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THE MERRIMACK PROJECT

A cooperative effort of

The United States Environmental Protection Agency

The Commonwealth of Massachusetts

The State of New Hampshire

MAY 1995

Part I

THE MERRIMACK PROJECT:

Pollution Prevention for Resource Protection

Introduction

The Merrimack River Industrial Pollution Prevention Project (Merrimack Project), is one element of the multi-faceted Merrimack River Initiative to restore, protect and enhance the water quality of the river, and is also part of EPA's Industrial Pollution Prevention Project (IP3), which seeks to incorporate pollution prevention into the national effluent guidelines development process and to promote a pollution prevention ethic in business.

Through a $120,000 grant each to Massachusetts and New Hampshire, the IP3 program helped finance pollution prevention assistance programs by both states, specifically in the Merrimack River Watershed.

As a result of the technical assistance programs, eight companies in the Merrimack River watershed eliminated more than 700,000 pounds of pollutants, and 12 companies reported savings of $1.1 million. An additional two companies reported eliminating 1 million pounds of pollution on their own, and an additional six companies reported annual savings of $750,000. More than one hundred people from the business commmunity joined a government-sponsored Business Environmental Network, originally formed for the Merrimack region, but now incorporated as the Northeast Business Environmental Network (NBEN) in order to open membership to a wider population. NBEN members meet regularly to review environmental requirements and pollution prevention opportunities, and hold public events to educate all businesses. The mission statement of the network explicitly affirms the union of environmental and economic interests. NBEN has been awarded three grants that affirm its value as a model of a nonpartisan forum: one from the Massachusetts Manufacturing Partnership, to provide administrative support; and two from EPA New England's Merrimack River Initiative, to establish an electronic P2 and environmental requirement information network, and to conduct a business/government dialogue on Regulatory Improvement Opportunities (RIO - see appendix for proceedings of the first meeting).

These successes are the result of collaboration between business, government and non-profit organizations, and between various sectors of government - most importantly, between two states. The project shows that the preventive approach can directly enhance economic viability.

The joint work by the two states and the EPA demonstrates that jurisdictional divisions do not prevent cooperative work to protect regional resources. It is also an example of an application of the watershed approach. The project introduced the watershed concept to many businesses that are now incorporating it into their approach to environmental responsibility.

The Merrimack River Watershed

The Merrimack River watershed encompasses 5,010 square miles including the mainstem and its many tributaries. The headwaters of the Merrimack River start in the White Mountains of New Hampshire and flow 180 miles to empty into the Atlantic Ocean at Newburyport, Massachusetts. The watershed represents approximately 33 percent of the land area in New Hampshire, approximately 15 percent of the land area in Massachusetts, and includes all or portions of 200 communities. The Merrimack runs through remote National Forest areas, rural towns, urban areas, and is a resource of great regional significance. It provides drinking water for more than 300,000 people and is also used for recreation, fish and wildlife habitat, irrigation, waste assimilation, power production and scenic enjoyment. It is one of the major "veins" of the New England region. The lower Merrimack region, which includes much of southern New Hampshire and portions of northeastern Massachusetts, is highly industrialized.

The Merrimack River was once considered one of the nation's dirtiest waterways. Contamination from raw sewage and untreated industrial waste rendered the river unusable for fishing, drinking or recreation. In the past 20 years many of the most obvious pollution sources have been addressed. The Merrimack can now be used for fishing and boating, and much of the river is used, after treatment, for drinking water.

Background

When EPA's IP3 awarded the grants to Massachusetts and New Hampshire in 1991, both states had already adopted pollution prevention as an overall priority, and in both states small programs to promote pollution prevention had already had some success. Massachusetts had passed a Toxics Use Reduction Act (TURA) and established within the Executive Office of Environmental Affairs the Office of Technical Assistance for Toxics Use Reduction (OTA), a nonregulatory office with a legislative mandate to provide confidentiality to the businesses to which it provides assistance. New Hampshire had established the NH Pollution Prevention Program (NHPPP) within the Waste Management Division of the Department of Environmental Services.

Both programs had already been visiting businesses, reviewing the processes which result in wastewater discharges, air emissions, waste shipments, or other pollution, and recommending opportunities for preventing the identified problems. Both programs had already begun to build up information on new technologies for pollution prevention and to share the information by holding workshops and conferences, by making presentations at public events, and by publications, particularly case studies. Both programs offered their assistance with no charge to the user, and on a confidential basis.

Summary of Results

Since the project began, use of technical assistance services has increased as a result of many factors, including more than 100 public events to explain pollution prevention practices, and the institution of referrals from enforcement agencies. For example, the Massachusetts program performed 21 visits in 1991 and 162 visits in 1993. By the end of 1994 OTA had made more than 450 visits. The increase suggests that the provision of technical assistance for pollution prevention is useful to businesses.

Sixty-two companies in the Merrimack watershed have been visited, and data has been gathered concerning 49 companies. Data was obtained from some of these companies on pounds of toxic materials eliminated and money saved. (See Table of Results on page 57.)

Pounds Eliminated

Many companies did not perform assessments of pollutants eliminated by pollution prevention, but some did.

> Ten companies reported pounds of toxic materials eliminated, totalling **1.72 million pounds**. Eight of those companies accomplished pollution prevention in connection with state technical assistance, eliminating **717,000 pounds**.

Money Saved

> Eighteen facilities reported annual savings of **$1.85 million** that are already accruing. This is an average savings of **$102,610 per company**.

In determining how much was attributable to state assistance, only those companies were counted where the state was a significant causative factor in P2 implementation.

> Twelve companies that could be characterized as having acted at the inspiration or with the significant help of the state reported savings of **$1.1 million**.

These estimates are very conservative. If a company reported "thousands" or "hundreds of thousands" of dollars saved, we have totalled only $1,000 or $100,000 respectively. Very few companies performed an assessment of total costs and benefits. Typically, the data refers only to reduced purchase or waste disposal costs, and in the majority of reports does not reflect other savings, such as permit fees avoided, gains in efficiency, reduced liability, reduced penalties, reduced compliance or safety costs, etc. We have not used net present value, expected savings, or the value of avoided enforcement action, nor have we assessed the cumulative effect of annual savings over a period of years. The following figures represent, as closely as we could determine, savings after payback of any project investment.

Some of the companies have had active programs for several years and have been accruing savings from pollution prevention for some time. Savings from pollutants that have been eliminated recur annually, therefore the worth of these projects will continuously increase over time. It should also be noted that certain materials, such as ozone depleting chemicals, have been

steadily rising in cost, a factor which over time accelerates the increase in the value of any program that has eliminated or reduced the use of the material. (Note Company #2 in the Table of Results).

P2 Implementation Rate

Out of 46 companies that were provided with pollution prevention information and are still in business, 30 accomplished significant P2 in that they changed their processes or materials, came into compliance, saved significant money, eliminated a sizeable amount of pollution, or established a strong ongoing program. Four companies had minor accomplishments. We had insufficient data for 8 companies, and included in that category companies that claimed to be reviewing our recommendations but had nothing as yet to report. When our attempts to follow up resulted in a lack of returned phone calls, and the company had not seemed appreciative of the recommendations made, we counted these as not accomplishing any P2.

The true performance rate can be captured only by stating a range. If we assume the 8 companies for which we obtained insufficient data to show P2 accomplishments have in fact accomplished no pollution prevention, and do not count minor P2 accomplishments, we have a 65% rate of substantial P2 performance. If we count the minor P2 accomplishments we have a rate of **74%**. If we assume that the eight unknowns did undertake P2, and count the minor accomplishments, we have a rate of 91%. **The P2 performance rate is within the range 65 - 91%**.

It is interesting to note that out of 11 companies that had already accomplished P2 on their own before being visited by a technical assistance program, 7 agreed to share information with other companies.

In order to obtain a picture of the effectiveness of the assistance programs, we examined the rate of implementation among those that had not already performed P2 on their own - 35 companies. A true recommendation implementation rate, which would assess the use of each specific recommendation made by state technical assistance staff, could not be obtained. It is reasonable to give state technical assistance credit for influencing **66%** - 23 companies - to accomplish P2. If we do not count the four companies that accomplished only minor P2, we have a rate of **54%**. This 54 - 66% range illustrates the low end, because it assumes that none of the unknowns performed P2. If we assume that they did, we have a range of **77 - 89%**. Therefore **the percentage of companies accomplishing substantial P2 as a result of technical assistance is within the range 54 - 77%. The percentage of companies implementing technical assistance program recommendations and accomplishing some P2 is within the range 66- 89%.**

Unquantified accomplishments

Some of the companies achieved P2 but did not produce data on money saved or pounds eliminated. These companies included:

A machine shop that ceased wastewater discharges with vacuum distillation

A manufacturer that reduced water use 87%, drummed waste 40%

A semiconductor company that is investigating a closed loop process

Four electronic components manufacturers that eliminated TCA

Two facilities that eliminated nuisance odors

Several companies improved compliance, for example by establishing proper hazardous waste storage practices, and some companies established ongoing pollution prevention programs.

It must be recognized that at the beginning of the project NH staff had a difficult time convincing companies that it was safe to consult with them. Companies often expressed wariness due to the location of the technical assistance program within the state's regulatory agency. The fact that New Hampshire's technical assistance personnel convinced 14 companies to let them come on site was therefore a substantial accomplishment. New Hampshire's follow-up resulted in a vast majority of companies that worked with the NHPPP stating that they were very pleased with the service given to them and that they would not hesitate to call on the program again or recommend the program to other businesses.

Other accomplishments of the project include:

The two states jointly performed technical assistance on a number of visits.

The two states jointly conducted a series of industry specific workshops.

The two states together held two major conferences: an outdoor (under a tent) Environmental Overview conference on a bluff overlooking the Merrimack River, and a Clean Air Act conference in Lowell (both also sponsored by the Merrimack Business Environmental Network).

New Hampshire established a clearinghouse of information on new technologies, pollution prevention products and vendors, fact sheets, and case studies and made it available to business and industry. New Hampshire provided written technical information to several hundred Merrimack Valley companies.

New Hampshire held a Solvents Bazaar in Manchester, at which 55 companies had the opportunity to bring parts needing cleaning to be cleaned by alternative products; a Pollution Prevention conference in 1993, attended by 45 Merrimack Valley companies; and a Pollution Prevention conference in 1994, attended by 58 Merrimack Valley companies.

The Business Environmental Network: forming a lasting commitment to P2, and improving relations between government and industry.

As part of the Merrimack project, OTA and NHDES formed a Merrimack Business Environmental Network (MBEN), an ongoing forum of businesses committed to pollution prevention, to environmental compliance, to interacting with government agencies, and to mutual self-help. In the first year of the project, OTA and NHPPP sponsored P2 conferences for local businesses. After the formation of MBEN, public events were conducted with the joint sponsorship of MBEN members. This increased attendance at these events, and the identification of pollution prevention as good business practice, not just government policy.

Presentations included AT&T engineers explaining how they substituted a food-grade material for ozone depleting cleaners, how a large dry-cleaning establishment (Anton's) adopted low-polluting dry-cleaning technologies, how a stain manufacturer (Cabot's) adopted efficient liquid transfer and storage practices and low-waste pipe cleaning, and several other company stories of how pollution prevention had benefitted the bottom line. This was the culmination of a project goal of finding the "stars" who had already accomplished pollution prevention, and persuading them to share their stories. See attached article.

MBEN generated a good deal of interest in other regions, who sent in requests for information on how to create similar organizations. To enable the network to reach a larger audience, OTA incorporated the network as the Northeast Business Environmental Network in September, 1994. The enthusiastic participation of businesses in MBEN, now NBEN, accomplishes the project's basic purpose: to form a continuing, collaborative, working commitment to pollution prevention by relevant parties. It was made possible by work performed in three distinct parts:

1. Working with public sewage treatment facilities
2. Working with businesses
3. Coordination of technical assistance and regulatory programs.

The work performed by the Merrimack Project in each of these three areas is described in the next 12 pages of this report.

Working With Sewage Treatment Facilities

New Hampshire and Massachusetts began their Merrimack project work by meeting with sewage treatment officials and discussing problem areas.

NH focused its work on the Franklin treatment facility because it is owned and operated by the state, and on the Nashua facility because it has a large base of industrial users.

OTA met with the five major mainstem Publicly Owned Treatment Works (POTWs) in Massachusetts. OTA had already worked with POTWs through an organization called the Massachusetts Pretreatment Forum, a self-help group of pretreatment coordinators from across the state. (This work had already introduced OTA to some of the POTW officials and was the foundation on which the Merrimack Project was developed).

The facility personnel in both states, commenting that most industries that discharge to their plants did not have any significant compliance problems, identified (1) non-regulated sources of pollution such as nonpoint sources, households and small businesses; and (2) unpermitted dischargers as problems that are largely unaddressed. Nashua staff reported problems with fats, oil and grease (FOG), and MA staff also heard about FOG when visiting Newburyport, where there are a lot of restaurants in town and there had been a series of costly incidents of grease buildup. In particular, grease in the treatment system was causing the growth of odorous bacteria, which led to a lot of complaints.

At a 1994 follow-up meeting with Massachusetts pretreatment coordinators, there was universal concern about pollutants from water supply facilities. Two major concerns were cited:

> Businesses complaining to POTWs about having to treat incoming water to meet discharge limits.
>
> Use by water supply facilities of zinc-containing chemicals for pH adjustment, leading to high levels of zinc in incoming water.

Although there was a high degree of interest by treatment staff in addressing pollution from sources other than the significant industrial users, the Merrimack Project maintained a focus on industrial sources while attempting to address their concerns to some degree. Analyses of permit lists and business directories were performed to determine the industrial categories appropriate for targetting in each area. POTWs helped select topics of concern.

Public workshops were then organized in the POTW communities. Massachusetts and New Hampshire staff worked together and companies from both states attended. With the Greater Lawrence Sanitary District, the two states conducted a workshop on pollution prevention for electroplating companies. With Haverhill, the two states conducted a workshop on pollution prevention in machine shop operations. With Lowell, and with the Toxics Use Reduction Institute at the University of Massachusetts at Lowell, OTA and NH conducted a workshop on pollution prevention for the printed circuit board industry. With Amesbury, OTA conducted a workshop on water conservation. With Newburyport, OTA conducted two workshops on reduction of fats, oils and grease from restaurants.

Results

Officials at all of the above named POTWs enthusiastically lent space, support, and time to the conduct of public educational activities. They all saw the holding of public events intended to disseminate P2 information as furthering their mission of protecting water resources. All POTW officials involved in the project supported the concept of assistance to the regulated public.

Several POTW officials commented that they valued their ability to create and maintain ongoing relationships with the companies under their authority. They expressed a wish to help their neighbors survive economically as well as comply with environmental requirements. The POTW officials valued the opportunity to increase public understanding of the place of the POTW in their community, and particularly the fact that increased expenses or savings at the POTW would affect the entire community.

Some of the POTWs have continued the practice of holding public events to educate their dischargers, and requests have come in from other POTWs in the state to conduct similar events. The Lowell, Greater Lawrence, Newburyport and Haverhill facilities have continued the practice of conducting public events.

Training

A significant outcome of the meetings with treatment facilities staff were the partnerships that were established and/or strengthened. As a result of the newly created partnerships, DES staff were asked to provide a pollution prevention training session at the Franklin treatment plant's annual workshop for industrial users. Similarly, Rick Seymour, the Nashua Pretreatment Coordinator, arranged for DES pollution prevention staff to provide a half-day training session for the NH Association of Pretreatment Coordinators. Both sessions were well attended and considered to be very successful.

