other potential student member so they could discuss the project.

May 10: First Green Team Meeting

The first Green Team meeting was attended by two members of the Business School group, three staff, two faculty, and one student, who chaired the meeting. Everyone made introductions and reviewed the documents in their resource folders. The Business School group members explained the purpose and scope of the Green Team, with one of the professors adding that all members should have a chance for their ideas to be heard.

The entire group expressed desire to begin with some visible and easily performed projects. The staff member in charge of document processing suggested that two-sided photocopies become the standard in the Business School. A professor asked if this would cost more, but the staff member explained that it would actually cost less money while, obviously, saving paper. After discussing this, the Team agreed that all document-processing requests in the Business School would be automatically done on two-sided copies; people wanted single-sided copies would have to specifically request them.

The Team members were very enthusiastic about their challenge. They decided to attempt several projects over the summer. Two members of PolPrev's Business Group agreed to stay on as "consultants" during the summer, with two others taking over that responsibility in the fall.

For More Information on How the Green Team Has Fared Since its Inception, Please Refer to Page 49.

Conclusions

When we began the Business School demonstration project, we saw our group as the change agents: armed with baseline data from the audit and with input from members of the Business School community, we would design pollution prevention strategies that would transform the School into an environmentally responsible institution. However, after a period of information gathering and meetings, we realized that merely soliciting input from the community was

insufficient. Change could not be effectively initiated by outsiders, and the community itself should therefore provide the structure for the greening process. As outsiders we faced several disadvantages. Most importantly, we were only at the School occasionally and had no one to actively promote the project in our absence. Our realization that the greening project would be much better accomplished from within the school, caused a fundamental shift in our approach: our group's role would become that of facilitator, and we would step back from taking too active a part in the greening. This new thinking prompted the conception of our idea for a "Green Team."

The greening project also required much more time than we had available. For instance, more time was required to publicize the project and thus extend the opportunity of joining the Green Team to all interested applicants.

Recommendations

The Green Team will soon be ready to begin its mission of greening. We would therefore like to provide the following recommendations, drawn from our recent experiences of project development. These recommendations represent not only those strategies which we found effective, but also those which, with hindsight, we believe would have made our project run more smoothly.

Gaining Recognition. Although members of the Green Team have the advantage of being insiders, they still must work to give the Green Team a high profile within the Business School community. Greening will necessitate institution-wide change, and this cannot be easily effected by a committee which remains peripheral to the community. By publicizing the Green Team's mission and goals, the team will also start to integrate the concept of greening into the Business School culture. Furthermore, as the Green Team gains recognition, it will become the focal point for other Business School members who are interested in helping to institute environmental responsibility.

The *Monroe Street Journal*, the widely read Business School newspaper, can provide the Green Team with a method of communication with the School and the wider community. The *Journal* has a weekly circulation of 3,000 comprised of students, staff, faculty, executive education attendees, other Business Schools and corporations. (See Appendix X for a copy of the article.)

Administrative Support. As part of its campaign to gain wider acceptance, the Green Team must continue to utilize the Dean's support. Although our group did not work in an active partnership with the Dean, we were able to channel the mission statement and charter through his office where these documents could receive the stamp of administrative approval. The fact that the Green Team invitations came from the Dean's office lent greater validity and weight. Further, it indicated that spending time on Green Team activities during the work day was condoned.

Financial Support. The Team will require both high administrative recognition and financial support if it is to endure. A permanent financial basis for its operations should prevent the "Green Team" from fading to the precarious status of a "nice idea." The Team should therefore request a line item in the Business School budget which will secure funds for its activities and provide the Team with a permanent base.

Creating and Evaluating Goals. The Green Team must create concrete goals to guide their work. Although the Charter provides a mission statement indicating long-range goals as well as projects which can be accomplished in the shorter term, it does not provide any specific measures of success. Therefore, should the Green Team decide to enact a "prompt project" and to post prompts requesting people to "turn off the lights," the Team should also create a measure with which they can gage the effectiveness of the project. For example, are they aiming for a 50% reduction in the number of rooms left lit when unoccupied or a 100% reduction. Once goals are set, a project can be evaluated to ensure that the chosen tactics are effective. A survey conducted after the prompt project might reveal that 75% of classrooms with prompts are left just as brightly lit as those without prompts—suggesting that new tactics must be devised.

Utilizing Existing Structures. The Green Team's work will be easier if its members can enact their strategies within pre-existing organizational structures. As previously mentioned, the Business School curriculum is open to change and has recently incorporated innovative educational approaches. The curriculum could thus provide a logical place for the Team to promote its message. For example, educational units which encourage discussion of environmental issues could help to incorporate an environmental ethic within the School's culture.

Forging Cross-Campus Links. Lastly, we recommend that the Green Team continue to forge and maintain cross campus links with departments and individuals who can provide useful feedback for their projects. At a large university, resources and expertise that could be of great benefit to one department are often available in another. However, the lack of communication and connections between departments works against sharing of such useful information. For example, Brent Chrite, Administrative Manager at the Business School, was not aware that the Plant Department could assist with evaluation, planning, and sometimes even funding of lighting projects until the Business group asked Hill to conduct an energy audit at the School. This new contact promises to be beneficial since the Business School may now use the University Plant Department as a consultant.

Follow up: May - December, 1993 - The Green Team on Its Own

Since this document was first printed in May, 1993, the Green Team has been very active. The following is a brief summary of what transpired in the months following the official "end" of the Master's Project.

Throughout the summer, the core committee members, with the exception of the students who were not in Ann Arbor, met and put into place the duplex copying policy which was agreed upon on May 10. Several members also addressed the Quality Team, a group of the20 most senior administrators in the school.

When school started in September, other staff, students, and administrators wanted to join the Team. As it turned out, there was so much interest in being a member of the Green Team that the meetings proved unwieldy. Debates were being held on what direction or action to take but nothing substantive was resulting from the meetings. Thus, the Green Team decided to split the Team up into three sub-committees. The committees were Operations Management, Curriculum Development, and Behavior Change/Marketing. These three groups represented three areas within the school that the Green Team was trying to make more environmentally sensitive.

The membership on these sub-committees was loosely coordinated. Since there were now three students involved in the Green Team, one student coordinator was assigned to each committee. Other than the student coordinators, no one was assigned to a specific group. In retrospect, for accountability's sake, this was not the best option for the Team. The next few months resulted in low attendance at the sub-committee meetings and the

creation of a sense of isolation among those who were going ahead with individual projects.

In December, the sub-committees decided to coalesce back into one Green Team. The Team had lost a few members along the way but the resulting group of 10 people were truly committed and ready to move forward with the tasks at hand. In a sense, the member's endurance was tested from having taken the wrong approach.

The following is a list of the projects which the Team started in the interim: a staff magazine collection for reuse at local Nursing Homes; a coursepack drive during exam week for reusing and recycling students' coursepacks; the adoption of the duplex printing option (printing out on both sides of the piece of paper) by the computer center; and the creation of a pamphlet for staff entitled "A Guide to Office Recycling." There are several other projects which are in the planning stages, such as having confidential and non-confidential re-use/recycle boxes for paper so that drafts can be printed on reused paper that has non-confidential materials on the back. Also, the person in charge of the Snack Bar is looking into purchasing recyclable plastic forks, knives and spoons.

Despite the success of all of these great projects, by late November, the Team was really beginning to feel frustrated by the lack of "buy-in" from the administration. The members, with their grassroots approach, found it difficult to ascertain what was going on in the school. For example, the Team members wanted to get large recycle containers placed on the loading dock for materials which heretofore had not been recycled; however, the Team had no idea who would need to be present at a meeting to discuss the matter.

The members also decided to focus on one topic, solid waste reduction for the next two years rather than trying to do everything at once. Since Dean White had been so supportive of the Green Team concept, the student members decided to meet with him to see what he could do to help get the higher echelons of the Administration more on board. The Dean reaffirmed his interest in helping the Green Team succeed in its mission of "greening" his school and said that he would appoint some of his upper level staff to create a sub-committee of the Quality Council whose job it would be to interact with the Green Team and keep the Council abreast of the Green Team's efforts. Brent Chrite, Administrative Manager for the School, and Brenda Ostrowski, who manages the Documents Processing Division were appointed.

These two will meet with the Green Team in January to set out a policy statement which will lead to the inclusion of environmental criteria in staff's and administrator's job evaluations. The goal is to have the evaluative criteria in place within six months. The Green Team is confident that with their own grassroots pressure pushing the school from the ground, up and the Dean's pressure pushing the school from the top, down, that the vision of an environmentally sensitive Business school will slowly unfold and become a reality.

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Chapter 5:
Case Study in Chemical Tracking

Introduction: Need for a Chemical Tracking System

Like other large research universities across the country, the University of Michigan has been experiencing an upward trend in hazardous waste generation associated with its departmental research. The increasing amount of hazardous waste generated at the University, the rising cost of its disposal, and the safety hazards associated with the use and storage of toxic chemicals create a pressing situation that must be addressed.

After members of the Pollution Prevention Master's Project (PolPrev) spoke with key faculty and staff from the Chemistry Department and Occupational Safety and Environmental Health (OSEH), it became apparent to us that the University needed an improved means for integrating and updating its current system for chemical ordering, inventory, and disposal. Based on the information collected from our audit and the contacts we made with Chemistry and OSEH, PolPrev decided to implement a demonstration project focusing hazardous waste reduction at U-M.

Project Overview

We utilized principles of action research and community participation in developing and modifying our project. Initially, PolPrev's Chemical Tracking group envisioned implementing a chemical exchange program to reduce the University's hazardous waste stream. This is a chemical management system in which one researcher's unused chemicals become another's raw material. A researcher consults an inventory of available surplus chemicals before ordering new ones. In this way, researchers share unused

chemicals instead of disposing of them. However, as the project progressed and as we reflected on the information we had gathered, the barriers we had encountered, and the opportunities that had arisen for pursuing interventions, we found it necessary to change our intervention strategy. Rather than focus exclusively on the establishment of a chemical exchange program at the University, our group decided to channel our energies into researching and building the framework and support necessary to establish a chemical tracking system (CTS)—a computer database designed to monitor chemicals from the point of purchase to the point of disposal. Because a tracking system would not only help facilitate surplus chemical exchange, but would also enable departments to identify on-site chemicals, the amount remaining, and their specific location, OSEH and Chemistry personnel encouraged our group to pursue chemical tracking as the primary focus for our project.

Such periods of re-evaluation and change in our project represented major decision points for the Chemical Tracking group. These decision points are emphasized throughout the following chronology section to reflect the project's continual evolution and modification.

As a consequence of these modifications in the project, our group's role in the effort to reduce hazardous waste at U-M also changed. Originally, we envisioned our group as leaders of this effort. However, as we became more cognizant of the complexity of establishing a university-wide CTS, we realized that our group should adopt the role of facilitator—that of bringing together people from different departments to solicit their ideas and suggestions for the design of the CTS. We believed it important that users of the tracking system be involved in its design, not only for ownership purposes, but also to ensure that the system would meet their individual and departmental needs. The interdisciplinary nature of our project, which involved technical, economical, environmental, and social issues, was an additional impetus to include people from different departments and disciplines in the planning of the tracking system.

To facilitate these cross-campus links, the Chemical Tracking group decided to form a focus group of University administrators, managers, faculty, staff, and students to help assess different CTS software programs and make suggestions for establishing a tracking system at U-M.

Interviews with other universities, ongoing meetings with people from the Chemistry Department and OSEH, and consultation with companies

developing chemical tracking systems were also key action components of our project.

This chapter presents a chronology of our Chemical Tracking project, highlighting our planning process and the challenges we encountered while trying to implement an interdepartmental chemical tracking system in a decentralized University. A more detailed description of tracking systems and their potential value to universities is discussed in the proposal section. Lastly, in the recommendations section of this chapter, we discuss our vision for chemical tracking at the University—what we would like to see happen to the system, such as expanding the system throughout the University, and using it to reduce hazardous waste via surplus chemical exchange.

Chronology

June 2, 1992: Recycling and "U" Conference

At a conference promoting recycling at the University, OSEH intern Jeffrey Hacala gave a presentation on his study of hazardous waste generation at U-M. After the presentation, the PolPrev member responsible for the hazardous waste section of our audit spoke with Hacala to inquire further about the study. Hacala suggested contacting the Director of OSEH, not only to get access to this report, but also to obtain the hazardous materials audit information we were still seeking. This contact with Hacala served as a springboard for future contacts with OSEH and the Chemistry Department.