OTA in the spring of 1992 conducted P2 training for POTW officials in Massachusetts, New Hampshire, and Maine, through the New England Interstate Environmental Training Center. This training consisted of explanation of the basic concepts of P2, a discussion of the Massachusetts Blackstone project, which pioneered cross media enforcement and referrals for technical assistance, and a participatory "P2 training exercise", where officials brainstormed process change responses to identified pollution problems.

Referrals

POTW officials began referring companies for technical assistance. Greater Lawrence Sanitary District responded vigorously, even going out on site visits with OTA and NH. Since 1991, the other POTWs have also referred companies to OTA (the origin of each request is not always a matter of easy determination) - about one half of company visits originated from POTW referrals. (There are often a number of events which stimulate a company to seek technical assistance. These included attendance at a workshop, telephone assistance, reading an article by or about the program, word of mouth from a company that has received useful help, or encouragement by DEP or DES inspectors, as well as the POTW, to call).

Innovations

The Project discovered that Louis Vallee of the Newburyport facility has been able to obtain, simply by request, information on chemical purchases from certain facilities. The requirement that chemicals brought on site be reported to the facility has been written into certain permits. When told of this, other treatment facility staff commented that he could not ask for this information because it was not required by law, and companies would challenge it in court.

The Greater Lawrence Sanitary District's 1993 Annual Report notes that it has now added pollution prevention questions to its full inspection forms. (Other POTWs have stated they will not ask for any information that the company does not have to provide. There have been many comments made during the Project concerning political pressures on POTWs, constricting what they may do).

NHDES is currently working on a project which involves development of a model sewer use ordinance which incorporates pollution prevention. As part of a review team led by the DES Industrial Pretreatment Coordinator, the Merrimack Project coordinator will comment on the draft ordinance and other documents developed under this project. The model ordinance will be a useful tool for communities in the Merrimack watershed as well as other areas seeking to enhance pollution prevention efforts at the local level.

Improved relations with sister agencies

At the beginning of this project, it was clear that there were several contentious issues between Massachusetts POTW officials and the DEP, and there was a distinct lack of communication between them. Credit for improving this relationship is due to proactive efforts on both sides; the POTWs have actively sought to address the outstanding issues, and DEP has responded by detailing officials to meet with the treatment facilities. Project work must also be considered to have played a role in linking the authorities. Improved relationships between industrial pretreatment coordinators at the New Hampshire plants and NHDES have also markedly improved as a result of the project.

Working With Businesses

The Business Environmental Network

The series of workshops with POTWs consisted largely of presentations by businesses in the area that had already accomplished pollution elimination by preventive measures. Because so many businesses were willing to share information with each, OTA and NH decided to establish an ongoing organization dedicated to technology and environmental information transfer. This organization was the Merrimack Business Environmental Network, which has now become the Northeast Business Environmental Network, with a Merrimack Watershed chapter. One of the purposes of the organization was to change the focus of the delivery of pollution prevention information, so that it would come from business, not just government.

MBEN conducted monthly meetings for its members, at most of which there have been presentations or discussions of environmental requirements and P2. MBEN, with OTA and NH, sponsored two major regional conferences, both of which garnered attendance of about 100. There were about 30 committed, active members of MBEN from the business community, who came regularly to all MBEN meetings, and more than 80 registered as members, who came principally to MBEN conferences. Members signed the mission statement, which reads as follows:

> The Merrimack Business Environmental Network is a coalition of businesses, agencies and associations which is committed to a shared concern for the Merrimack Valley, its rivers, and the Valley's quality of life. This Association has made a long-term commitment to seek and implement solutions to promote pollution prevention through improved management and technology, while enhancing the economic viability of the business community.

In order to emphasize the connection with the resource to be protected, MBEN's first conference was held at Maudslay State Park in Newburyport, MA on a bluff overlooking a broad expanse of the river. The conference consisted of presentations by government officials concerning regulatory requirements and breakout sessions for company case studies of P2. MBEN members explained how they had reduced waste, air pollution, water discharges, and increased worker safety, profitability, and quality. The conference was a visible demonstration by area businesses to area businesses of the viability of P2, and was thus different from the first series of POTW-sponsored workshops, which although also effective and also incorporating business presenters, were more readily identifiable as government agency product.

The second MBEN conference consisted largely of information to assist businesses in compliance with the Clean Air Act, and the majority of the presenters were from government. The topic and approach was the decision of MBEN members, and the conference demonstrated that TAPs and BENs can serve as conduits for regulatory information. Evaluation forms indicated that attendees found the conferences to be highly useful.

Publicity about the MBEN conferences led to calls from other watersheds and states, a mention in Pollution Engineering and an invitation to write about MBEN for the Pollution Prevention Review. (See attached article).

OTA has been asked by Salem Sound 2000 and the Nashua River Watershed Association to assist with the formation of similar groups. In response to the interest by parties outside of the watershed, MBEN has voted to change its name to Northeast Business Environmental Network, Merrimack Chapter. Bylaws for NBEN stressed the nonpartisan nature of the group and prohibited it from engaging in political lobbying. NBEN has sponsored several conferences on environmental compliance and pollution prevention, focusing in 1994 on the Clean Air Act and emergency response, and in 1995 on providing opportunities for businesses and government to work together on regulatory improvement.

With EPA's Merrimack River Initiative funding, NBEN held a half-day discussion on Regulatory Improvement Opportunities. Seven thousand businesses from Massachusetts and New Hampshire were invited in a letter co-signed by EPA New England Administrator John De Villars, Massachusetts Secretary of the Environment Trudy Coxe, New Hampshire Department of Environmental Services Commissioner Robert Varney, and Massachusetts Department of Environmental Protection Acting Commissioner Tom Powers. NBEN chair Gabriel Paci, CEO of Raffi & Swanson, a Wilmington, MA coatings manufacturer, explained to 100 attendees that the purpose of RIO was to enhance discussion, not vent frustration. He urged those participating to work to understand each other's point of view: the missions of and constraints on government employees, and the costs and practical effects of requirements on businesses. Breakout sessions facilitated by NBEN, and employees of EPA and UMass Lowell's Toxics Use Reduction Institute were also run on established ground rules of mutual respect and constructive discussion. Quite positive evaluations of the event affirmed the value of NBEN's nonpartisan approach both to those who came to complain and those who came to defend.

Coordination With Regulatory Programs

Both Massachusetts and New Hampshire provided an understanding of pollution prevention concepts and activities to pretreatment coordinators at sewage treatment facilities, and to other environmental officials, and increased the coordination between technical assistance and enforcement.

Both states have included efforts (which are ongoing) to identify opportunities and barriers to incorporating pollution prevention into the work of regulatory agencies, and have used the project as a pilot to test new initiatives.

New Hampshire does not have a toxics use reduction law, nor mandatory facility P2 planning. The absence of this incentive, and the associated revenues, has made for significant differences in the focus of the two programs. New Hampshire's approach focused on using existing resources. New Hampshire took the fact that technical assistance came out of a regulatory program, and the opportunity to do the Merrimack Project to enhance efforts to incorporate P2 into the way business is done. New Hampshire established a Multi-media Pollution Prevention Task Force as a forum for discussion on how to incorporate prevention into a regulatory agency.

OTA adopted the strategy of establishing training exchanges and referrals with DEP. At the same time, DEP has made waste prevention a top priority and has reorganized to reflect this. The agency now makes multi-media inspections, and its FIRST program (Facility Inspections to Reduce the Source of Toxics) is only one of many program innovations that are an expression of the agency's commitment to the priority of toxics use reduction.

Massachusetts

Introductory Training

OTA has introduced the concepts both of technical assistance and of pollution prevention to enforcement officials of many agencies. The office has assisted with P2 training for EPA inspectors and managers, for DEP inspectors and managers, for POTW pretreatment coordinators, for board of health agents, and for audiences made up of regulatory officials of various kinds and authorities.

When technical assistance for pollution prevention was first presented to enforcement officials, some had adverse reactions. One reaction was to assume that resources would be diverted from enforcement to technical assistance, or that enforcement would somehow be diminished. OTA attempted to counter this assumption by contending that nothing about the establishment of technical assistance necessitates either result, and by affirming that enforcement is the most important reason for companies to seek and utilize technical assistance, and do P2.

Another adverse reaction was that the touting of prevention could seem to mean a denigration of control. OTA attempted to counter this unintended effect by pointing out that although the hierarchy meant prevention should be exercised first and foremost, it must be recognized that when it is not implemented, recycling, treatment, or other management of wastes already

generated is still preferable to other alternatives. It has been necessary to affirm on many occasions that pollution reduction is a desirable activity, even if it is not prevention.

Enforcement staff were also concerned that if inspectors made suggestions concerning pollution prevention activities, that companies would interpret these suggestions as commands. Comments that inspectors did not understand industrial processes well enough to make competent recommendations were also frequently heard.

OTA's recommendations were that inspectors could refer companies to a technical assistance agency for specific help, while talking about pollution prevention in general, to indicate the priority the agency places on the approach. OTA also recommended that inspectors can adopt the strategy of asking questions in lieu of making commands, because asking questions:

* is a non-directive method of illuminating P2 opportunities and pointing a company in the right direction, or discovering worthwhile avenues of investigation

* denotes respect for the regulated company and can enhance the relationship between the company and the regulator.

Most importantly, dialogue concerning process educates the inspector, which can only improve regulatory practices.

The relationship of enforcement and technical assistance

In its presentations and in many meetings with enforcement officials to work out policy concerning the interaction of enforcement and technical assistance, OTA has stressed two points:

* confidentiality must be assured or companies will not feel safe consulting with a government agency

* continued strong enforcement is of paramount importance, because it is a major motivator for doing P2, or for seeking technical assistance.

Another important point of discussion has concerned the tailoring of enforcement strategies to encourage prevention, such as waivers, extra time, penalty mitigation, or targetting. OTA strongly supports the use of these measures. Staff have frequently worked with companies facing short time-frames to address violations. Conventional end-of-the pipe control equipment is readily available: to supplant the control strategy with a preventive technique may only be possible if the company has the time for investigation and trial.

However, OTA has frequently expressed the opinion that flexibility should only be awarded based on actual activities, investigations, or trial undertaken or attempted by a company, on need demonstrably related to P2 opportunities, and information must be obtained from the company by the enforcement agency.

OTA has asked that enforcement officials not soften their stance based on the mere fact that technical assistance has been sought or provided. This has become an important issue for OTA

because staff have been made aware that some companies have received reduced scrutiny from some inspectors simply because they are adopting a posture of seeking technical assistance or investigating P2. Some inspectors have asked OTA for information on the company's progress, and OTA has had to point out that absent consent from the company it is bound by law not to provide that information, and some inspectors have expressed frustration with OTA as a result. Continuous discussion of this has to some extent addressed this frustration, but it is clear that an express policy as underlined above is necessary in order to avoid this problem.

Coordinated work with regulatory officials

Work with DEP has evolved from training to mutual exchange. OTA has been meeting with the Northeast Region of DEP as part of DEP's FIRST (Facility Inspections to Reduce the Source of Toxics) program to expand the Blackstone model of cross media inspections and technical assistance referrals. OTA has delivered a series of seminars, and DEP conducts cross training for OTA on DEP's regulations. OTA has long emphasized to its staff the importance of being up to date on regulations.

The seminars have covered:

* P2 in general

* cleaning alternatives to solvents

* alternative finishing systems (low or no VOC painting and coatings such as powder coatings, electrodeposition, and efficient paint transfer systems such as high volume, low pressure spray)

* an overview of the problems posed for those planning P2 activities by restrictive military specifications

* printing

* the requirements of TURA and form S reporting.

The OTA team has attended semimonthly inspection review meetings at DEP and has been asked to comment at these meetings on how to recognize P2 opportunities and how to suggest them during visits.

DEP now sends copies of all Notices of Noncompliance to OTA, and included in these notices is language encouraging the recipient to contact OTA for help. Inspectors often recommend OTA's services to companies. (See attachment).

Other Projects

Massachusetts has received an EPA grant to establish a permanent household hazardous waste collection site in the Merrimack Region. As a result of months of exploration and discussion,

OTA and the city of Haverhill have signed a contract to establish a permanent collection site for used oil. Haverhill's POTW is part of the emergency response team, which identified the need for the site in order to address a large number of annual responses to abandoned containers of used oil.

Massachusetts has also received a grant to develop a self-audit checklist designed to promote P2 concepts. A draft version is attached.

New Hampshire

The P2 Task Force

In May of 1992 NHDES created a Pollution Prevention Task Force to serve as a forum to discuss ways to incorporate pollution prevention directly into the daily workings of the relevant regulatory and non-regulatory programs. The Task Force is made up of representatives from each of the department's four Divisions; Air Resources, Water Resources, Waste Management, and Water Supply and Pollution Control, as well as the Commissioner's Office. The Merrimack Project Coordinator provides staff support to the Pollution Prevention Task Force.

The Task Force developed and adopted a statement of purpose and objectives:

> Statement of Purpose
>
> "To direct, coordinate, and promote strategies which prevent pollution of air, land, and water. Such strategies include, but are not limited to: toxics use reduction, waste reduction, and best management practices to conserve natural resources and protect human health and the environment."

The Task Force also developed a common definition of pollution prevention, a statement of goals, and a pollution prevention strategy to serve as a foundation for ongoing and future pollution prevention initiatives. The definition and goals statement were adopted as agency policy by the DES Senior Management Team (See attachment).

Examination of regulatory activities

The Task Force developed model language incorporating pollution prevention into DES Letters of Deficiency (LOD) (see attachment). LODs are the mildest form of enforcement letter and are sent out after an inspector has visited a site and noted minor violations. The Task force undertook a survey to determine which types of LODs would be most appropriate for inclusion of the new language: for example, the language would not be appropriate for letters regarding failed septic systems, but would be appropriate for RCRA, Industrial Pretreatment, and Air LODs.

More intensive scrutiny in the coming months will be given to including pollution prevention in permitting, and identifying appropriate targets for multi-media permitting and inspections.

Flexibility in Media Grants

Early in 1993 the Task Force began working with DES Assistant Commissioner John Dabuliewicz to identify pollution prevention projects to incorporate into the department's ongoing federal grants. Three projects were identified and subsequently approved by EPA. Two of the projects were media specific (waste and water), and one was a multi-media effort.

In the water area DES staff initiated a flexibility project which involved piloting a new approach to solving water quality problems. Instead of full compliance inspections for all major dischargers, those facilities which have good compliance records are subject to much less intensive inspections, which frees up staff time to deal with known water quality problems. These water quality problems are being traced to their source(s) and then dealt with using a technical assistance/pollution prevention approach.

The Hazardous Waste Compliance Program (HWCP) has also initiated a new type of inspection known as a "partial inspection". This project involves targeting Small Quantity Generators (SQGs) which have never been inspected. Instead of a full compliance inspection these SQGs receive a partial inspection which involves a review of the physical conditions of the plant only. Inspectors distribute pollution prevention literature and refer the plant personnel to the DES Pollution Prevention Program for technical assistance. Prior to instituting this project the Hazardous Waste Inspectors received a 1/2 day pollution prevention training session.

Two multi-media flexibility initiatives are being carried out by the Pollution Prevention Task Force:

Regulatory barriers. This work involves identifying barriers or disincentives to pollution prevention which exist in the department, and developing methods to address them.

Targeting. This work involves compiling information on compliance and technical assistance efforts from air, water and waste programs, such as listings of "problematic" industry types, processes, and chemicals; sensitive resource areas; and densely populated geographic areas where there may be a particularly acute public health risk. The inaccessibility and format of existing data on environmental quality and facilities has thus far inhibited this effort. Researching how and where the media programs currently target their efforts is an important part of identifying the best opportunities for protection of the environment and public health.

Providing Pollution Prevention Technical Assistance

Currently, the NHPPP is the department's primary multi-media technical assistance program. The Task Force is considering several models for integrating pollution prevention technical assistance into a regulatory agency. Some of the models to be considered are outlined below:

- inspectors doing referrals: involves regulatory inspectors entering a facility, noting opportunities for pollution prevention, and referring the facility to pollution prevention staff;

- "super-inspector": involves regulatory inspectors who are trained in pollution prevention technical assistance;

- building pollution prevention into the compliance schedule: when a regulatory inspection takes place and violations are noted, pollution prevention activities can be incorporated directly into the compliance schedule;

- compliance audit: involves staff who visit a facility, note compliance problems and opportunities for pollution prevention, and give the facility a period of time to incorporate P2 measures into processes and procedures before an official regulatory inspection is done.

It should be noted that a combination of one or more of the above models may also provide an appropriate structure for providing technical assistance.

Staff Training Initiative

During implementation of the Merrimack Project it became evident to the Task Force that in order to advance pollution prevention much work needs to be done in the areas of training, education, and outreach. Institutionalizing a preventive approach in the Department is dependent upon the cooperation and commitment of all DES employees. Such commitment can be fostered through appropriate training activities.

The Task Force has recently initiated a Pollution Prevention Orientation Program for the Department. A three hour introductory session on pollution prevention will be offered to all DES staff, including clerical support staff, field/technical staff, laboratory staff, and administrators. The purpose of the training will be to introduce staff to pollution prevention concepts; provide updates on Task Force initiatives; and provide opportunities for staff to incorporate prevention into their daily activities.

To date, there have been two pilot training sessions, one for RCRA inspectors, and the other for senior management. Feedback on the sessions has been very positive. Training sessions will be scheduled for all other staff when the Strategy is completed.

Biomonitoring Component

A unique aspect of the New Hampshire portion of the Merrimack Project was the biomonitoring component. The science of biomonitoring focuses on measuring the health of an ecosystem by sampling the type and abundance of certain "indicator" species which are present. In this case macroinvertebrates (aquatic insects, worms, clams, etc.) were used. The purpose of biomonitoring is to provide information on the actual conditions in the river which have developed over a period of time. Ambient water quality sampling will give a "snap-shot" picture of water quality, but biomonitoring can give a better evaluation of the actual impact that a discharge or other pollution source(s) may have on an ecosystem over time. By initiating a biomonitoring program information may be gathered on the condition of the river which will allow a comparison of conditions before and after the implementation of pollution prevention activities.

In setting up the biomonitoring effort, project staff consulted with staff from the DES Biology Bureau, and staff and volunteers from the Merrimack River Watershed Council (MRWC). The

MWRC has a well-developed citizens monitoring program, and resources have been combined in a joint effort.

Project staff are currently working with Biology Bureau staff to develop a biomonitoring plan for the Merrimack which will be implemented this year, beginning with spring sampling events. It is expected that the data that is gathered will be useful in measuring changes in the ecosystem at a later date, due to the implementation of pollution prevention efforts.

Other Projects

NHDES has received an EPA grant to establish the state's first permanent household hazardous waste (HHW) collection facility. The facility will be sited in the City of Nashua, one of the largest cities in the Merrimack Valley, and will also involve setting up regulatory protocol for accepting hazardous waste from small quantity generators (SQGs). The HHW Collection Center will be available to the residents of Nashua and several surrounding communities. A pollution prevention educational component is included as part of this project.

Through a grant from the U.S. EPA, NHPPP staff and other DES staff are working with the University of New Hampshire, Chemical Engineering Program to develop an inter-disciplinary pollution prevention curriculum. The goal of this project is to better prepare students to deal with waste management and pollution issues when they enter the workforce. As part of the project, graduate students from UNH will develop case studies which focus on New Hampshire facilities which have successfully implemented specific pollution prevention activities.

Both states are working with the North East Waste Management Officials' Association to promote pollution prevention activities by automobile service, repair, and maintenance facilities. New Hampshire is organizing several workshops for auto-related businesses with the NH Automobile Dealer's Association (NHADA) for May of 1994. The workshops will focus on multi-media pollution prevention and environmental compliance.

THE MERRIMACK PROJECT

TRUE TALES OF TECHNICAL ASSISTANCE

DESCRIPTIONS OF ON-SITE VISITS AND RESULTS

As of MAY 1994

Part II

TRUE TALES OF TECHNICAL ASSISTANCE

Descriptions of Work Performed with Merrimack Companies

The following detailed descriptions of technical assistance provided to companies in the Merrimack River watershed by the Massachusetts Office of Technical Assistance (OTA) and the New Hampshire Department of Environmental Services are here presented in order to illustrate:

* the kinds of problems companies have and what they seek assistance for

* pollution prevention opportunities that are found in the field

* the kinds of recommendations that are made

* the kinds of activities companies actually do after receiving assistance.

It is hoped that these examples will be of assistance to anyone wishing to understand in detail how a pollution prevention technical assistance program actually works.

As of April 1994, OTA and NH have made site visits at 62 companies in the region; 47 companies are discussed here. Two additional case studies are appended.

OTA delivers all of its services under a legislative requirement of confidentiality. NHDES also promises confidentiality. The following descriptions of technical assistance work do not identify the company or describe the company product sufficiently to allow identification. In some cases, confidentiality has been waived. The technical assistance was provided by OTA's Northeast Team, consisting of Team Leader Ken Soltys and engineers Marina Gayle and John Flynn. Some case work was performed by previous OTA staffer Anne Reynolds, OTA's technical chief Bill McGowan, and OTA's assistant director Rick Reibstein. The NHDES site visits were performed or supervised by Paul Lockwood, Vince Perelli, and Stephanie D'Agostino.

MASSACHUSETTS COMPANIES

Company #1 is a job shop performing stamping and deep drawing of metal parts. They recently moved to the area, and determined to start out with a cleaner operation. The company was referred to OTA by the Greater Lawrence Sanitary District.

Before it contacted OTA, the company had decided that when it moved it would convert from using trichloroethylene (TCE) to an aqueous-based cleanser in its process lines, and close the loop to reuse wastewater. It sought OTA's help specifically in how to accomplish closed-loop operations, the type of equipment they would need and where to buy it.
After a site visit that included a walkthrough of the firm's processes, the OTA team presented a number of cleaning options, and assisted the company in comparing and evaluating each option. The company chose the Bowden aqueous degreasing system, which is essentially an industrial soap and water washing machine.

In dealing with wastewater, OTA recommended that a simple filtration unit could be fabricated which could be connected to the effluent from the vibratory tumbler as needed. The unit could be a portable cart-mounted pump and bag filter, with a small holding tank. If cart-mounted, the unit could also be connected to the sander, obviating the need to use the sump/cyclonic filter/settling tank currently in use. OTA also noted that deburring and polishing operations were creating an explosive dust hazard, and recommended wet grinding - however the company cited difficulties with such an equipment switch. Therefore OTA recommended wet scrubbing of exhaust air, and detailed the information necessary for accurate sizing of such equipment - air flow, fan motor horsepower, duct size and length, anticipated particulate loading, particle size, and hours of operation. OTA also provided information on wet scrubber equipment.

OTA further recommended the installation of closed loop cooling water systems on spot welders and compression molding machines, which have small cooling water needs. A simple recirculator with cooling coils and fan was all that OTA felt was necessary. OTA also recommended an oil/water separator specifically designed for the condensate from air compressors, citing estimates that there was one 250 standard cubic feet per minute compressor in use, and that historically such compressors produce about 25 drums of oily wastewater per year, at an estimated cost of $80 per drum.

In addition, the firm took OTA's suggestion to install an evaporation system, eliminating the need for dumping an acid neutralizing bath, requiring constant monitoring, to the POTW. The monitoring would have cost approximately $2,500/year.

Results: This company reports no initial cost savings in switching to a closed-loop system. The firm's engineering manager says the cost of running the aqueous system is about 20 percent higher than the TCE degreasing system because a greater amount of detergent is needed to achieve the same quality of cleaning. However, the firm no longer buys or uses TCE and does not have spent TCE to dispose of.

The engineering manager says OTA was extremely helpful in laying out the closed-loop system and especially in helping him understand which federal, state and local regulations applied to his firm. "You really need a technical assistance group like OTA to decipher the laws," he said. "The hardest part is figuring out what is applicable to your business. I would have had a real hard time figuring it out on my own."

Company #2 is a manufacturer of microwave components and semiconductors used in wireless communications and the aerospace industry. Since its initial meetings with OTA, this firm has incorporated pollution prevention into its corporate culture, has saved $8.6 million to date and has eliminated the purchase and use of 81 tons of toxic chemicals. (These figures differ from those quoted in the table of results: these figures include pounds reduced at company facilities outside of Massachusetts. The dollar savings is a company estimate of the net present value of their program, which is so high partly due to the rapidly rising cost of freon and TCA. In order to maintain a conservative method of estimation of the value of savings under the Merrimack Project, we only looked at the value in one year of one year's savings).

One of the firm's manufacturing division chiefs was investigating cleaning alternatives to freon and TCA when he learned of an OTA event called the "Solvents Bazaar", held in Worcester in 1990. The Solvents Bazaar was, to our knowledge, the first event of its kind. Manufacturers and vendors of alternative cleaning systems demonstrated their equipment for about 100 attendees, who brought dirty parts from their factories, so that they could see whether or not the alternatives worked. The firm's division chief sent a representative, and was so impressed that he called OTA to request a site visit.

The company was in the process of evaluating the effects of freon and TCA cleaning on wire bonding, component attachments, soldering. Any metallization has an oxide that starts to build immediately, and thus effective cleaning is essential to good manufacturing of circuitry. The original intent of the program was to find supplemental cleaning; it was not expected that replacement cleaning would be found. There was a sense that the program should investigate ozone friendly cleaners, but the program was not focused on environmental issues.

The division chief credits OTA's visits with "enlightening" the company to the concept of cleaning alternatives, the number of alternatives being developed, and the possibilities for success. Through OTA, the firm learned about work being done at IPC, a printed circuit board trade association. As a result of this contact, the division chief developed an Ozone Depleting Substance (ODS) elimination program that incorporated IPC testing recommendations. The company's program included ionographic testing to determine the amount of ionic residue left on a part; chromatography organic residue determination to detect amounts of organic residue and identify particular contaminants; Surface Insulation Resistance, to indicate the electrical performance of a cleaned part; and SEM Auger Surface Analysis, which is electron beam surface probing to characterize the elements of part surface layers. This regime of careful testing was used on a number of identified cleaning alternatives, and provided a careful measure of cleaning effectiveness.

An alcohol and water based material with some surfactants and saponifiers, manufactured by Kyzen Corp., was eventually selected. Other materials based on oil and terpenes turned out to be more effective cleaners (of solder flux residue) than the freon and TCA base lines. However, Kyzen far out-distanced all other candidates in this company's program. According to the company representative, Kyzen's cleaner has virtually no flammability problem, which is unique to alcohol-based preparations. It was explained to OTA that the material has a flash point so close to boiling point that the material doesn't ignite, but boils instead.

The ODS elimination program has been a success, and is seen as greatly enhancing reliability as well as meeting environmental goals. The success of this program, and the 33/50 program, the new Clean Air Act Amendments, and the state's Toxics Use Reduction Act, has led to a much greater emphasis at this company on environmental issues. The division chief moved from manufacturing to become the corporate head of environment. He has instituted a full-scale planning program, based on the process outlined in the state's Toxics Use Reduction Act. This program evaluates each process line at each of t he company's facilities in terms of tracking materials in and waste out.

The program is seen as an effort to improve both manufacturing yield and environmental performance, and is called "Process Parameter Optimization" (similar to language used by OTA for several years, but independently arrived at by this firm). The materials accounting system has proved successful at generating accurate information about process steps, about points at which materials become waste, about opportunities for pollution prevention at each process step, and information useful for comparing alternatives and prioritizing projects. The division chief has required the program to be followed at the company's facilities in other states, even though they are not under the jurisdiction of the Toxics Use Reduction Act. The division chief organized a company-wide conference on Design for the Environment, and has proved to be a key member in the formation of the Merrimack Business Environmental Network (described elsewhere in this report). Through the Network, he has acted as a resource for many local businesses on compliance with the CAAA requirements for labelling products made with CFCs.

OTA recommendations made to this company at the first series of meetings also concerned investigation of "no clean" options, and as a result the company has installed some Nitrogen and Hydrogen atmosphere soldering, which is fluxless (there is no oxidation of the metallic parts without oxygen in the atmosphere), eliminating the need for flux cleaning. Other recommendations concerning fluxless solders have not yet panned out, but the company has an aggressive program of investigation and evaluation.
The division chief credits OTA as being a "tremendous asset" in getting his firm started down this road.

OTA also recommended rearranging work stations for centralized batch cleaning, which is currently under design consideration. Because not every degreaser has as yet been eliminated, (although all TCA will be), OTA's recommendations for increasing the freeboard cooling have been implemented.

The division chief has been a speaker at OTA/DEP workshops for TURA reporters, giving the message that careful evaluation of materials use, pollution generation, and alternative options has greatly benefitted the bottom line of his company, and that the law is requiring activities that are just good business.

Results: The firm has set targets for reducing the use of chemicals identified in EPA's 33/50 program. The targets were set using 1988, when 154,000 lbs. of these chemicals were used, as a base year.

To date, a reduction of 49,000 lbs. of the 17 chemicals on the 33/50 list has been achieved. The target for 1998 is a 123,000 lb. reduction.

In addition, the firm has achieved 90 percent of its ODS elimination program. That means to date, the firm has reduced use of freon/TCA by about 127,500 lbs. The company expects to completely eliminate the use of all ODSs by the end of 1995.

Through its pollution prevention efforts, the firm has reaped additional benefits, including the ability to begin notifying its customers that all products are manufactured without the use of ODSs, which is expected to lead to increased sales; elimination of the concerns of employees who were working with hazardous chemicals; and reduced toxics use reporting and compliance requirements.

The division chief says more technical assistance programs similar to OTA would help P2 efforts, and that such assistance programs should emphasize the cost-effectiveness of P2 strategies. He also believes P2 programs should include a mechanism to tie customer acceptance of products into the general concept.

Company #3 is an electroplater, referred to OTA by EPA counsel because the company had substantial violations. The EPA attorney knew of OTA's services because she and OTA representatives have participated in EPA Region I meetings of a group known as the Pollution Prevention Task Force (headed by P2 coordinators Mark Mahoney and Abby Swaine). This company's case is an example of how important enforcement programs are to deal with companies that do not take the initiative to properly address environmental issues.

OTA met with the company on a number of occasions, and supplied information to the company's consultant. The company's chemist attended the Merrimack Project workshops on printed circuit boards, water conservation, and electroplating.

OTA noted evidence of extensive spilling of plating chemicals on the shop floor, and recommended drain boards and changing the layout to avoid dripping of parts. OTA noted a lack of controls on some hazardous wastes and materials, and recommended a materials control system, which would institute chronological ordering of incoming material, refusal of materials in damaged containers, and inventory control cards to log amounts of withdrawal, dates and

initials of individuals. The OTA team also advised the company to contact scrap chemical dealers.

Further, OTA recommended improved rinsing to conserve plating chemicals and water. The company officials indicated that they were familiar with all of these ideas, but after extensive discussion it was apparent that the idea of a dead rinse was in fact new to them. (Dead rinse involves rinsing in still water, allowing the rinsed-off metals to accumulate, and using this as makeup for the evaporating plating bath to save on input of metals and drastically reduce metal discharge.) OTA provided information on non-cyanide zinc plating (Isobrite), the supplier of which (Allied-Kelite), will share disposal costs with the customer, and will take back spent nickel and chrome solutions.