August 3, 1992: First Contact With OSEH

PolPrev scheduled a meeting with OSEH's Director, Ken Schatzel, and Hazardous Waste Coordinator, Hank Baier, who provided us with information and data for our audit and a copy of Hacala's 1992 report, *Strategies for Hazardous Waste Reduction at the University of Michigan*. While reading the report, we became increasingly aware of the hazardous waste problems at U-M. Hacala's waste stream audit showed a distinct upward trend in hazardous waste generation at the University. In addition, disposal costs were rising twice as fast as generation and more than five times as fast as research revenue. From this meeting and the insight provided by the report, we realized that hazardous waste generation at U-M was a pressing problem presenting an opportunity for pollution prevention.

August 17, 1992: Introduction to Tracking Systems

A second meeting with Schatzle and Baier was held to introduce them to our Project advisor, Professor Bulkley, and to discuss possible opportunities for carrying out a demonstration project that would focus on reducing hazardous waste at U-M. Both Schatzle and Baier were amenable to using OSEH for our demonstration project, but desired a better understanding of what our intentions were and what the project would entail. When asked what would be the one best way of reducing hazardous waste at U-M, Baier replied, "a way to track chemicals." This was our first introduction to CTSs.

At the same meeting, Bulkley mentioned that a member of the National Pollution Prevention Center (NPPC) External Advisory Committee—Joseph Morabito, Director of AT&T Bell Laboratories' Environmental Health and Safety Center—was involved in developing tracking systems. Because PolPrev was to present an overview of our Project and audit at the September Advisory Committee meeting, we decided that this would also be an opportune time to meet with Morabito to acquire a better working knowledge of chemical tracking systems.

September 2, 1992: NPPC External Advisory Committee Meeting

PolPrev members presented an overview of our Master's Project, including the findings from our audit and our desire to develop demonstration projects that would address problematic waste streams. Based on the audit findings, which indicated problems in the University's management of hazardous chemicals, and our interest in hazardous waste issues, Morabito encouraged us to look into Bell Lab's chemical tracking system as a means for reducing hazardous waste at U-M. He felt that although Bell Lab's system had been designed for use in industries, it could easily be adapted to meet a university's needs. At this point, however, PolPrev had not yet decided on demonstration projects and the waste streams that would be targeted. Thus, the idea of implementing a CTS at the University was viewed as only one of many possible pollution prevention interventions that could be pursued.

September 11, 1992: Demonstration Project Chosen

At the beginning of fall 1992, PolPrev evaluated the audit information that had been collected over the summer. As explained at the end of Chapter Two, PolPrev members carefully considered and then decided upon two complementary demonstration projects, one at the Business School and the other

focusing on hazardous waste reduction. Members interested in the latter met to discuss their ideas and suggestions for an intervention project.

September 17, 1992: OSEH Confirms Commitment to Our Project

Baier met with PolPrev's Chemical Tracking group to confirm OSEH's commitment to working with us on our demonstration project. As OSEH's Hazardous Waste Coordinator, Baier was very knowledgeable about practices at the University and helped guide our project in its early stages.

Initially, our group considered establishing a chemical exchange program. However, Baier felt chemical tracking would be a more viable and useful intervention. In an attempt to guide us in our project while ensuring OSEH's needs were met, Baier suggested that we:

- research and interpret Superfund Amendment and Reauthorization Act (SARA) Title III regulations and clarify which rules universities must comply with.
- research information on chemical tracking systems.
- contact the U.S. government and encourage the creation of a national MSDS (Material Safety Data Sheet) database.

Also during this meeting, Baier helped us to gain a better understanding of the nature and function of tracking systems by outlining what a CTS looks like. Overall, this meeting helped our group to establish a working relationship with OSEH and focus the beginning of our project.

October 6, 1992: Clarification of Questions

After reviewing several articles on CTSs and discussing the development of a chemical tracking project at U-M, we found that there were a number of general questions to clarify to ensure that we were focusing our energies in the proper direction. Once again, we decided to meet with Baier whom we hoped could address our questions. Prior to the meeting, our group prepared a list of questions for him (see Appendix XI). Some of the more important questions included:

- How can we get information on U-M's chemical purchasing practices?
- How do we obtain information on the number of individual labs using hazardous materials?

- What steps are necessary to implement a tracking system at U-M?
- What steps are needed to get support from the University community?
- What areas of resistance will we run into?
- Would it be helpful to focus on the Chemistry Department as a model for the chemical tracking and exchange program?

From this session with Baier, we gained new insights into how the University manages hazardous chemicals. A key piece of information was that maintaining a chemical inventory is left up to the discretion of each individual department. Whether a department chooses to inventory its chemicals (e.g., location, amount left in the container, date purchased) is completely voluntary.

Baier suggested the following as steps which needed to be taken prior to implementing a CTS at the University:

- Develop organizational charts for OSEH, the Chemistry Department, and University Purchasing and Stores to ascertain the key contact people in each of these departments.
- Create a flowchart of how the CTS will work at U-M.
- Bring staff and faculty together from different departments to help plan the tracking system to give them a sense of ownership over the system.
- Write a proposal or strong argument for the reasons why a CTS should be implemented at U-M.

Baier agreed that it would be helpful to focus on the Chemistry Department as a model for the chemical tracking program. Subsequently, our group began contacting chemistry professors to determine how the Department managed its hazardous chemicals and whether faculty would be receptive to using a chemical tracking and exchange program.

October 9, 1992: First Contact With the Chemistry Department

Our group met with Henry Griffin, Professor and Associate Chair, Department of Chemistry, to discuss the possibility of using the Department as a model for our demonstration project. Griffin expressed an interest in working with us and mentioned that implementing a CTS within the Department had been a goal of his for over a year.

This meeting gave our group a better idea of the different needs a tracking system would have to meet. On the one hand, OSEH wanted a system that would help the University achieve better regulatory compliance and that could generate SARA reports for the EPA. The Chemistry Department, on the other hand, needed a system that would track chemicals from the time they were received at the loading dock and "read into" the system by a bar-code reader, until the time they were disposed of and "read out" of the system. In other words, the system should allow the Department to maintain a comprehensive chemical inventory of all the hazardous chemicals in the Chemistry building. Furthermore, the system needed to be flexible enough to be integrated into the Purchasing Department's database.

Griffin stressed improved efficiency and safety as the major reasons for implementing a CTS. Waste reduction was not his primary focus, but he seemed to think that a CTS would help achieve this.

Overall, he envisioned our group piloting a tracking system in the Chemistry Department that would be both accessible to OSEH and interfaced with the Purchasing Department. This pilot project would then serve as a model for the rest of the University.