OTA also pointed out that false bottoms on the plating tanks would allow for tank cleaning without dumping the entire bath. These bottoms can be constructed of screens with a nominal 200 mesh size.

OTA advised that the company could use recirculating bag filters to extend the life of plating baths, and provided a sketch of what such a system would look like. Team members pointed out that above the baths were rusted, dirty overhead pipes, which were potential sources of contamination to the baths. Pipe insulation would address this as well as providing for energy savings.

OTA also discussed metal recovery systems with this company, but did not provide extensive information because at this point the company had not proceeded with any previous suggestions. Thus, this case illustrates an important point about the delivery of technical assistance. At some point a technical assistance team has to evaluate the reception of their work, and consider how best their resources are to be devoted. It did appear that the company was not seriously evaluating OTA's advice. Because the team was receiving numerous requests for assistance from other companies, work with this company was curtailed.

This situation also raises an important point concerning the relationship of enforcement and technical assistance. If a company calls OTA because they are recommended to do so by an enforcing agent, care must be taken by the enforcement agency not to assume that the company is thus implementing pollution prevention. It may not have been the case with this particular company, but its example suggests that a company may use contact with OTA to project the appearance of pursuing P2. If an enforcement agency wishes to give some leeway to companies that pursue P2 as a strategy for addressing violations, that agency should request evidence of such work directly from the company. If a company is seeking an advantage based on a claim of working with a technical assistance agency, it seems reasonable to ask what recommendations had been received, and what progress has been made. OTA is bound by confidentiality, and thus it is improper for the enforcing agency to refer to OTA and then expect to call this office and find out what is happening with the company. We do recommend to companies that have had violations that they volunteer information to the enforcement agency concerning their implementation of P2.

Results: A follow-up phone call made in March 1994 determined that in fact the company had, contrary to our assessment, taken many of the recommendations seriously and addressed some of our concerns. Most of the pollution prevention measures the company adopted were related to improved housekeeping practices, although some changes were made in rinsing techniques and monitoring on the process lines. The company president says that by installing filtering systems and dead rinses as suggested by OTA, the firm reduced chemical use -- cyanide, in particular -- by 5 to 10 percent.

The president says those same changes have resulted in "tremendous savings" in the firm's waste treatment costs: the company now spends approximately $1,000 a day on waste treatment, a savings of roughly $50 per day -- or $13,000 annually -- compared to before P2 strategies were adopted.

The company plans in the future to install a water reclamation and reuse system that will reduce water use by approximately one-third, from 15,000 gallons per day to under 10,000 gallons per day. The firm's president says a 10,000 gallon tank is in place, but the company lacks the capital to complete the system at this time. He repeatedly referred to a lack of capital and EPA fines the firm is paying off as the reason for not implementing other P2 suggestions made by OTA.

Company #4, a consumer product manufacturer, was referred by the Greater Lawrence Sanitary District (GLSD). OTA went to the site for a general meeting, and did not have a full scale walkthrough. OTA went with John O'Hare of GLSD. This company was having problems meeting limits on Fats, Oils, and Grease (FOG), and in releases of surfactants, which were a concern for GLSD because of foaming in its effluent. The problems of this company raise some important questions concerning the current protocol for measurements of FOG. Freon is used in the Mbas test, and OTA conjectured that it might dissolve organic components other than grease, which leads to a false reading of high FOG, actually due to nongrease chemicals.

The company has reduced its water use 87 percent through examination of flushing (line cleaning) techniques. Instead of cleaning with water, they now use compressed nitrogen to push dedicated absorbents called "pipe pigs" through each line. They have also achieved a 40 percent reduction in drummed waste by replacing flat bottom tanks with tanks that have conical bottoms. The cone-bottom tanks provide for more efficient draining, and when the tanks are cleaned, there is much less residue to clean. OTA suggested rinsewaters for batch makeup, and using a small still to reclaim alcohol.

Results: OTA's discussions with the company have led to its active participation in and support of the Merrimack Business Environmental Network. This company has accomplished a great deal on its own, and OTA has suggested publicizing these accomplishments. However, the company is very reluctant to pursue this course at this time, claiming that touting its environmental achievements will leave it open to criticism from environmental activists who will not be satisfied with the company's claims.

Company #5 is an adhesives manufacturer referred to OTA in 1992 by the local board of health as a result of nuisance complaints received from neighbors concerning odors. OTA found that one of the coating lines could be linked to an existing thermal oxidizer with sufficient capacity to handle its vapors, but recommended consideration of a solvent vapor recovery system using a nitrogen strip process, which would allow reuse of the solvents in cleaning or other operations.

OTA noted that the coating station could be enclosed, in order to capture fugitive emissions, and that discharges from mixers could be also be enclosed by connection to portable containers by using flexible braided stainless steel hoses and quick disconnect couplings.

The company had arranged to install activated carbon filters on exhaust ducts from other mixers, but OTA noted that the kind the company was planning to use would have a relatively small capacity and would need to be changed frequently. OTA pointed out that the contractor, who had agreed to regenerate the filters, would have to handle them as hazardous waste.

In addition to the odor issues, OTA noted that the company should limit its acceptance of sample chemicals, and obtain agreements from vendors that they would take back any unused samples. OTA also discovered that a still in use at the facility was configured so that the end of the distillate discharge tube was higher than the condenser outlet (the exit port for the distillate). This meant that distilled liquids would run back into the boiling chamber to be reboiled, or could block the discharge tube, causing dangerous pressure buildups.

Results: The company fixed the improper distillation system, and did hook up to the carbon filtration unit some areas of the process that had been uncontrolled, leading to a distinct improvement in odors. The company did obtain agreements from its vendors to take back unused samples, and no longer accepts delivery of unsolicited samples. The company was very attentive to hazardous waste requirements concerning the used carbon filters. OTA staff observed no odors of any kind during its last visit in the spring of 1992. Since this time, OTA has hired a new staff member who happens to live within 100 yards of the facility. He affirms that the problem was substantial and states that there has been no problem for a long period.

The firm also implemented OTA's other suggestions, including the installation of new duct work connecting to the firm's existing thermal oxidizer and enclosure of the coating stations. The company's general manager credits OTA with helping the firm to solve a chronic odor problem.

By the time the firm contacted OTA, it was two years into a VOC emissions abatement program it developed with the help of a private consulting firm stemming from a consent order from the Massachusetts DEP. Since 1990, the company has spent more than $325,000 on pollution control and reduction efforts, including installation of the thermal oxidizer, reformulation of adhesives, and reduction in the use of toluene. By the time the VOC abatement program is complete, the company's emissions are expected to go below 13 tons/year, down from more than 130 tons/year before the program began.

The general manager says because of the large capital expense involved, it is difficult to quantify

any cost savings related to the program. However, preliminary calculations indicate approximately 10 cents is saved in terms of compliance costs and savings in chemical purchases for every $1 spent in capital costs. "The payback is not outstanding," he says. Installation of the thermal oxidizer provides some savings by reducing the company's use of natural gas by burning VOCs. Reformulation of adhesives and toluene reduction have resulted in savings of $10,000 and $5,000 a year, respectively.

The general manager says an additional benefit is a better working atmosphere for employees who now experience less exposure to solvents.

The general manager also says he believes regulatory programs would work better if those writing the regulations had a better understanding of what the practical application of regulations are for specific industries. "Industry is not opposed to pollution control regulations or to reducing pollution, but we don't feel like whoever is writing the regulations always know what they are talking about," he says. "It seems like decisions (about regulations) are made in a vacuum."

This case is another example of the need for a pollution prevention technical assistance agency to understand conventional control technologies, as well as pollution prevention techniques. The company had an existing system, and although OTA pitched a solvent recovery system, the company was more interested in maximizing utilization of what it had. Because OTA did not take the position that they would work exclusively on prevention, and did provide assistance in optimizing the existing system, the company was able to improve its odor situation. It may be surmised that OTA's practice of providing general assistance did increase the credibility of its recommendations overall.

Company #6 is Babco Textron, which machines specialty metal parts for the aerospace industry. The company came to the Haverhill workshop for machine shops, and heard a presentation by General Electric on their new, safer coolant (Blazocut), which this company also used. However, General Electric was recycling their coolant and this company was not. After their visit, OTA staff recommended several changes to Babco's cooling system.

Staff pointed out that the existing cotton filters would support bacterial growth - and polypropylene filters would not. Also, the cartridge filters being used, once spent, were taking up considerable space, whereas bag filters (less expensive to buy) are collapsible. The company was already buying bag filters for an aqueous degreaser system, and these could be used on the coolant. Most importantly, Babco had on site an ultrafiltration system, used for treating effluent water from stone tumblers; this could be used to recycle the coolant. However, OTA pointed out that this was just one feasible method for recycling the coolant, and recommended the company contact GE. Babco was subsequently invited to the GE Lynn plant to review the their coolant recycling system. A variation of this system, incorporating phase separation coalescers, was installed. Ultimately, the ultrafiltration unit was used for recycling the water from the stone tumblers, which had been discharged. The company has agreed to share this information with other companies.

It is worth nothing that the environmental manager at this company was responsible for materials management, and this apparently had resulted in a very effective materials management program, reducing the amount of overstocked chemicals, and cutting the variety of chemicals used from 500 to 162. A computerized inventory, which is used to approve chemical purchases, is linked to MSDS's and tracks usage.

Results: Babco had installed an aqueous cleaning system using Blue Gold cleaner (sodium hydroxide based), and ultrasonic agitation, which replaced a TCA degreaser. The company did agree to act as a referral source for other companies considering such a system, and has been willing to demonstrate it, allowing other companies to bring their dirty parts to their facility for cleaning. Babco's Mike Cowell also agreed to present at the September, 1992 33/50 EPA conference in Framingham.

Babco had a Zyglo nondestructive testing system, which uses florescent dye to detect flaws. The system uses air atomizers for spraying and a garden hose for rinsing. OTA recommended that Babco use high volume low pressure (HVLP) spray guns to apply the Zyglo, that the air atomizers be used for spray rinsing, and that the rinsate be run through the ultrafiltration unit for dewatering. These recommendations were implemented.

The company has since relied on OTA for help in obtaining clarifications with DEP regulations, and is currently working with OTA on refinements to its chemical management system.

This company is in Danvers, and not in the Merrimack River system. However, it is included here because work with the company began with their participation in a Merrimack Project workshop, and the firm has provided information and demonstrations to a number of Merrimack companies with which OTA has worked.

Company #7 is in Salem, outside of the Merrimack watershed. However, it is discussed here briefly because OTA persuaded the company to run trials of the Venturi Systems Hydrovac technology, which is an inexpensive method for superaerating water. OTA's research at the very beginning of the Merrimack Project led to the discovery of Venturi Aeration, a tiny two-person company from southern New Hampshire. OTA visited a site where Venturi was digesting restaurant grease, using the Hydrovac to provide oxygenation to grease-eating microbes. The site was digesting grease that would otherwise go to landfills, or be disguised in septage hauls, and the company was meeting FOG limits in its discharge. This information was presented at the Merrimack Project workshop for Newburyport on Fats, Oils and Grease from restaurants.

OTA also visited a site in Pelham, NH where Venturi was stripping VOCs from groundwater, and showing nondetectables in their monitoring. OTA was interested in the innovative uses to which the Hydrovac technology could be put, and recommended at company #7 that the technology be tried for aerating grease-laden water before treatment in order to turn sulfides to sulfates, bacterially digest FOGs, stimulate aerobic bacteria to control anaerobic bacteria, and get the best settling and separation in the mixing tank.

Results: The company agreed to a trial, but the system did not perform to the company's expectations. Venturi Aeration felt the pump became fouled with suspended solids, that chrome present in large quantities was consuming available oxygen, and that the sulfide conversion to sulfates was also consuming available oxygen. OTA observed that the wastewaters were much improved, but the company felt that because they were not restored enough for reuse, it would not use the system. Recommendations for improving trials were not implemented, and the company has not tried the system since that time (October, 1992).

OTA experience with Venturi Aeration, however, convinced staff that there was potential for new applications of this inexpensive superaeration device, and that the company was innovative and eager to experiment. OTA has assisted the company in preparing financial information, and in introducing it to new business opportunities where the new technology might be applied or recognized. OTA recommended trials of the Hydrovac for odor control at the Greater Lawrence Sanitary System; these were successful, and large scale systems have been put in place. (See attached case study).

This case illustrates the danger of inflated expectations. Although initial discussions with the company included the possibility that the Hydrovac might render the wastewater suitable for reuse, OTA expected that if it did not, there would still be an advantage in enhancing the treatment system in place. In fact, by reducing sulfides and increasing chromium conversion, this seems to have taken place. But the company regarded the trial as a failure because it did not lead to complete water recovery.

OTA is still working with Venturi Aeration, which is now also marketing a vacuum filtration system. This was demonstrated recently at company #7, and the system did clean a large percentage of wastewater, rendering it reusable. However, the concentrated filtrate, run back through the system, did not clean up. It will be interesting to see if this trial comes to be regarded as a partial success or as a failure.

Company #8 is a metal parts manufacturer which contacted OTA after being notified by the Lowell treatment facility that they were exceeding aluminum discharge limits of 2 mg/L. OTA found technical violations with hazardous waste laws, and emphasized the legal risks the company was taking. The treasurer of the company, who assigned himself as environmental coordinator, was attentive to these remarks, and made OTA aware of some actions that he subsequently took to address improper storage.

OTA recommended that a bath no longer used should be eliminated from the cleaning line, and that the available space be used for dead rinses immediately following caustic cleaning and acid baths. OTA also suggested spray rinsing of parts over the process tanks, and designing racking to maximize drainage.

Results: The company did remove the old bath and installed dead rinses, installed bag filters to extend the life of the chemical baths, and also improved their self-monitoring by using a less

expensive aluminum testing method that OTA told them about - a Hach DR 100 Colorimeter (OTA also mentioned that similar test kits could be obtained from LaMotte Chemical - we always try to avoid recommending just one supplier, and preferably recommend three). It is our understanding that these actions resolved the zinc problem.

After implementing OTA's recommendations, the company's aluminum discharge now averages 1.6 to 1.0 mg/L, reduced from the 2.2 to 2.6 mg/L it averaged before the changes. The company president says the effort was made solely for regulatory compliance and says "very little" pollution is being prevented. Because of the changes, he estimated the company saves 10 percent, or $500 annually, on its water bill.

This company serves as an example of that population which is primarily interested in compliance at lowest cost, which needs to have regulatory limitations as a requirement or it is questionable as to how much they would undertake on their own. The company aslo serves as an example of how difficult it can be to get some people to recognize indirect or intangible cost savings. This company had savings from: the space that was opened up to other uses after the dead rinse was removed; the extension of the chemical bath life, (which results in less frequent dumping and reduced purchases); and the fact that the POTW was no longer notifying them of violations (worth at least the value of the fine they would have had to pay if they had not rectified the problem, without considering the cost of legal representation or engineering consultation if the problem had continued). None of these were noted by the company, nor did the company consider the amount of pollution prevented to be significant. However, if we take a conservative estimate of annual flow at this company of 1,875,000 gallons (based on information provided by the company), convert it to 7,265,625 liters, and then multiply it by 1.1 milligrams for the amount reduced per liter (the previous average of 2.4 minus the current average of 1.3), and we have 7,992,187.5 milligrams, which equals 7,992.2 grams, which equals 17.6 pounds. Perhaps today this is not a significant amount of pollution, but ten years of such savings would mean nearly 200 pounds of metal not entering the waterway, and if just ten other companies did the same thing it would mean a ton of pollution avoided, by implementation of very simple measures.

Company #9 is Alternate Circuit Technology, which came into contact with OTA as a result of its environmental engineering manager, David Unger, taking the class for TURA planners at the Toxics Use Reduction Institute (TURI) at the University of Massachusetts at Lowell. TURA requires toxics use reduction plans by large quantity toxics users: these plans have to be signed by certified TUR planners.

ACT pursued a federal grant to finance installation of an ion-exchange, reverse osmosis (RO) system for recovering metals and reducing water discharge from plating operations. Under this system, rinse waters go to a 25 gallon per minute RO system, recovering all rinsewater except about 2 gallons, which is discharged.

In addition, ACT followed OTA's suggestion for reclamation of etch material, saving the company from disposing of 40,000 gallons of bulk etch annually. ACT purchased an acid reclamation unit that had been the subject of a presentation by Digital Equipment Corporation

at the Printed Circuit Board workshop sponsored by OTA, the Toxics Use Reduction Institute, NHDES, and the Lowell POTW and held at the University of Massachusetts at Lowell.

Results: David Unger says the firm has not quantified exact savings realized from use of the RO system, but says since it has been in use, there have been "no upsets" in the system operations, and ACT controls and monitors its water quality. He said the discharges to the POTW have been cut by 2 million gallons in the first six months of use of the RO system, which should dramatically reduce the $12,000 annually the firm pays in sewer fees. In addition, because of the etch recycling, ACT save $7,200 annually in disposal costs.

David Unger said he believes hazardous waste generators greatly benefit from easy access to a non-regulatory agency that can walk through the plant and keep information about what they find confidential. "Most people don't know or just forget about compliance details," he says. "No one can afford the fines. And it doesn't do any good to put companies out of business."

Company # 10 is a contract spray painter which contacted OTA after hearing about us at a seminar (not an OTA seminar). OTA conducted a joint walkthrough with the NHDES personnel. The team observed an excess of left-over paint, and recommended purchases of reduced quantities. The team also recommended buying base paint and mixing colors as needed, rather than buying colored preparations.

The team also pointed out a number of actions advisable for better compliance with air and hazardous waste regulations. The team suggested that when the company had overstocked paints, it could offer a discount for their use. The team provided information on respirators for use by employees, and recommended and provided information on operator training in the use of protective devices and in proper spray painting techniques. The team discussed improvements to paint gun cleaning operations that would reduce the amounts of solvents used, the use of a dedicated cleaning station, and the use of a waste exchange for left-over paints.

Almost one year later, the company was urged to call OTA by DEP after receiving an inspection. DEP told the company that OTA could assist with the calculation of VOC emissions. DEP knew of this OTA capability because OTA engineer John Flynn presented to DEP air personnel a computer program he developed for making such calculations, and DEP had made an assessment that the program was useful. (OTA is working on refining this program).

OTA assisted the company in understanding how solvent density, formula weights, and other data are used in calculating VOC emissions. Review of MSDS sheets from suppliers revealed inadequacies, and up-to-date information was obtained. The company has implemented OTA's method of measuring VOC emissions and tracking them by computer.

OTA made many of the same recommendations that had been discussed previously: reducing VOC emissions by employing a gun cleaning station, improving worker training, and investigating electrostatic painting methods (which dramatically increase paint transfer efficiency).

OTA provided information on alternatives to the company's methylene chloride phosphating operations, which are another source of VOCs at the plant, noting that aqueous based cleaning/phosphating systems may require a drying step before paint application. OTA sent notes from a teleconference on painting, held in 1992, for which OTA arranged several downlink sites throughout the state.

Results: This company has taken full advantage of OTA's compliance assistance service: OTA basically prepared their air source registrations for them, bringing them into compliance. In a recent follow-up phone call, the company reports that it has implemented the good housekeeping and improved purchasing practices OTA recommended and has assigned a staff member to monitor hazardous waste storage and handling. A company manager estimates the firm saves $5,000 a year by reduced purchase of thinner, and now purchases higher quality paints, generating less waste and reducing employee exposure to hazardous materials.

Company # 11 is Brush Wellman Inc., a manufacturer of electrical components, which contacted OTA after receiving a multimedia inspection, jointly conducted by DEP and the Newburyport POTW. On the initial visit, this team found minor hazardous waste violations, and recommended the company make use of available technical assistance services.

OTA found the company had a very clean and well run operation, and had already virtually eliminated TCA and dramatically reduced use of Freon. One problem was that the aqueous cleaning now in place did create a problem with water spotting on gold plated parts after a final rinsing with deionized water (there had been no spotting with Freon drying). The company was using a rinsing aid called Cerematek. OTA suggested that the spin drying operation could be supplemented or substituted with mild tumbling in a octagonal barrel tumbler filled with ground corn cobs. This should eliminate the spotting and the need for the Cerematek chemical additions. It was pointed out that the corn cob tumbling would likely burnish the gold, and that the company should evaluate whether or not that was desirable to their customers. They were referred to another company, which had agreed to discuss their experience with corn cob tumbling.

The company had already extended the life of their baths by changing filters more frequently and reducing evaporation by using floating plastic balls on the bath surfaces, and has pursued OTA's advice to further increase bath life by careful monitoring of pH and constant constituent adjustments to maintain the optimal bath operating parameters.

OTA found that the regulatory violations at the company were the result of confusion concerning requirements, and obtained clarification of the issues, which consisted of dating and satellite storage. The company had extensive air monitoring on site, and appeared to be committed to both compliance and preventive activities.

Results: Jean Borgard, Plating Supervisor, credits OTA with helping BW reduce its use of hydrochloric acid nearly 40 percent (from 26,000 lbs/yr to 16,000 lbs/yr), saving the company

roughly $35,000 a year in purchasing costs, plus associated savings in reduced wastewater discharges.

In addition, the firm is investigating new cleaning and drying options identified by OTA that will allow the elimination of the use of Freon 113. According to Borgard, BW expects to stop using Freon by July 1994, saving an additional $40,000 or so annually in chemical purchase and waste hauling and disposal costs.

Borgard said OTA provided information on good housekeeping practices regarding the storage and shipment of hazardous waste, keeping the firm in compliance and preventing the possibility of fines for violations.

The plating supervisor said the most helpful service OTA provided was giving BW the opportunity to "benchmark" or compare its operations with other firms and see how others had successfully reduced the use of toxics. "They helped us develop a good environmental policy for the company and the community."

Company #12 machines aluminum parts, and learned of OTA's services by attending the Machine Shop Workshop in Haverhill. The company needed help with hazardous waste compliance, and selenium discharges. The company's discharges were uncomfortably close to a new limit (0.2ppm) set by the Amesbury POTW. The company did not know where the aluminum was coming from.

OTA had bath samples analyzed by a laboratory, which is a service OTA provides when necessary to identify P2 options. These tests indicated two sites at which selenium was present in significant amounts, the major source being a chemical used for chromate conversion.

OTA recommended the company use a local laundry equipped to handle oily rags, instead of disposing of wipes. The team suggested that using recirculating filters for the acid and caustic process baths would not only keep them clean and extend their life, but also provide movement of the solution, thus increasing their efficiency. (In-tank filters for acid baths would not require expensive out-of-tank teflon construction). The team advised that evaporative losses could be reduced by using tank lids and closing them during periods of non-use, and provided information on floating media covers, (such as that used by company #11). Dead rinse tanks (with filters) also were recommended, which could be used as make-up for the preceding evaporative baths, and could be replenished by overflow from other running rinses. OTA pointed out that spent acid or alkaline solutions could be used for pH adjustment in wastewater treatment, and that heated baths could be insulated.

OTA explained reactive rinsing: that the same tank could be used for rinsing parts from both acidic and alkaline baths, and that alkaline rinsewater could be reused to rinse parts from the acid cleaning, and that this method saves water and affords some neutralization, saving on the addition of treatment chemicals down the line.

Methods for maintaining bath chemistry were also discussed, and the company was given information about monitoring equipment, including a hand-held fast titrater, and inexpensive resistivity sensors for measuring the level of dissolved chemicals. The sensors can be preset for desired levels and can activate horns or lights for warning operators that rinsewaters need to be drained. This method replaces the calendrical method of replacing bath and rinse waters, (where dumping occurs at a set interval), with a method that only sends waters to treatment when necessary.

Results: The team surmised that the company had not implemented many of the elementary prevention techniques summarized above because there is no chemist on staff. The company was also hampered in its progress on these matters by the departure of the person with whom OTA worked. In addition, the company was planning to move, and thus was reluctant to invest in any changes or new equipment. OTA has recently reestablished contact with the company. The company has plans to switch from TCA, an ozone depleter, to TCE. OTA visited the facility to explain the problems and liabilities inherent in using TCE. In the course of this visit, OTA recommended consulting with Babco Textron to observe their ultrasonic aqueous cleaning system, and employed a sniffer to evaluate emissions from their degreaser. There were no significant readings when the degreaser cover was closed, but when it was open there were observable emissions.

At this company, as well as others, OTA observed less than optimal choices being made to eliminate ODSs (Ozone Depleting Substances) in order to avoid the new Clean Air Act requirements for CFC labelling. OTA has observed a number of companies with plans to switch from TCA to TCE. This is ironic because so much effort has been expended attempting to convince companies to abandon the use of TCE and other chlorinated solvents that result in hazardous waste generation, Superfund cleanups, VOC emissions, occupational exposures, and organic contamination of water. It is noteworthy that the EPA's Significant New Alternatives Program does list TCE as a potential substitute for ODS cleaners. OTA is now spending significant energy to convince companies to continue to explore safer ODS alternatives.

The company is also one of many that calls on OTA primarily when it needs assistance with compliance, and which needs considerable hand-holding in order to implement process changes. This case illustrates the principle that companies are less likely to institute process changes when they do not fully understand the process they are using.

Company #13 is a manufacturer of semiconductor devices. John O'Hare of Greater Lawrence Sanitary District suggested that because they have a low flow operation, they might be able to go to a zero water discharge system, and suggested they contact OTA.

OTA discovered that the facility is a very small quantity generator of hazardous waste with no knowledge of the applicable regulations. OTA supplied them with the appropriate information, and also recommended they contact suppliers of ion exchange equipment. In addition, we recommended trials of NMP, hexane, and citrus-based cleaners for removing paraffins. The

company did contact vendors and obtain prices.

This company's case illustrates the regulatory confusion regarding zero water discharge systems. The POTW has asked OTA to clarify this matter, and OTA has requested clarification from DEP. DEP met with OTA in 1991 and decided eventually to consider the matter on a case-by-case basis. A consensus has recently developed that case by case resolution is insufficient, because companies need clarification before they proceed with capital investments. DEP has reconvened a committee to devise solutions to the "closed loop closed door" problem. OTA is playing a significant part in this effort, defining technologies for zero water discharge, and proposing policy and regulatory solutions.

Briefly described, the problem with zero waste water technologies is that if a company closes the loop and begins treating or recycling hazardous waste (which they typically do), they may be considered "treating without a license" - a violation of part B Treatment, Storage and Disposal Facility license regulations under RCRA.

This is because it is possible for regulatory authorities to interpret their situation as no longer having the potential to affect the facility that receives wastewater - the POTW or receiving water - and thus no longer being adequately regulated by another program - the Clean Water Act.

Although Sylvia Lowrance in 1989 proposed in a letter that a possible answer to this quandary is for Clean Water Act authorities to issue zero discharge permits, many pretreatment officials have commented to OTA that they are too busy regulating facilities that do discharge to them, to have to worry about facilities that have sealed their drains and discharge nothing.

GLSD has, however, recognized the benefits of zero water discharge facilities, and has issued "zero discharge" permits. The legal value of these has not been tested.

Please see attached description of the "closed loop closed door" and other opportunities for regulatory improvement.

Company #14 is an electroplating company under new ownership and involved in establishing a new site for operations. Their previous site had significant violations, and DEP had recommended they give us a call.

Several team members participated in the site visit, presenting a fairly complete set of general recommendations on good plating operations. Then the team took a look at the plant where the operation was to be set up, and pointed out the floor was not protected from absorbing spills, and that ventilation needed to be improved.

At a second visit, the team observed that the tanks were two to three times larger than necessary, and recommended the use of simple steel mesh in-tank filtration, evaporation reduction by use of covers or floating media, and the installation of automatic chemical addition systems for the chemical baths. OTA recommended using bag filters instead of cartridge filters to save money,

reduce waste volume, and gain filtration efficiency.

The company asked for more information, although its primary concern seemed to be obtaining financing for its required contribution to a Superfund cleanup site.

Results: Follow up with this company was not as prompt as it could have been; five months passed before a second letter of recommendations was issued. This letter recommended recovery of pure copper and etchants using the Sigma Innovation etchant regeneration system, successfully used by Digital Equipment Co. in Puerto Rico, about which a presentation had been made at the Merrimack Project's Spring 1992 Lowell workshop for Printed Circuit Board manufacturers. Other information concerned countercurrent and dead rinses; drip boards; using deionized water for rinsing; tank covers; and using local precious metal recyclers for photowastes, scrap board trim, and possibly for metal dusts, filters, resins, and solutions.

Company #15 is an industrial laundry that called OTA after a visit from DEP, and a referral by Lou Vallee of the Newburyport POTW. The company was near flow limits and was interested in water conservation. In response to OTA's Previsit Questionnaire the company commented that "one finds oneself facing more and more compliance issues. Thus, when the DEP visited our plant, I asked 'where does one go for help?'"

OTA suggested trying the Hydrovac technology to reduce biological oxygen demand (BOD) in the final effluent, by recirculating the contents of the holding tanks and coupling the superaeration with microbial treatment. The team also suggested reusing final rinse waters for wash water makeup, by constructing a holding tank and using a heater and pumps. OTA mentioned that detergency can be enhanced by use of softened, or deionized water, and suggested that new ozonation techniques can replace or reduce the amount of detergent chemicals necessary for washing. The company was informed that Highland Laundry of Holyoke was willing to provide a demonstration of their working system. **(See attached patent)**. OTA also discussed use of a chemical dispensing system, to eliminate overuse and spillage.

Results: As a result of the visit, OTA investigated the potential for substituting citric acid for sulfuric acid, used to neutralize alkaline wash waters before discharge. Neutralization titrations were conducted to compare sulfuric and citric acid strengths. Sulfuric was about 1.52 times as strong. This translated to an approximate cost for citric acid of $12 per 1000 gallons of wastewater compared to $1.73 for sulfuric. Even though sulfuric is covered under TURA, and the company has to pay a fee for its use, the switch to citric acid did not seem to be economically justified.

The contact person at this company was subsequently laid off, and OTA is not aware of implementation of any of the recommendations, but there has been no recent follow up to this company.

Company #16 is the Frank C. Meyer company, a print shop. (See attached case study.) Because of its pollution prevention efforts, this company eliminated the generation of 10 drums of hazardous waste per week, saving $92,000 annually, and installed a wastewater reclamation and

reuse system, saving an additional $46,800 per year.

The company initially contacted OTA at the recommendation of the Greater Lawrence Sanitary District, and asked us to help them determine if their tank and machine washing solutions were suitable for drain disposal. OTA obtained information from GLSD on their effluents and compared it to ink analyses submitted by the company's vendors. It was apparent that the source of zinc, copper and lead loadings was the inks themselves, and OTA recommended that since the inks were likely to be insoluble in water, filtration, starting with a five micron bag, would probably solve the problem. OTA recommended techniques for preventing contamination of wash water with ink waste.

After only one month, the company had already instituted new press clean-up procedures which reduced the amount of solids in wash water more than half, and had successfully used press wash water in the make up of black ink. The company had already mounted a small bag filter and pump - OTA recommended increasing its size. By lowering the pH of their wastewater, the company was now precipitating inks. The wastewater was now suitable for discharge.