At the close of our meeting, he pointed out that we would need to convince key University administrators to fund this project. For this to happen, we would need to write a proposal describing the need for a CTS at U-M and how it would benefit the University. Our group agreed to follow up on these suggestions. However, we continued to struggle with the following questions: How will the tracking system fit into the Department's current system for ordering, receiving, controlling and disposing of hazardous materials? How can the system be adapted for use in a decentralized university?

October 14, 1992: Interviews With Chemistry Faculty and Staff

To learn how the Chemistry Department orders, manages, and disposes of its hazardous waste, our group interviewed research professors, the stockroom manager, and the building manager. During our interviews, it became evident that the Chemistry Department has no way of verifying what happens to the hazardous chemicals once they are received at the loading dock—it only records that the chemicals were received. After the individual researchers pick up their chemical orders, what happens to the chemicals is often unknown. This could pose any number of safety and fire hazards. For instance,

if a fire were to start in a Chemistry lab, the Ann Arbor Fire Department would have no way of determining what chemicals were in that lab and whether firefighters should enter such a potentially dangerous environment. Based on our research into chemical tracking systems, we believed such hazards could be prevented by implementing a tracking system.

October 22, 1992: Chemistry Department Committed to a CTS

After interviewing Chemistry faculty and lab managers, our group was put into contact with Richard Giszczak, the Department's Lab Safety Officer. At this meeting, we learned of Giszczak's involvement in the Department's plan to install a CTS. He had requested information from several companies that develop CTS programs. However, due to his other job responsibilities, he did not have the time to follow up on these contacts. He shared with us what information he knew about tracking systems and provided suggestions for how best to carry out our project.

Like our contact people in OSEH, Giszczak also felt we should put together some sort of design committee, comprised of people from several different departments, who could provide feedback on the CTS's design. In addition, he encouraged us to write a proposal to the University, requesting funds for the installation of a tracking system in the Chemistry Department. His commitment to having a CTS in place in the near future further indicated the Department's commitment to our project.

Also in this meeting, Giszczak spent time detailing how the Chemistry Department orders and manages its chemicals, and how a CTS would help make this process more efficient. Lastly, he suggested that we might want to consider attending an upcoming CTS presentation by Chemtox, a company that develops CTS software, which was to take place in Dearborn, Michigan the following week. We agreed that the presentation would be a good opportunity to research chemical tracking systems and decided to send two members of our group to the presentation.

October 28, 1992: Planning a Focus Group

As we increasingly realized the need to involve a variety of personnel in our project who were from a number of different departments, we decided to talk with Raymond DeYoung, an assistant professor in the School of Natural Resources and Environment (SNRE) who is knowledgeable about behavior change and community participation issues. DeYoung agreed that our project

would stand a better chance of being successful if it were to establish cross-campus links and were to invite people from different departments to participate in the CTS planning process. He suggested forming an administrative focus group, which would participate in a series of meetings to discuss their interest in and vision for a chemical tracking system at U-M. He also suggested establishing connections through letters and computer conferences if meetings were too difficult to coordinate.

November 9, 1992: Bell Labs Presentation

After speaking with the Bell Labs representative and conducting further research into chemical tracking systems, our group decided to schedule a presentation of Bell Lab's tracking system. As suggested by Baier, Giszczak, and DeYoung, we decided to bring together a focus group—composed of administrators, managers, faculty, staff, and students from different U-M departments —to discuss the benefits and feasibility of implementing a CTS at U-M. The following departments were represented: Chemistry, OSEH, Risk Management, Purchasing and Stores, SNRE, Civil and Environmental Engineering, and the Office of the Vice-President for Research.

Prior to the close of the presentation, we expressed an interest in forming a second focus group, which would meet before the end of the semester, to continue the discussion and assessment of the University's need for a tracking system. We passed around a sign-up sheet for people who wanted to participate in this ongoing work group. Those who signed their names—representatives from Chemistry and OSEH—became integrally involved in our project. With us, they formed the core working group that laid the foundation for the installation of a CTS at U-M.

December 8, 1992: Preparation for Chemtox Presentation

After members of our group had attended the CTS presentation by Chemtox earlier in the fall, we decided to ask the people who had attended the Bell Lab's presentation to also assess Chemtox's software package. Originally, we intended to invite the entire focus group back for this and other software review meetings, but Baier advised us that this process might be too tedious and time-consuming to keep the interest of the entire focus group. Consequently, we decided to just have the smaller working group attend the CTS reviews. We would send memos to the larger group to keep them informed or our project.

December 8–14, 1992: University Interviews

To assess how well adapted the Chemtox system was to a university setting, our group decided to interview staff at other universities who were currently using Chemtox's software. We prepared a questionnaire containing general questions about chemical tracking and exchange at the universities, as well as specific questions about Chemtox's tracking system (see Appendix XII). We contacted people at the University of Illinois (Chicago), West Virginia University, and Boston University. The interviews were very helpful in our assessment of the Chemtox system.

At the time, we hoped to conduct similar interviews with universities using other software programs, but discovered that we were essentially pioneers in this field. Only a handful of universities—those listed above plus Columbia University and Antioch College—were using these programs. However, of those universities, most were using the systems for report generation purposes, not to track chemicals.

December 14, 1992: Chemtox Presentation

As mentioned above, the Chemical Tracking group invited members of the core working group to attend this presentation. Due to scheduling difficulties with the representative of Chemtox, the presentation had to be electronically transmitted via a modem and speaker phone. To keep the attendees of the Bell Labs presentation informed of our group's progress, we documented the Chemtox Presentation and sent them memos.

Also at this meeting, we presented the working group with the first draft of our chemical tracking proposal. We asked each of the members to review the proposal and give us their comments and suggestions for revisions.

January 1, 1993: Stanford University Hit With Fines

Stanford University, cited for 28 violations in its hazardous materials (hazmat) program, was assessed a fine of $186,000 for infractions encountered in 1988-89. The newest infractions could result in penalties of up to $25,000 per violation per day. Our group hoped that the violations cited at Stanford would serve as an impetus for U-M to reassess its own hazmat program and take necessary actions to ensure compliance with federal and state regulations. The news article citing the violations lent credibility to our project by pointing out the need for improved chemical tracking systems on college campuses. This is especially important at large research universities like U-M.

January 12, 1993: Survey of the Chemistry Department

The Chemical Tracking group decided to conduct a survey in the Chemistry Department to obtain information on the amount of chemicals the Department purchases in a year. Giszczak organized the effort. Estimating the amount of chemicals purchased was no easy task for the Chemistry Department. Staff had to go back and manually total all the individual accounts (approximately 150) within Chemistry for the 12-month time period between September 1, 1991 and August 31, 1992—a process that took an estimated four full working days, further illustrating the need for a CTS at the school.