This case demonstrates that some companies can be inspired to do pollution prevention simply by introduction to the concepts. These companies benefit greatly from the provision of technical assistance.

Company #17 is a manufacturer of electronic components, referred to OTA by John O'Hare of GLSD. The company had just moved to the GLSD area. Process effluent contained lead, selenium, and tellurium, which was being drummed and shipped. OTA learned that the company had spent considerable money on a lead treatment system that did not work.

OTA noted that the company was using TCA, informed them of upcoming Clean Air Act requirements for labeling, and recommended several alternatives. The company did switch to N-methyl-2-pyrrolidone, and reports that it doesn't work as well, but is acceptable. The firm also reports no cost savings at the time of the switch, but noted the costs of TCA was rising rapidly, so they would be saving money over time.

OTA's recommendations focussed on various methods for recycling water, with zero water discharge as the goal. Many of these systems involve evaporation, and OTA typically recommends that companies consider enclosed evaporation, as that may be considered under the state's hazardous waste regulations as "treatment that is integral to the manufacturing process" and thus needing no permits or licenses. (OTA has identified an inconsistency in DEP rulings on this issue, with some officials recognizing end of pipe enclosed evaporation systems as integral, and some officials stating that it does not qualify because it is end of pipe and not necessary for producing the product.) OTA noted that if the company chose an atmospheric evaporator, it might by accident be driven to dryness, and in that case it would be possible to drive lead and selenium compounds into the atmosphere.

The company did express enthusiasm with the idea of cold vaporization, which is a technique for

enclosed evaporation. Enclosed evaporation techniques recover water, rather than driving it into the air. Cold vaporization operates by pulling a vacuum, which enables the water to evaporate at room temperature. The company was concerned with a lack of available funds to purchase such a system.

A company representative said he appreciates non-regulatory assistance offered by OTA and sees a need for expansion of such technical assistance programs, particularly for small businesses. He said smaller firms like his -- which doesn't have a full time environmental compliance officer -- could use help in developing hazardous materials safety programs, including employee training. He said hazardous waste handling and management has become a "regulatory nightmare" and called on the state and federal governments to write regulations in simplified language "so you don't need a lawyer to understand what applies to your industry."

Company #18 is a manufacturer of air filtration and conditioning systems, which came into contact with OTA as a result of receiving a Notice of Noncompliance (NON) from DEP for improper disposal of oily rags.

OTA noted significant VOC emissions from painting operations, and the use of a contact cement containing TCA, which would require CFC labelling. OTA discussed using low VOC paints, and pointed out that the supplier of their paints, Sherwin Williams, was offering high solid (low VOC) versions of the same paints in use at the plant.

Results: OTA followed up several times with this company, and determined that no actions were being taken. OTA then took the unusual step of writing to the president of the company to inform him of the opportunities we had discovered. There has been no response.

Company #19, a manufacturer of plastic components, was referred to OTA by DEP inspector Joe Dowling. OTA observed that the facility was very clean and operations appeared to be well run, and complimented the company on this.

The company had selected an aqueous cleaning system to replace TCA, and was having trouble obtaining financing.

VOC emissions from cleaning paint guns was one concern, and information on gun washing systems was provided. In-house distillation or off-site recycling of the spent solvent was discussed. OTA provided information on worker training in spray painting, and HVLP spray guns. There was a possibility that electrostatic coating could be used with the plastic parts, but this would mean that a conductive material would have to be applied first. OTA also described the use of "plural component" spray equipment, which mixes paints as needed in the gun: this avoids the batch mixing of paints, which usually results in mixtures left over. This system allows reduced inventories as well as wastes. OTA also provided information on spray booth filters and a computer controlled matching and blending system.

The highest potential for VOC reductions was by switching from VOC based paints to waterbased

systems. The company representative told OTA that it was the first time that consideration had been raised, and it was of interest because the company had received letters from customers asking what they intended to do about the Montreal Protocols.

OTA investigated whether some solid waste generated by the process could be used in bituminous concrete as a filler. OTA did propose to the state highway department that the polyurethane material be evaluated for this use.

Some months later, OTA followed up with further recommendations, which focused on "color management" - scheduling light color applications before dark, and dedicating various spray booths for application of particular colors, to reduce the need for line cleaning.

The company wrote OTA a letter thanking the team for their "excellent work" and expressing appreciation for the existence of an agency that one can turn to for "help vs. fines".
The company's operations manager (OM) said OTA was extremely helpful in clarifying issues of labelling, handling, and storage of hazardous waste.

Results: In a March 1992 phone call, the OM said the firm has installed an aqueous based washing system and as a result has reduced its purchase and use of TCA by 85 percent, from 14 tons annually to approximately 2 tons. He estimated savings in the range of $60,000 a year in purchase, reporting fees, and waste handling and disposal. The firm has been unable to convert to 100 percent aqueous cleaning because certain parts require a molding agent that doesn't wash off with water and detergent. The company is continuing to investigate alternative molding agents.

In addition, the company has found an in-mold painting process that allows the elimination of post-mold painting, priming and degreasing. Although the one-coat in-mold paint is a relatively high emitter of VOCs, the firm has found that the reduction in VOCs from the elimination of the post-mold processes more than offsets the emissions from the paint. Only a few parts are currently painted in the new process, but many more are scheduled to be added in the next several months. The operations manager estimates that when the majority of parts are painted through the in-mold process, the company will save 30 percent of the cost of its entire manufacturing process.

The operations manager expressed frustration in working with the state regulatory agency whom he says was initially unresponsive in the firm's attempts to reclassify its generator status after reducing its VOC emissions. The reclassification apparently has not occurred and he has been advised to pay the fees as a large quantity generator (LQG). He said he was "tired of hearing about how overburdened they are and how they don't have any money. It's just an excuse."

Company #20 makes plastic foam. The company agreed to a visit after receiving a letter from OTA stating that we had reviewed TRI data and noticed that they had experienced an increase in releases, and would they like a visit to help achieve reductions? This was followed up by a

phone call.

The company was switching from Freon 12 as a blowing agent to methylene chloride, which also provides necessary cooling because the polyurethane reaction is exothermic. OTA recommended using vacuum tables for cooling, which would reduce the need for methylene chloride. Another approach would be to enclose the foaming area in a vacuum chamber. OTA also mentioned increasing the silicone surfactant concentration as a strategy for increasing foam "openness" and thus improve the cooling, reducing the need for methylene chloride. OTA also suggested reducing the amount of toluene diisocyanate to achieve a reaction which would generate less heat.

Results: The company did not like these recommendations, and has not pursued further work with OTA. They are TURA filers, and thus are required to develop TUR plans, which require consideration of TUR options.

Company #21, an electroplating company, called OTA when they heard that DEP was concentrating on their local area. They were also referred by Newburyport POTW, and also knew of OTA because they had attended the TURI course for TUR planners. OTA helped the company with various compliance issues, such as identification of characteristic wastes, labelling requirements, air registrations, and eye protection under OSHA. Plastic coated racks were dissolving in acid baths, and OTA recommended using epoxy coated racks. The shop was well managed and OTA did not find many ways to improve the process. The company expressed appreciation for the help.

Unfortunately, a fire destroyed the plant and the company has gone out of business.

Company #22 is an electroplating shop strongly urged to call us by Lou Vallee of the Newburyport POTW. This company presented OTA with a problem: dangerous conditions were discovered at the site, and the question was, were they dangerous enough to warrant reporting to DEP? The language of TURA says that imminent threats must be reported.

OTA decided to take the following tack: to discuss with the company the fact that we were considering whether or not to report them, and that we would not report them if the dangerous conditions were immediately addressed. The company did address the dangers, and OTA then made weekly visits to the company for a period of a month, with frequent follow up in the months thereafter. OTA conducted training for the company employees, during which it was made clear to them that they could ask OSHA for an inspection if they felt they were working under dangerous conditions at any time in the future. The company owner agreed to this training and allowed us to talk to the employees and solicit information from them, absenting himself from the office while we met with them.

The dangerous conditions consisted of a sump located below the raw material storage area floor. The opening to the sump was accessible to any liquid chemical spill, and OTA felt that if acids were spilled, they could react with cyanide salts. We did not feel this was an imminent danger

requiring reporting, but it was a dangerous condition. The company diked the opening.

Another situation consisted of an open top drum of chromic acid which could have been knocked over into a cyanide rinse collection sump. This drum was removed from the area.
A third situation was the storage of sodium metabisulphate next to the chromic acid tank - mixed together, these can yield hydrogen sulfide. This was immediately remedied.

OTA also pointed out an air pack which was blocked from easy access and had no label showing it had been recently checked. This was remedied.

OTA explained that the company's hazardous waste storage practices were not according to the regulations, and these were put in order.

Other recommendations consisted of installing drain boards, countercurrent rinsing, dead rinses, recirculating particulate filters on both process and rinse tanks, use of ultrasonic agitation on cleaning tanks, regular maintenance of process tank chemistries, and monitoring of the tanks, such as by resistivity meters.

On a later visit, the company complained that their conductivity measurement systems were corroding, and staff recommended equipment that would not corrode. OTA consulted with the manufacturer of the cleaner the company was using, and recommended the proper temperature for its use, and reported that the manufacturer asserted it would work much better with agitation, but not aeration (would cause foaming). OTA recommended noncyanide nickel stripping, and looking into alternatives to cadmium and chromium as well, citing the Sanchem Inc. (Chicago) nonchromate aluminum sealant which has been demonstrated to pass corrosion testing.

In its meeting with employees, OTA heard a lot of complaints about indoor air quality. It turned out that the company had once used adequate ventilation, but had removed the system after receiving complaints from neighbors. OTA pointed out in a letter to the president that this merely transferred the problem to his employees, and that they were unanimous in their concern. We strongly suggested restoring ventilation, and adding controls, and pursuing methods of eliminating the problem at the source. We also pointed out that there were no emergency procedures in place, and the employees knew nothing about emergency response; we included recommendations about implementing these measures.

At the employee meeting, it was mentioned that several years ago the company had engaged in weekly meetings at which plant operations were discussed with all employees. We suggested that these meetings be reinstituted, and that the items for discussion should be whatever chemicals were causing a problem for the wastewater treatment operators, the amounts and types of hazardous wastes generated and the reasons why, and the levels of contaminants in the air.

At last contact, the company had installed some drip boards and had erected a partition between an acid and a cyanide tank, but had not pursued any of the other suggestions to our knowledge. The ventilation problems seemed to be as before.

The company president claimed that there were no indoor air problems at his plant because OSHA had given him a clean bill of health. We asked when that was, and it seemed to have been several years ago, perhaps as long ago as the early 1980s. By telling employees that they could complain to OSHA if they felt unsafe, we were risking opening ourselves to charges of not adhering to our mission of providing assistance. We felt, however, that the company president was too relaxed concerning the hazards at his plant, and that we could not report what were not technically imminent hazards, but long-term hazards. This case illustrates the need for a vigorous OSHA program and a healthy respect by certain small, but high hazard industries for the imminence of an OSHA visit.

Company #23 is a precision machine and stamping operation, referred to OTA by Lou Vallee of Newburyport, who also stated to the company that DEP was planning to make inspections in the area.

The company had an open floor trench connected to the sewer, in the same room in which degreasing was occurring. OTA recommended diking the trench and removing the degreasing operations. Both were done.

OTA recommended replacement of TCA, citing semiaqueous and aqueous options. OTA recommended consulting with clients on how clean parts had to be. One process suggested was to wash in a hot aqueous solution, with ultrasonic agitation, to be followed by a still rinse in ultrasonically agitated hot tap water, and if staining is a problem, to use cascaded rinses in hot or cold deionized water, followed by hot air drying.

OTA noted that although the soapy water discharge from a tumbler did not show heavy metals in analyses, that it did present a total suspended solids problem; therefore the use of a recycling system was advisable. The system would route the discharge to a settling tank, with overflow pumped through a particulate filter and then a small ultrafilter, with the reject from the ultrafilter being collected and filtered on a second pass when feasible. OTA cited such a system in use at Babco Textron, which uses the soap from the ultrafiltration backwash as a supplemental lubricant, and mentioned that this company would be amenable to receiving a technology transfer visit.

OTA also recommended adding some degreasing agent to the tumbling operation so that some cleaning and deburring operations could be consolidated, which would eliminate a separate cleaning step.

Results: The company had been planning to switch from TCA to TCE, but OTA cited liability issues surrounding the use of this chlorinated solvent. The company investigated aqueous systems, but did end up switching to TCE. A company manager said they have experimented with aqueous systems and other "safe solvents" including citrus, but have consistently had problems with the time it takes for parts to dry. He said they tried ultrasonic aqueous cleaning, but found that it was not acceptable because it cleaned a smaller percentage of parts per batch

than TCE. He said the firm is continuing to experiment with alternative cleaning and drying methods, but is not expecting to eliminate the use of TCE anytime soon.

The manager said OTA was very helpful in providing information about proper storage and management of hazardous wastes and the company has implemented OTA's suggestions in that regard.

The manager expressed concern over increasingly stringent wastewater discharge limits. He said currently the company does not pretreat its wastewater. He said he fears tighter restrictions which would require the firm to institute pretreatment, something that he said would be "very costly."

Company #24 is IMI Inc., a printed circuit board manufacturer. OTA's visit resulted from a cold call made to the company following up on a letter stating that we had been notified by DEP that the company had received a notice of noncompliance for hazardous waste storage violations.

Noting what seemed like an unnecessarily complicated process, OTA went over the manufacturing steps with the process supervisor in great detail. The supervisor stated that when the company had problems they would often add a corrective step, rather than change the process at the source of the problem. These steps tended to stay in use long after they were necessary.

After the visit, the company contacted the McDermid company, a supplier of chemicals of higher quality than what the company had been using, and a vendor that offers technical support. McDermid went through the company's process line and made recommendations which resulted in the removal of a substantial number of steps - a line that had 50 steps now has approximately half that.

The supervisor was concerned about water use, and stated that the Myron water control was calling for more water than was necessary. OTA called Myron and recommended that the probes be located where the buildup of dissolved solids would be sensed, and that the conductivity settings be higher than the average conductivity of tap water to allow a reasonable buildup.

OTA also recommended switching to deionized water rinsing for final rinses, drip boards, and the use of dead rinses to replace continuous flow rinses. Some dead rinses could be preceded by spray rinses - the combination should be effective for cleaning inside holes.

The company found that operators were unilaterally making changes in the Myron control settings, and have corrected this - leading to a cutting in half of water use.

OTA noted a large quantity of spent etch, and recommended a Sigma Innovation regeneration system (presented by Digital at the Lowell Printed Circuit Board workshop). The company tells OTA it is now "seriously considering" etch recycling equipment.

OTA recommended filtering oxide baths to prolong their life, and the company is also considering this. OTA recommended continuous filtering of an electroless copper bath, and the company has installed this. OTA noted flaking from the ceiling was contaminating a number of baths, and the company states it is currently upgrading the ceiling and is using covers on the baths at night and on weekends.

A referral to John Lott at Dupont concerning spent film material resulted in advice concerning a new type of film and reduced usage of film, which the company has implemented; resulting in reduced spent film disposal.

Results: According to Ron Zangari, in charge of IMI's waste treatment operations, OTA helped IMI in its search for ways to eliminate the use of TCE. The company stopped using TCE in June 1993, eliminating the purchase and use of nearly 8,000 lbs. at a cost of roughly $4,000 per year plus the associated disposal costs. The firm found that by making changes in other parts of its process lines, it could eliminate the need for cleaning the boards with TCE, which also meant the elimination of a 15-minute step in its production process and improved working conditions for employees. "Nobody wants to work around a chemical with such a bad history," Zangari said.