February, 1993: Computer Purchased

In early February, Giszczak informed our group that the Chemistry Department would be purchasing a computer for the purpose of using it as a CTS database. On one hand, our group was excited—Chemistry's decision to buy the hardware for the system re-emphasized their commitment to establishing a CTS for itself. On the other hand, we were concerned that the Chemistry Department would go their own way and, in effect, dismantle the groundwork we had laid to make this a cooperative project between OSEH and Chemistry. To expand and integrate the tracking system throughout the University, we felt it crucial that the project remain a cooperative effort between the two departments. To date, this continues to be a challenge for us.

February 18, 1993: Chemguard Presentation

Again, we limited the audience to members of the working group—primarily OSEH and Chemistry personnel. We documented the presentation and sent memos to members of the larger focus group. By this point, our working group had reviewed a total of three CTS software programs. While members of the working group were impressed with the design of two of the chemical tracking systems (Bell Labs and Chemguard), they still felt that we should at least review one or two other systems before choosing one for the University. Thus, we continued to research other available CTS programs.

March 3, 1993: LogiTrac Presentation

We concluded our review of different tracking systems by bringing in another company, Logical Technologies Inc., to give a presentation of their system—LogiTrac. While LogiTrac appeared comprehensive and adaptable to a university setting, the working group did not feel that it was as developed or easy to use as the Chemguard and Bell Labs systems.

After the meeting, the Chemical Tracking group met to debrief and to decide what our next step should be. With the semester drawing to a close, the group felt a need to bring the working group together one final time. We needed to assess the different chemical tracking systems we had reviewed and choose one that would meet OSEH's and Chemistry's needs, as well as one that could easily be expanded throughout the rest of the campus.

March 26, 1993: Proposal Submitted

In an effort to complete our demonstration project, we finalized the CTS proposal and sent it to key U-M administrators who would ultimately make the decision of whether or not to grant the funds for a CTS at U-M.

Our group also created a decision matrix (see below), to help members of the working group better assess the different tracking systems we had reviewed. Members were asked to rank the chemical tracking systems according to the systems' abilities to meet the criteria listed on the matrix (1 = poor, 5 = excellent). After ranking the CTSs, members were to mail us their responses so we could compile the data and coordinate a meeting to discuss the results.

Decision Matrix

Criteria	Bell Labs	Chemtox	Chemguard	LogiTrac
ability to track from purchase to disposal				
chemical inventory by building and room				
integrative with purchasing department				
ability to use barcode technology for data entry				
report generation capabilities				
accessible MSDS information				
user friendly				
cost				
reliability				
maintenance				
product support				
fully developed system				
licensing possible				

April 25, 1993: Meeting With U-M Administration

To ensure that our demonstration project's momentum would continue after we graduated, the Chemical Tracking group met with Vice-President for Research, Sarah Newman, to strategize ways to maintain support for the system and expand it throughout the University. She offered helpful suggestions and, most importantly, her support to continue working on this project.

Currently, we are investigating potential sources of funding for the system and are trying to establish it as a faculty sponsored research project.

For a discussion of how the project progressed during May–December, 1993, please refer to the end of this section, page 75.

Chemical Tracking Proposal

The implementation of a chemical tracking system at a university requires not only the support of the people who will be directly involved, but also financial support. To acquire the funding necessary to implement a CTS at the University of Michigan, the Chemical Tracking group drafted the following proposal, describing the function of a chemical tracking system and how such a system could benefit U-M. We sent this to key University managers and administrators, including the Associate Vice President for Business Operations, the Academic Affairs Provost and Vice President, and the Associate Vice President for Research.

Proposal for the Installation of a Chemical Tracking System at the University of Michigan

Executive Summary

The level and quality of research at the University of Michigan is among the finest anywhere, yet the increasing amount of hazardous waste generation associated with this research, the rising cost of its disposal and the safety hazards associated with the use and the storage of toxic chemicals are creating a situation which must be addressed.

The purpose of this proposal is to inform key people at the University about the value of installing a chemical tracking system at the University in order to gain their support. This document demonstrates how this project fulfills a necessary role in chemical management at the University and achieves quality management in an area with great potential for improvement at most universities in the United States. The University of Michigan has the opportunity to lead the nation's top research universities on the path toward improving regulatory compliance, safety, cost savings and waste minimization through accurate chemical management.

Problem Statement

Regulatory Compliance

Complying with federal, state and local hazardous material statutes may once have been optional, but with the passage of the Resource Conservation and Recovery Act (RCRA), Superfund Amendments and Reauthorization Act (SARA) Title III, and Occupational Safety and Health Act (OSHA) Right-To-Know laws, it is now a financial and legal necessity. Every year, the number of regulations governing the use of hazardous materials increases. As this happens, the cost of complying with those regulations also increases. Violations are leading to stiffening civil and criminal penalties.

Just this year, the California Environmental Protection Agency (CEPA) cited Stanford University's hazmat program for 28 violations including: containers that were badly rusted and ready to deteriorate, containers without labels, and incompatibles stored together. As a result of these violations, Stanford was assessed a fine of $186,000 for violations encountered in 1988–89 and was fined another $25,000 per day for the newest infractions.

The violations cited at Stanford University should serve as an impetus for Universities everywhere to reassess their hazmat programs and to take necessary actions to ensure compliance with federal and state regulations. Lack of compliance with these hazardous waste laws could result in fines of substantial magnitude.

Increasing Costs

A university that utilizes hazardous chemicals in teaching or research faces more than just the potential financial penalties associated with regulatory non-compliance. If a university lacks a comprehensive inventory control system, other costs likely to be incurred include:

- increased disposal costs.
- increased and often unnecessary chemical purchases.
- increased time and labor spent filing and updating records.

A recent waste stream audit conducted here at the University of Michigan revealed a distinct upward trend in hazardous waste generation (Hacala, J., *Strategies for Hazardous Waste Reduction at the University of Michigan,* 1992). The results of the report showed waste disposal costs are rising more than twice as fast as generation and more than five times the rate of increase in research revenue. Reasons for disposal included spent product of reaction, unknown age, and suspected contamination. Such reasons for disposal can be mitigated with improved inventory control. Thus, there is a need for tighter inventory control to achieve a more efficient purchasing strategy—knowledge of chemicals purchased or chemicals already in stock would be available.

Finally, the current University system for filing and updating chemical records is inefficient, labor intensive, and unnecessarily expensive. A chemical tracking system will greatly improve present conditions.

Safety

Presently, there is no system in place at this University to record and update the location of hazardous chemicals stored and used in laboratories. As a result, many chemicals are kept past their shelf life, presenting potential fire and safety hazards. The presence of unknown chemicals in laboratories

poses further hazards as in the case of fires, spills, or other emergencies. The University needs to address these safety concerns and implement a program capable of producing a hazard summary of chemicals in specific locations to facilitate emergency response.

Furthermore, Material Safety Data Sheets (MSDS)—documents containing vital health, fire, and exposure hazard information, as well as exposure treatment and chemical disposal procedures—are only useful when the people who need them, have them. MSDSs should be accessible to every employee 24 hours a day, 365 days a year. The University of Michigan would benefit greatly and serve as a role model of safety to other universities by installing a program that would make such accessibility a reality.

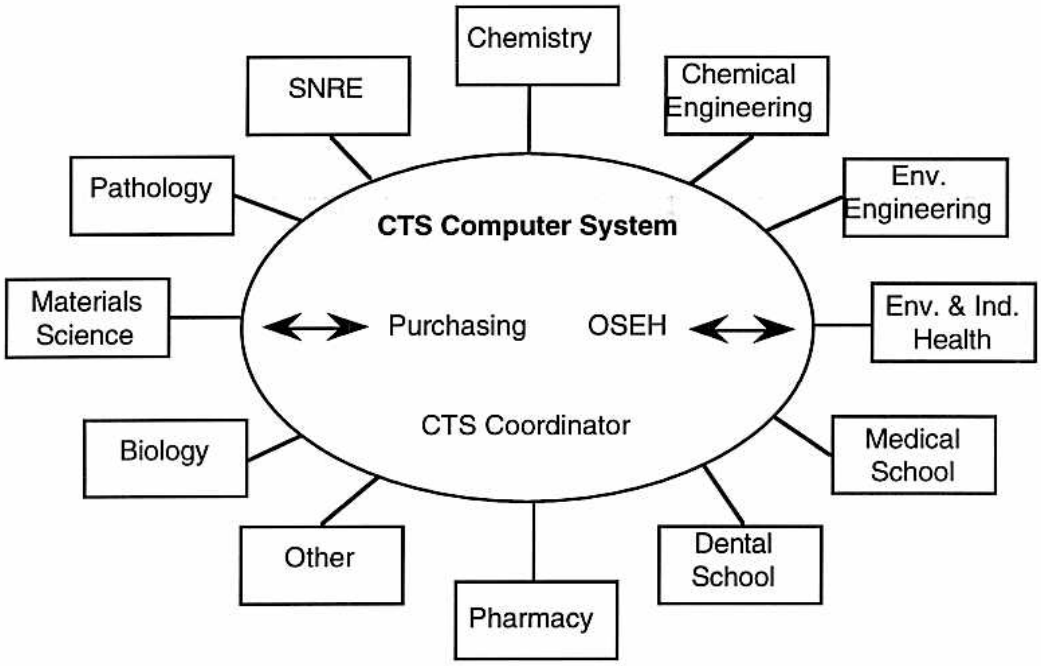
Waste Generation

The waste stream audit conducted at the University showed that 214,389 pounds of hazardous waste were generated in fiscal year 1990-1991. This represents a 29% increase over the 1989-1990 baseline of 165,864 pounds. The 1991-1992 totals were projected to be up 38% over that baseline. Findings also showed that the Chemistry Department ships more hazardous waste than any other department within the University. A successful chemical exchange program could help curb the upward trend in hazardous waste generation and significantly decrease disposal costs as well.

Action Plan

Since September 1992, the Pollution Prevention Masters Project has been working with the office of Occupational Safety and Environmental Health (OSEH) and the Chemistry Department in evaluating chemical tracking systems for implementation at the University. In March 1993, a pilot project in the Chemistry Department will test a CTS to determine its effects. Once the CTS is established in the Chemistry Department, expansion of the system to the remainder of the University could easily be achieved. OSEH would play a primary role in the expanded system. A CTS coordinator position should be created to oversee functional operations of the University-wide CTS. (See Figure 1.)