By implementing water conservation measures, such as monitoring rinses and turning them off when not in use, IMI has realized savings in water use and costs. Five years ago, the firm used 220 gallons per square foot of circuit board manufactured; today use is down to 80 gallons per square foot. Zangari said the next step is closing the loop with a full-scale water recycling system, but he doesn't expect that to happen soon. He said the company is rapidly growing and has other priorities for capital expenditures.

If IMI's search for a method of etch regeneration proves successful, the firm's status would change from a large quantity generator (LQG) to a small quantity generator (SQG). The company already recovers copper from the spent etch.

Zangari believes that the extensive paperwork, filing procedures, and fees involved in recycling hazardous waste provides a disincentive for many companies. "It is easier to manifest the waste and ship it off than to apply for recycling permits. The forms and filings and fees make it very complicated -- there must be ways around that. They (government regulatory agencies) should make recycling a more attractive alternative."

Company #25 is a furniture manufacturer, contacted by OTA after OTA received a copy of an NON that the company had received from DEP concerning fugitive emissions, discharge of boiler blowdown, and hazardous waste storage violations.

This company was investigating conversion from solvent based seal and finish coatings to water based versions. In case the conversion did not work, OTA recommended installing cooling coils on the freeboard above the liquid level in the dip tanks, and collecting the condensate. OTA suggested tank covers and lids with foot pedal actuated closure mechanisms, and enclosing the

application areas and directing emissions to a solvent recovery system. OTA suggested that product use could be reduced by spraying stain instead of dipping, or by using vacuum staining on unassembled parts. Staff pointed out that drip boards could be used on the stain process to return excess stain to the dip tank. The company was provided a copy of a Tufts University Capstone Project report on P2 for wood finishing.

When presenting its recommendations, OTA commented on two matters that seemed to annoy the company representatives. One was the fact that within minutes of coming into the staining area, OTA staff started to cough. This fact, along with the quantity of VOC emissions and the fact that some of the solvent constituents in the stain are defined as hazardous air pollutants, supported the suggestion for installing vapor control or recovery technology.

The second matter consisted of whether or not the company had to file reports under TURA. There is a difference in TURA-defined thresholds for reporting on chemicals that are processed, or "otherwise used". The company was using over the threshold for otherwise used of toluene and xylene, but was claiming that these chemicals are processed, not otherwise used. OTA cited TRI guidance to the effect that the company's use of these chemicals was not in the processing category, but in the otherwise used category, and thus they were required to file under TURA. The company replied that they had discussed the matter with a DEP official and had been told otherwise. OTA informed them that if the DEP official had given them incorrect information, that would not relieve them of the responsibility to report.

OTA also recommended that the company contact OSHA to make use of their consultation program, citing the fact that employees were working around open tank operations.

OTA also offered help in calculating VOC emissions, citing its new computer program.

Results: The company did not appear to appreciate being told that everything was not okay, and did not appear to believe OTA concerning their responsibility to file under TURA. If the company has implemented any of OTA's suggestions, we are not aware of it.

Company # 26 is a manufacturer of electronic products. OTA observed a clean and well run operation. The company had replaced TCA with an aqueous cleaner, and because it was experiencing a residue on product, there was consideration of switching to TCE. OTA recommended expending the effort to find a cure for the film residue. OTA recommended heating the cleaning solution, adding ultrasonic agitation, and rinsing with deionized water. Methanol drying was recommended if there were staining. OTA also noted that rinse waters could be reduced by the use of flow controllers with conductivity probes.

Results: OTA has not conducted follow up to discover whether or not these suggestions were implemented.

Company #27 is a machinery manufacturer that received a Notice of Noncompliance from DEP for incomplete air registrations and lack of hazardous waste storage signage. The company called

OTA, and the team assisted with compliance issues.

OTA found that condensate from a steam cleaning process was going to treatment, and recommended that an ultrafiltration or vacuum evaporation system be considered for removing dirt and oil from the water, which could then be reused in the boiler. It was mentioned that the UF approach would require maintenance because membrane modules need to be cleaned with sponges and detergent on a regular basis.

The company had obtained the services of a consulting engineer, who recommended a system that OTA felt was complex, expensive, and had questionable reliability. The company did order the vacuum evaporation system that was one of the options OTA suggested.

The company noted complaints from customers concerning paint surfaces that had badly rusted upon delivery. OTA recommended various approaches: examining surface cleanliness before paint application, applying a primer, applying a baked coating, and using a paint containing rust inhibitors.

Company #28 is a manufacturer of electronic components that received an NON from DEP and agreed to a visit from OTA after a cold call from us.

The company was disposing of solvent laden rags in the dumpster, and OTA recommended using a laundry equipped to clean such rags. The company decided to eliminate TCA and replace it with an aqueous cleaning process. OTA had recently learned that DOD, EPA, and an Industry Ad Hoc Solvents Working Group had reviewed various cleaning materials, and recommended certain cleaning substitutes. OTA pointed out that the company would have less trouble conforming to DOD requirements if the replacement they chose was one of the ones that this group recommended. The company decided not to go with a cleaner they had been considering which was not on the list, and in May, 1993 decided to use the Alpha Metals (Jersey City, New Jersey) saponifier.

OTA recommended using enclosed equipment to reduce emissions from cleaning of spray guns. The last followup by OTA, in October 1993, indicated that the company was not going to go ahead with the Alpha Metals cleaner, and had not yet looked into the rag cleaning suggestion.

Company #29 is Cabot Stains, a manufacturer of wood stains, both oil/solvent-based and acrylic. The company opened its plant in Newburyport in 1985, with several built-in, state-of-the-art pollution prevention measures such as a pitched floor for spill containment, a nitrogen blanketing system, and a closed-loop, two-hose delivery system to prevent the release of VOCs during tank (solvent) loading and unloading. Interestingly, the company did not do a cost/benefit analysis before including these measures in their construction plan; the firm assumed these measures would prevent problems and save money in the long run, and worked with a designer/contractor familiar with the painting industry to design the plant. Although there are no firm numbers available, manufacturing manager John Gihlstorf estimates the company spent an additional $1 million in construction costs to achieve pollution prevention and spill prevention measures.

Although the plant was extremely clean and well-run, OTA staff did find additional opportunities for pollution prevention, including switching from paper bags to fiber containers lined with reusable plastic for zinc oxide storage and use, and the installation of spill mats and/or drain closures in the dry loading dock areas.

Since it moved to its new plant, the company has reduced its fugitive VOC emissions to 13 tons -- estimated to be one-tenth of the emissions at its former plant in Chelsea, Massachusetts, which had been constructed in 1908. John Gihlstorf says the pollution prevention program has been worth at least $197,000 per year, and that aggregate savings over the years the new plant has been in operation would be in the millions.

Company #30 is an autobody repair and painting operation which contacted OTA after receiving a notice of non-compliance from DEP. There were many opportunities for source reduction and detailed financial information showing a very favorable return on investment for solvent recovery equipment (95 percent after 2 years, 239 percent after five years) was given to the firm by OTA's financial analyst. In addition, several recommendations were made for improved housekeeping methods that would help solve the company's compliance problems which included open drums, lack of labels on hazardous waste containers, and floor drains leading to the ground. There has been no follow up with this company as yet.

Company #31 is not a private company but a publicly-owned sewage treatment facility, the Greater Lawrence Sanitary District. See attached case study.

Company #32, a producer of tags and labels, learned about OTA's services from the Massachusetts DEP. Although it used perchlorethylene in its plating process, the company did not have a compliance problem; the environmental manager sought OTA's help in general waste disposal and environmental improvement issues.

After consulting with OTA technical staff, the firm eliminated perc and switched to a non-toxic cleanser called "Solvit" that also is less expensive than perc. The new cleanser costs half of the price of perc ($6/gallon as opposed to $12/gallon for perc) and the firm uses less than half as much (estimated 2,000 lbs/yr as opposed to 5,000 lbs/yr of perc). Thus, the company saves roughly $3,000 a year in chemical costs alone, and has eliminated use of a VOC.

The environmental manager says he sees great benefit in preventing exposure of employees to perc. Although the firm's use of perc was within regulatory guidelines, he knew "perc was bad." "We basically (switched from perc) for the health and safety of our employees. It's just nicer not to have to deal with it." Among other benefits, the firm no longer has to buy special safety gloves at $40 a pair that were issued to employees working with perc, he says.

The environmental manager credits OTA with helping him properly dispose of aging chemicals

that had been stored in his plant in addition to steering him toward the non-toxic cleaner. He also said OTA helped him understand his responsibilities as a small quantity generator (SQG) and verified that he was correctly disposing of waste ink.

"OTA was very knowledgeable, and if they didn't have the information on something they knew where to get it. I needed help and they were able to give it to me."

Company #33 is Runtal North America Inc., a manufacturer of radiators for residential and commercial use. Deepak Peshori, operations manager, said he sought OTA's assistance for general operations review "to be proactive rather than reactive" on environmental operations and compliance.

Peshori said his company followed OTA's suggestion to install conductivity meters in the rinse system, allowing recirculation of the rinse water and reducing the amount of discharge. This system also allows for automated monitoring of pH and addition of hydrochloric acid (HCl), eliminating the need for a person to monitor the system and add the acid. He estimated the firm now saves between $10,000 and $15,000 a year in the purchase and disposal of HCl.

Peshori said the company's 1995 budget will include money to pay for suggestions that OTA made for improving painting operations, including the mixing of paints in-house and the installation of a spray paint gun washing system to reduce VOCs. He said the firm is working with suppliers to find a high solid paint that allows more coverage with less paint, reducing VOC pollutants. He estimates capital expenses involved to be up to $60,000.

Note:

As a result of the formation of the Merrimack Business Environmental Network and its activities, attendees at meetings and conferences have many of the above stories and the stories of other companies, notably, how AT&T and Raytheon replaced freon cleaning with biologically derived materials (see attached news article), and how Hadco utilized the ROMAR process for removal of heavy metals from chelated solutions. (See attachment).

NEW HAMPSHIRE COMPANIES

A majority of the facilities have either implemented or are planning to implement recommendations received from the NHPPP. Very few of the companies that had implemented recommendations actually attempted to measure the amount of pollution reduced or money saved from implementation.

Another finding is that the vast majority of companies that worked with the NHPPP stated that they were very pleased with the service given to them and that they would not hesitate to call on the program again or recommend the program to other businesses.

It is also important to note that the New Hampshire Pollution Prevention Program has responded to a number of referrals from POTW officials in the Merrimack Watershed, and direct requests for assistance. These referrals and requests resulted in appropriate information packets being compiled and sent by NHPPP staff.

#1. A PLATING JOB SHOP

This facility provides plating of copper, nickel, and electroless nickel and chrome on various metal parts furnished by others. Upon visiting the site, NHPPP staff found that the facility already employed the following pollution prevention technologies: closed loop & ion exchange, counter-current rinsing, water reuse, cyanide-free electroless copper, filter press, and evaporation. NHPPP staff made some recommendations for minor improvements, but for the most part the facility was generating very little waste. Due to the exemplary nature of its operations the NHPPP approached the company to serve as a training site for the Program's retired engineers. The company agreed and was subsequently used for that purpose.

#2. AN ALUMINUM FOUNDRY

This medium sized facility produces investment castings primarily made of aluminum, brass, and magnesium. Approximately 220 people are employed at the facility which operates 3 shifts, 5 days per week. The facility operates on a job shop basis as a result of the repeat work that developed over a long period of time. NHPPP staff and engineers visited the site and reviewed the principal operations and waste streams. The NHPPP staff found that the facility had an active program to reduce process wastes, but that opportunities existed for reducing/eliminating CFC's through alternative mold release practices. Other potential waste reduction opportunities included the areas of: water reuse, heat recovery, casting waste. Follow-up contact with the facility indicated that they had implemented some minor changes, but felt that they lacked financial resources and time to implement the more complex projects.

#3. AN ALUMINUM HEAT SINK ANODIZER/FABRICATOR

This company was visited by NHPPP staff and retired engineers as part of the training program for the engineers. The facility purchases and processes aluminum extruded stock. In addition to an extensive machining operation, a substantial portion of the operations involve anodizing and chromating processes. The facility generates 15 unique waste streams as part of its operations. The NHPPP team found that the facility already employed several waste reduction measures such as counter-current rinsing, rack drainage intervals, precisely controlled robotic operations and the use of water-based coolants on a number of machines. NHPPP team members identified additional areas for potential waste reduction including: replacing the current degreasing operation with an aqueous-based system; separating hazardous and non-hazardous liquid waste streams; eliminating or reducing the need for large quantities of speedi-dri through employee training and use of re-useable absorbents; and converting the machining operations to water-based coolants. Preliminary follow-up indicated that the company will be implementing the recommendations of the NHPPP by replacing a perchlorethylene vapor degreaser with an aqueous wash system, and will be reducing the use of clay absorbents through drip pans and good operating practices. They are also researching process modifications in their anodizing operation. Subsequent follow-up indicated that the facility would be attempting to measure actual reductions in waste sometime in the near future.

#4. A PRINTED CIRCUIT BOARD MANUFACTURER

This company is a small custom printed circuit board job shop employing a staff of 25. The facility specializes in hard-layer, multi-sided printed circuit boards. The main waste generating processes consist of electroplating, electroless plating, etching, and wastewater treatment. The company already employs a number of pollution prevention techniques which include counter-current rinsing, proper tank layout, bath monitoring, etc. The company also has a large ultrafiltration unit in conjunction with standard wastewater treatment. The NHPPP identified pollution prevention opportunities in the areas of: drag-out reduction, wastewater segregation, water reuse, and metals recovery. Follow-up indicated that the company had implemented some of the NHPPP's recommendations, reduced it's water usage by 1/3, and was still working on implementing some of the more complex recommendations.

#5. A POTATO CHIP MANUFACTURER

Based upon a referral from the Greater Lawrence Sanitary District the NHPPP team visited this small manufacturer of potato chips. The company was purported to have an oil/grease violation and was being surcharged for BOD and TSS. Lab analysis indicated that the type and source of the oil/grease was potato starch and would not be a problem for GLSD. Because of the lab results and the cooperation exhibited by the company in working with both EPA and the NHPPP (a report was drafted to address the discharge problem), the company was removed from the

GLSD regulatory system.

#6. AN ELECTRONICS PRODUCT DISPOSITION CENTER

This facility is the site of an extensive demanufacturing operation which was developed to ensure regulatory compliance, and compliance with corporate "green" philosophies. The site visit by the NHPPP team was primarily conducted to observe this company's impressive inventory management system and the product distribution, disassembly, and disposal protocol. Program elements included vendor takeback, Design for the Environment, packaging waste reduction, and ODC elimination.

#7. A CIRCUIT BOARD ASSEMBLER

This company employs 35 people and manufactures small circuit board assemblies and electronically controlled components such as valve actuators. Work at the facility is done on a contractual basis, and the company does not manufacture either the circuit boards or components used in the assembly process. NHPPP staff found that the major area of concern was reduction of air emissions from the wave solder area. Emissions of concern were generated by the use of CFC-113, ethyl alcohol, and methyl alcohol. With information provided by the NHPPP, the company opted to research the feasibility of eliminating its freon degreasing unit. Follow-up indicates that the company is still conducting research and has not yet implemented the NHPPP's recommendations due to the complex nature of the processes at the plant.