Figure 1: A Conceptual Model of a Fully Integrated CTS



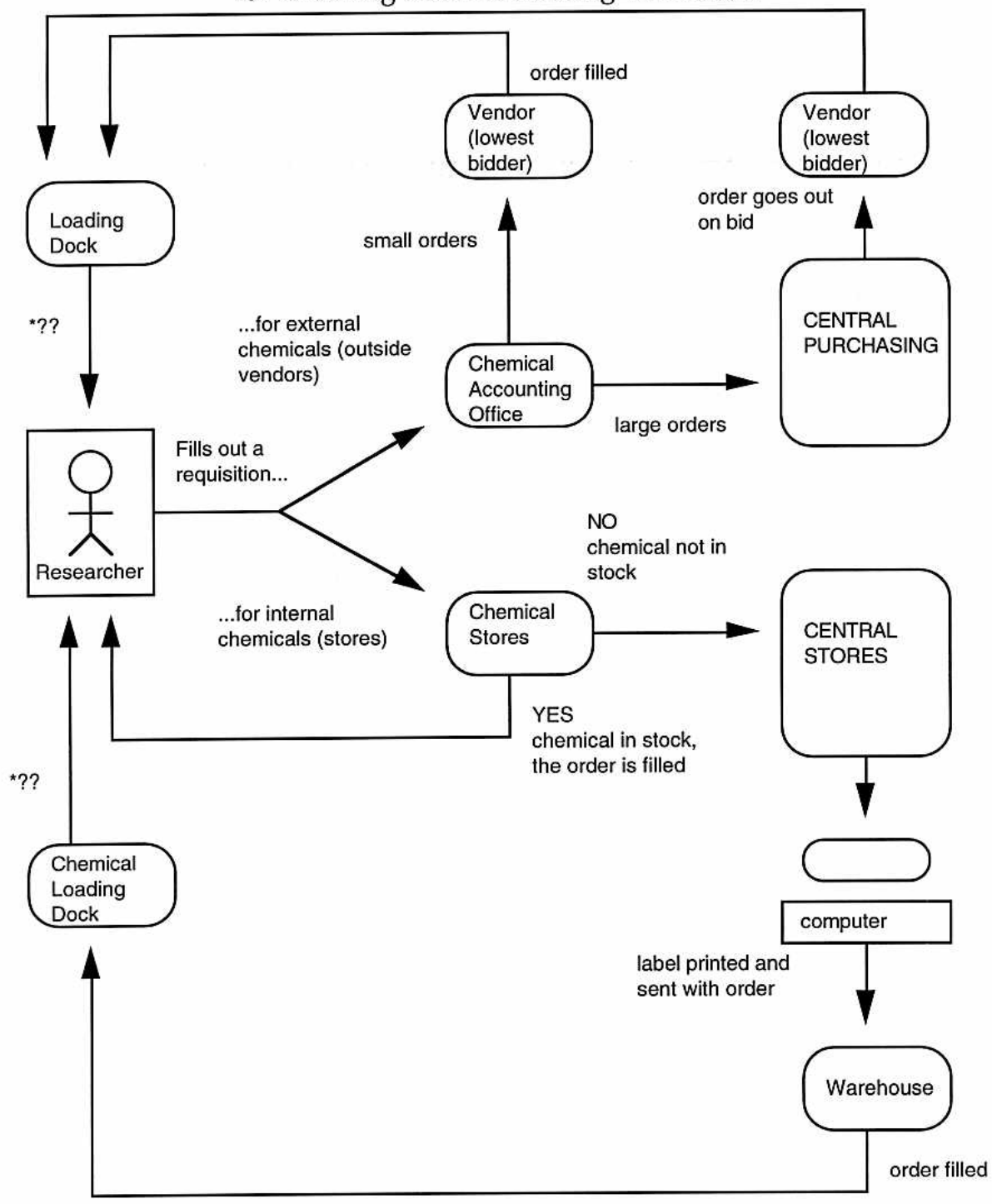
Description of a CTS

A chemical tracking system is a computer database that contains information on the handling, storage and disposal procedures necessary to safely deal with chemicals present at an institution. A computer database combined with bar-code technology provides the means to track the use of chemicals for safe and efficient management. At the University of Michigan, a quality CTS would:

- Use bar-code technology to track chemicals from the time they are received and "read into" the system until the time they are disposed of and "read out" of the system.
- Provide the means for integrating and updating the current systems for chemical ordering, control and disposal.
- Provide Material Safety Data Sheets (MSDSs) for each chemical present at the institution. (This would also be a part of the CTS database which fulfills legal requirements of the University.)

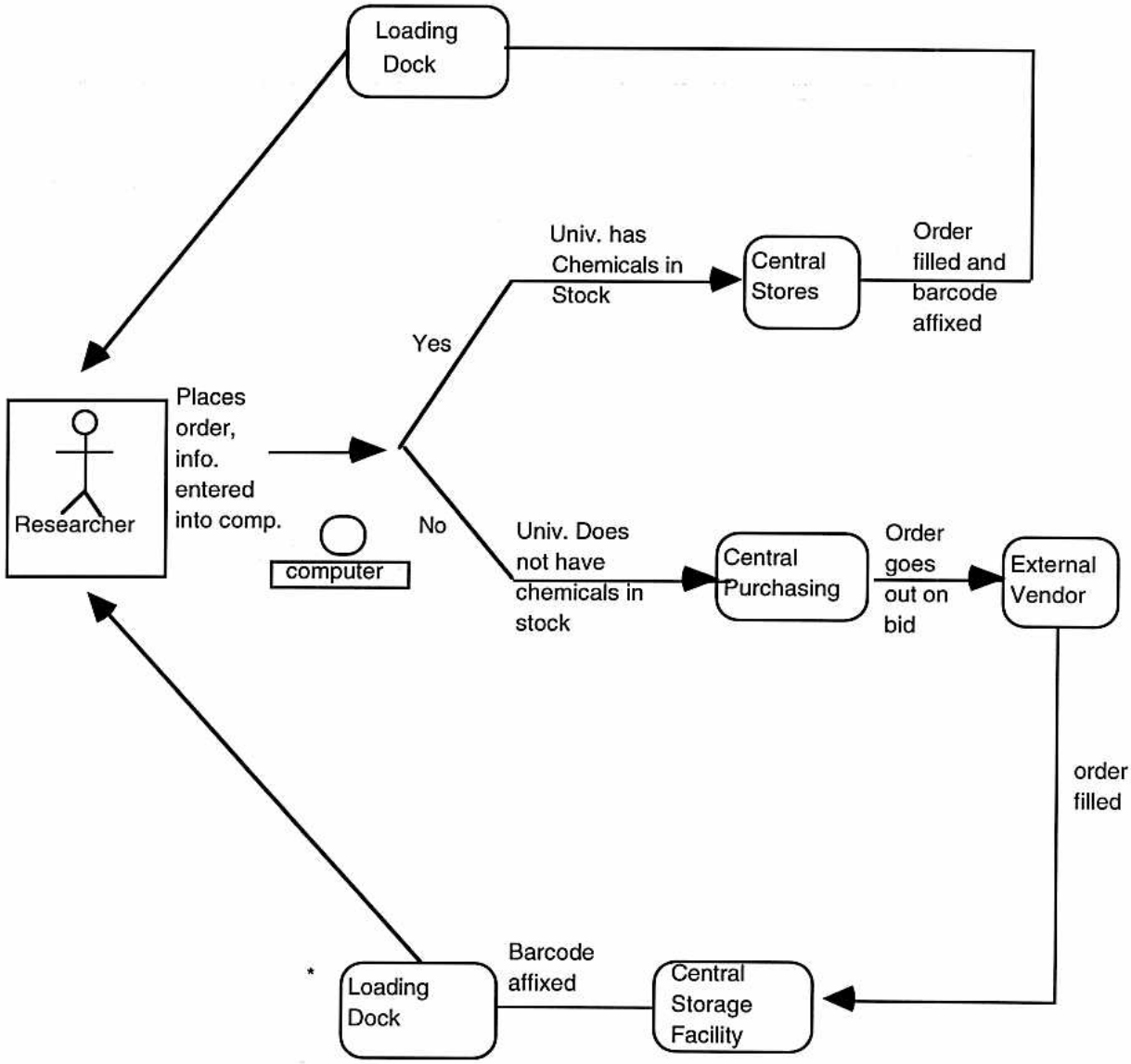
A brief look at the Chemistry Department's current system for ordering and distributing chemicals and how this would be changed using the CTS is provided in figures 2 and 3 on the next two pages.

Figure 2: Chemical Department's Current System for Ordering and Distributing Chemicals



* Currently there is no check and balance system to ensure that chemicals delivered to the loading dock are received by the appropriate researcher.

Figure 3: University-Wide Chemical Ordering System
With Chemical Tracking System Installed



* If there is no central storage facility for the chemicals, a barcode label would be affixed to the container at the loading dock or the receiving area of that department.

Criteria to evaluate existing CTS software include the following:

- can track chemicals from purchase to disposal
- can record and update the location of chemicals by building and room
- can be interfaced with Purchasing Department's database
- utilizes barcode technology for data entry
- offers report generation capabilities
- provides easy access to MSDS information
- is user friendly
- is affordable
- is reliable and easy to maintain
- CTS company offers ongoing product support

Conclusions: Potential Impacts of CTS

The increase in hazardous waste regulations combined with skyrocketing disposal costs poses a disturbing trend and could lead to future financial and legal concerns for the University. Use of a CTS would help provide the framework necessary to fulfill the following goals:

Regulatory Compliance

- reduce potential for ever-increasing fines
- increase accuracy in fulfilling state and federal reporting requirements
- provide easier accessibility to Right-To-Know information

Cost Savings

- decrease disposal costs
- reduce unnecessary purchases through improved inventory control
- reduce time and labor spent filing and updating chemical records

Safety

- location, quantity, and type of hazardous chemicals is known rather than estimated
- MSDS database is easily accessed

Waste Minimization

- upward trend in hazardous waste generation can be curbed via chemical exchange opportunities
- inefficiencies that lead to unnecessary waste can be accurately tracked
- unnecessary chemical purchases can be reduced through tighter inventory control

Conclusions

One of the most significant characteristics of the Chemical Tracking project was the way in which our group's goals changed and evolved throughout the project. Initially, we wanted to implement a pollution prevention strategy that would lead directly to the reduction of hazardous wastes at U-M. Our goal was to work toward establishing a chemical tracking system with the intent that it would lead to a University wide chemical exchange program. However, while OSEH and Chemistry were interested in the development of a chemical tracking system, they were not as interested in the use of this system for a chemical exchange program. This caused our group to re-evaluate the focus of our project. We wanted to work on a project that would lead directly to hazardous waste reduction. We also wanted to act as facilitators for this project—not directors pushing our own agenda.

After reflecting upon the situation and upon Chemistry's and OSEH's needs, we decided to place all of our energies into the establishment of a chemical tracking system at the University. We realized that implementing a tracking system would actually help to lay the groundwork necessary for an effective chemical exchange program to take place. Further, our group felt that the baseline data that would be generated from a CTS would help to paint a clearer picture of chemical usage and disposal practices at the University.

The evolution of this demonstration project reflected both the challenge of addressing individual and departmental needs at a university and the difficulty of implementing a significant pollution prevention intervention within a short time-frame.

Recommendations

Future Leadership. To ensure that our efforts at establishing a chemical tracking system continue after our project ends, new leadership must be formed. We recommend the following as potential strategies for coordinating this leadership: working with the Chemistry Department to establish a Research Assistant position to oversee the initial implementation and operation of the CTS; encouraging OSEH to fund an internship through the Office of Waste Reduction Services to help with the implementation of the tracking system and its subsequent expansion throughout the University; educating faculty within the School of Natural Resources and Environment about our Project so that they can promote it to incoming students who would be looking for Master's Projects to take on; and finally, investigating opportunities for developing it into a faculty sponsored research project.

Expanding the System. Another issue which remains to be addressed is how to expand the tracking system throughout the University. Originally, the Chemistry Department was chosen to pilot the program because it is one of the largest consumers of hazardous chemicals at U-M and since its administration had been interested in implementing a tracking system for over a year. However, many other departments across the campus also use hazardous chemicals, and are confronting similar problems in their hazmat programs: regulatory compliance, safety, cost of disposal, and waste generation.

To ensure that these problems get addressed, the CTS must be expanded throughout the University to service departments other than Chemistry and OSEH. This will require an ongoing effort to forge and maintain cross campus links between departments. These links are important for bringing people together to discuss individual and departmental needs concerning the design of the CTS and for tapping into existing resources and support systems at the University.

Chemical Exchange. Unused chemicals can constitute as much as 40% of the hazardous waste generated from laboratories (RCRA, 1985). Because surplus chemicals place increased demands, in terms of expense, time, and workforce, on waste removal, these chemicals should be exchanged rather than left as waste. Through a surplus chemical exchange program, the materials would

become part of the inventory of the entire chemical management system. Once the chemical tracking system is firmly established at U-M, a conscious and strategic effort should be made to use the system for such chemical exchange purposes. The CTS will provide the University with a centralized database containing information on the quantity and type of surplus chemicals available to chemical users. A well designed exchange system could lead to an effective hazardous waste reduction program.

Follow-up: May–December 1993

Over the past six months, under the capable guidance of Vice President for Research Sarah Newman, the system has been expanded from simply a CTS for Chemistry to a university-wide CTS. Newman was impressed with the fact that the original CTS group was formed with grassroots support from members of the university community, and that the committee had not simply been administratively appointed. Thus, she took the project on wholeheartedly.

In May, the CTS group decided to make the CTS university-wide rather than simply a Chemistry Department experiment which would then be expanded to other departments. The group realized that if the Chemistry Department built the CTS for their needs, only they would have input into the definition of the data fields, and set up the system. Since the University is very decentralized administratively, perhaps the system would be incompatible for other department and therefore, would never be expanded university-wide. Because of this, the final decision on which software package to buy was postponed and CTS group was expanded.

The current CTS group includes members from OSEH, the Vice President for Research's Office, both the basic and clinical Medical Schools, the College of Engineering, the Department of Chemistry, the School of Natural Resources & Environment, and the College of Pharmacy. These people have developed the preliminary plan to test a university-wide chemical tracking system through data modeling sessions.

The Information Technology Division on campus will hold three half-day sessions to brainstorm and refine the elements of the plan which would be necessary for an effective CTS at the University of Michigan. This refined view of the CTS will then be written up in another proposal to the Office of the Vice President for Research and the Office of Business and Finance. These

two offices have been receiving verbal updates on the project and they seem to be supportive at this time. The Director of University Purchasing is very interested in the project as well.

The planning should be finished by the end of the April 1994; then the group plans to have several test sites around campus. According to Newman, "there is NO chance that this is NOT going to happen."

It is Newman's understanding that only one other university, the University of Washington, has a CTS in place. Therefore, this CTS will be the only other major chemical tracking system at a large research institution in the nation.

As you can see, the Chemical Tracking System is moving forward—full speed ahead.

References

Hacala, Jeff (1992) Strategies for Hazardous Waste Reduction at the University of Michigan. Unpublished.