#8. A SAPPHIRE PRODUCTS MANUFACTURER

This facility employs 95 people and specializes in advanced sapphire crystal technology. Through the use of a patented crystal growth process the company grows sapphire tubes, rods, ribbons, fibers and 3-dimensional shapes. On-site finishing capabilities include machining, grinding, and polishing. These finishing processes generate the majority of the waste. The NHPPP was called in to determine pollution prevention opportunities for the sapphire grinding operation. Follow-up indicates that the grinding operation has been sub-contracted off-site. The company also implemented a used oil recycling program and on-site solvent recovery, and has little waste additional waste. Limited opportunities may exist with alternative machining and degreasing techniques.

#9. A MICRO-CIRCUIT BOARD MANUFACTURER

The NHPPP visited this site based upon a referral from the Greater Lawrence Sanitary District (GLSD). The small micro-circuit board manufacturer had relocated and was subject to GLSD jurisdiction as a categorical industry, regardless of its extremely deminimus etching discharge

(gold, TiW, TaN, Nickel-Chrome). The NHPPP was called in to work with the company to determine closed-loop possibilities. During the site visit the NHPPP team discovered that the actual process wastewater was substantially lower than the 30-50 gallons per week indicated on the GLSD's Industrial Waste Survey. The discharge rate actually took into account all water discharges including sanitary, non-contact cooling, and process wastewater. The NHPPP suggested that the company test and measure the actual amount of the process wastewater discharge in order to better characterize the problem, and consider close-looping the discharge. Follow-up indicated that the company has gone to a close-loop discharge and is no longer subject to GLSD regulation.

#10. A PRINTING OPERATION

This company is a large contract printer which employs approximately 300 people on a 3-shift basis. Operations normally run 5 days per week and perform both sheet and web-fed, off-set lithographic printing. The NHPPP team visited the site and found that the company had already implemented several pollution prevention initiatives including ink reuse and recycling, silver recovery, water conservation, use of soy-based inks, and alternative plate-making processes. The company was primarily interested in reducing the VOC, solvent, and rag wastes associated with the "blanket wash" operation. The NHPPP provided information and recommendations on solvent alternatives, solvent conservation, and reduction in solvent-soaked rags. It seems that production quality and efficiency is not acceptable when the available solvent substitutes are used, and that more research needs to be done on an industry wide basis. Follow-up indicates that the company has implemented some recommendations, (they purchased a centrifuge for rags), but that they are still researching solvent alternatives.

#11. AN ELECTRICAL WIRE MANUFACTURER

This company manufactures medium to high voltage power and aerial cables. The NHPPP was contacted primarily to look at the cable degreasing process. Raw aluminum cable is delivered on large spools for coating and finishing. When the manufacturer draws the aluminum through the dies to create the proper thickness, the aluminum is first coated with an oil-based lubricant to facilitate the drawing. This oil layer, although thin, must be removed in order to insure proper bonding of the plastic and rubber coatings which are applied. In the past degreasing of the cable feed stock was accomplished by using solvents. The company did switch from a solvent to a continuous feed sodium hydroxide bath with ultrasonic agitation. There were some problems with this process because it slows the cable feed rate, and sodium hydroxide is hazardous (due to high pH), although it is not an ozone depleter. Follow-up indicates that the company is still researching alternatives to the sodium hydroxide process.

#12. A MANUFACTURER OF PRECISION MOLDED PARTS

This company is a small job shop which produces precision molded rubber and rubber/metal

bonded parts and employs 45 people. The company was referred to the NHPPP after a routine inspection by the DES Winnepesauke River Basin Bureau Industrial Pretreatment Coordinator (Franklin WWTF). The inspector found that opportunities existed for pollution prevention. The waste generating process starts with the creation of metal washers which are produced from cold rolled steel fed into a stamping machine while lubricant is applied. Vapor degreasing with solvents is used to clean some parts, while others are treated using iron phosphate. Spray adhesives which generate air emissions and hazardous filters are also used in the process. Following the site visit the NHPPP issued a report to the company which contained many pollution prevention recommendations. At this time the company is reviewing the report, which will be finalized after the review and comment period is completed.

#13. A MANUFACTURER OF WIRE RESISTORS

This company produces wire wound resistors for the electronics industry. The NHPPP was contacted primarily to review the resistor cleaning process using sodium hydroxide. Problems with the process included: at the end of its useful life, the cleaning solution exceeds the TCLP limit for lead, requiring that it be handled as a hazardous waste; and a small number of parts exhibit poor adhesion of the labeling inks. The NHPPP visited the site, and completed a report which was forwarded to the company. The report contained four potential solutions to the cleaning problem which ranged from elimination of the need to clean through a change in manufacturing process through improvements to the existing cleaning process. At this time the company is still considering whether to implement any of the recommendations contained in the report.

#14. AN ARMY NATIONAL GUARD FACILITY

This facility's main function is the maintenance and servicing of helicopters and fixed-wing aircraft. Other services provided at the facility include a small print shop which provides printed material for all NH National Guard facilities, and support and maintenance for various motor vehicles and pieces of equipment. Services are provided by a staff of 225 military and civilian personnel. In 1992 the facility manifested over 19,000 pounds of hazardous waste, including oil, diesel fuel, antifreeze, solvents, paints, gasoline, and grease. The NHPPP was contacted by the Army National Guard's Environmental Specialist to assist in waste minimization efforts that had been initiated at the facility. NHPPP staff visited the site and developed pollution prevention recommendations for each of the identified waste streams and issued a report. Follow-up indicated that the ANG has organized a Task Force to work on implementation of the recommendations.

TABLE OF RESULTS

The following table sets forth data that was obtained by telephone survey, team interview, and file review. The companies reported on various aspects of their projects, some reporting savings from avoided waste disposal, and some including estimations of related savings, such as reduced purchase costs and less time spent on regulatory compliance. Most of the figures below are only examples and do not represent the full savings from company programs, but only the most easily accessible available data. Savings quoted are, to the best of our ability to determine, after payback of the original investment.

Unspecified numbers are pounds. ND means No Data.

Massachusetts Companies

Facility	Action Taken	Results	Comments
1. Metal Stamper	A. Aqueous subst. for TCE B. acid dumping elim.	A. Purch. cost decreased Safety increased B. $2,500	OTA "ext. helpful" Avoided monitoring
2. Electronic Components	A. 127,500 TCA/freon B. 49,000 33/50 chems	A. $810,900	Co. calculates NPV $5.8 million. OTA credited with project start
3. Plater	Chem use reduced	$13,000 treatment costs	Mitigating several thousand dollar fine
4. Consumer Products	Water use down 87% 40% less drummed waste by using conical tanks	ND supplied	Reluctant to publicize
5. Adhesives	A. Odor elimination B. Reformulation reduced toluene	A. Nuisance av B. $15,000	Bd Health referral B. Co. cites worker safety
6. Metal (Babco)	A. Ultrasonic subst. for TCA B. Coolant, testing chems elim.	A. $16,300	A. Pur & dsp. costs B. ND. Adopting Chem tracking
7. Tanner	Performed trial of new techn application (Venturi)	Water not restored sufficiently for reuse	Co. wd not follow up though OTA felt problem resolvable
8. Metal	A. Alum. disch. down B. New monitoring	A. Co. now in compliance. B. $500	Co. downplays P2, cites compl. as motivation

Facility	Action Taken	Results	Comments
9. Circuit Board (Altern. Circuit Tech.)	A. 320,000 etch B. 2 million gallons water saved, metal recovery, other	A. $7,200 B. Several $1,000 expected	A. Dsp costs TURI grant helped
10. Painter	Thinner purch. down	$5,000	VOC compl sav not estimated
11. Electronic Components (Brush Wellman)	A. TCA/freon elim. B. Bath life extension HCl down 40%, 10,000	ND B. $35,000	A. Further elim. expected to save $40,000
12. Machine Shop	Unknown sources Al and Se	OTA analysis identified sources	ND on implem.
13. Semiconduc.	Co. considering closed loop	OTA sought reg. clarification	Co. moved DEP working on Zero Discharge Permit
14. Plater	Co. setting up	Rec made	ND on implem.
15. Industrial Laundry	Near flow limits	Rec made	ND on implem.
16. Printer (FC Meyer)	A. Had elim. 279.5 tons VOCs B. 160,000 ink wastewater	A. ND on savings B. $46,800 avoided dsp csts (down 35%)	A. Maj. air permit avoided B. Water use down
17. Electronic Components	NMP (ODS) subst. for TCA	ND on savings	Appreciative of OTA
18. Air Systems	Regulatory referall	Rec made	No response - letter to CEO
19. Plastics	A. Had elim. 12 tons TCA (down 85%) B. New paint process reduced VOCs	A. $60,000 B. Mfg costs down 30% - $250,000	
20. Plastic	Blowing agent tox	Rec made	Did not like rec
21. Plater	Visit in advance of potential inspection	Rec made	Facility burned down
22. Plater	Hazards identified POTW referral key	Some safety, P2 measures implem.	Not imm. haz but illus. need for enforcement

Facility	Action Taken	Results	Comments
23. Metal stamper	Compliance & P2 Improved HW storage	Rec made	Co. investigating
24. Circuit Board (IMI)	A. Cut process steps 50% B. TCE down 8,0000 C. 64% less water D. Recovering acids	Time & labor sav B. $4,000+	A. ND on $ B. Worker safety cited C. Considering closed loop process D. Cites reg. barrier to recycling (paperwork)
25. Furniture	P2 info requested	Rec. made on compliance	Co. did not appreciate noting deficiencies
26. Electronic Components	Had elim. TCA Residue problem TCE	Co. considering	OTA discour. TCE ND on implement.
27. Machine Shop	Compliance, closed loop recommendations	Closed loop implemented	ND on savings Co. enthusiastic
28. Electronic Components	Had elim. TCA	OTA rec on subst.	Decided to use other product
29. Coating Mfr (Cabot)	A. Had elim. VOCs 117 tons 90% down B. Minor improvem. rec	A. $197,000 B. Rec implemen.	Co. shared info at MBEN conf.
30. Auto	Rec. solv. recovery	Financial analysis w/ OTA help	ND on implem.
31. Sewage Treatment (GLSD)	17,292 potassium permanganate	$24,036 purchase costs avoided	Allowed greater septage intake worth >$100,000
32. Graphics	Elim. perc Chem disposal	$3,000	Cites worker safety Valued OTA help
33. Radiators (Runtal)	Monitoring rinse conductiv., pH, other	$10,000 purchase costs avoided	Working on rec. Co. proactive in seeking help
Printer (Americraft)	Had el VOC 88% nonalcohol fountain solution	$85,736	Co. included est. $35,000 from effic. and permit cst avoided
Computer (Tristar)	200,000 Sulfuric elim. Ended calendar dumping Process monitoring	$200,000	Purchase, dsp costs down Significant use reduction

New Hampshire Companies

Facility	Action Taken	Results	Comments
Plating Job Shop	Had closed loop	Became training site	
Aluminum Foundry	Had program; rec altern. mold release, water reuse, heat recovery, other	Some implementation	Co. cited financial resources and time constraints
Aluminum Works	rec. aqueous, waste stream segregation, water-based coolant	Implementing aqueous wash, other process modifications	Co. is measuring waste reduction
Printed Circuit Board	Had good rinsing, ultrafiltration; rec drag-out reduction wastewater segregation water reuse, metal recovery	Implementation: Ongoing program water use reduced 33%	
Potato Chips	Oil and grease	Analysis showed grease was starch	Company no longer facing enforcement
Electronics	Vendor takeback site	Use as example	
Circuit Board	CFCs and VOCs	Researching freon elimination	Ongoing
Sapphire Products	Rec made	Used oil recycling, solvent recovery	
Micro-circuit Board	Rec. closed loop	Company implemented	
Printer	Had soy inks, ink reuse water conservation innov. processes; rec. solvent alternatives	Some implement.; bought centrifuge	Ongoing
Electrical Wire	Switch to NaOH from solvents has problems	Still working	
Molded Parts	Spray adhesives	Reviewing rec.	Referred by inspector
Wire Resistors	Lead in cleaner	Rec. made	Reviewing
Military	Vehicle, paint wastes	Rec. made	Task force organized

THE MERRIMACK PROJECT

POLICY CONSIDERATIONS

Part III

POLICY RECOMMENDATIONS - New Hampshire

The following recommendations are based on experience gained through implementing the Merrimack River Industrial Pollution Prevention Project.

*1. **Provide increased grant flexibility.*** In order to institutionalize pollution prevention, state regulatory agencies need to have increased flexibility in the ongoing media grant programs. Recently, there have been positive steps in this direction, and EPA should continue to work with the states to encourage new and innovative pollution prevention projects through the grant flexibility process.

*2. **Re-evaluate measures of success.*** Many of the regulatory programs within the Department of Environmental Services are federally supported, and success of those programs is measured by counting "beans" such as the number of inspections performed or enforcement actions taken. It is the opinion of NHDES that in order for pollution prevention to succeed, emphasis needs to be placed on re-evaluating the measures of success, so that they focus more on compliance and pollution reduction. This will require a willingness by EPA to restructure the bean counting process, perhaps by allowing counting of things like actual reductions in pollution and technical assistance visits.

*3. **Use the established POTW-industry relationship to promote P2.*** Oftentimes a POTW Pretreatment Coordinator already has an established working relationship with the industries that he/she regulates. This relationship provides an excellent opportunity to further the goals of pollution prevention. In most instances the IPP Coordinator has both the economic and environmental needs of the community in mind. Industries that are under regulation know that the municipality would like to see them remain as viable enterprises. In the case of pretreatment industries, they are probably more likely to listen to recommendations by the local IPP that they deal with regularly, than some state or federal regulator.

*4. **Identify and work to eliminate regulatory barriers/disincentives to P2.*** Within many state and federal agencies, especially regulatory agencies, there are numerous existing barriers and disincentives to the implementation of pollution prevention. Some potential sources of barriers include: existing state or EPA statutes and regulations; state or federal policies or procedures; and institutional practices, attitudes or behaviors which have developed without critical evaluation. In order to implement P2 to the fullest extent possible, EPA and the states should continue efforts to identify existing barriers within the regulatory environment and work to resolve those barriers as appropriate.

*5. **Address targeting & information issues.*** In attempting to target industries for the Merrimack Project, NH project staff had a difficult time accessing and interpreting water

quality data, as well as information on individual facilities. This was especially true when trying to cross reference information, such as TRI reporters and NPDES dischargers. Such cross referencing had to be done manually with lists on hardcopy. To make targeting of technical assistance and pollution prevention efforts more effective, EPA and the states should work toward more comprehensive, "user-friendly" databases. NHDES is currently in the process of inventorying all existing data and information management systems within the department, and developing specifications for a centralized, multi-media system, which will contain certain key attributes. Programs and divisions within DES will still maintain their databases, however, the centralized system will provide "whole facility" information which managers can use to target assistance and compliance efforts.

6. Compliance assistance. Experience gained through the Merrimack Project indicates that compliance issues are an important part of technical assistance. Many small and medium sized companies want to comply with environmental laws, but need some help in wading through the regulations. EPA and the states should consider developing programs for their technical assistance staff which include regulatory compliance training. Outreach efforts that combine regulatory and pollution prevention information are the most effective way to facilitate compliance with environmental laws.

7. Continue to encourage and support multi-media efforts. EPA and several states have begun to work on multi-media permitting and inspection projects. NHDES will likely do so in the near future. This process can prove to be much more effective and efficient than the more traditional single media approach, when focused on the appropriate facilities. EPA should continue to work with the states to facilitate multi-media pilot projects. Such efforts hinge upon grant flexibility issues and revising measures of success.

8. Continue to encourage and support geographic initiatives. Pollution and natural resources do not respect political boundaries. Watershed-based projects such as the Merrimack Project and the Merrimack River Initiative provide an ideal opportunity for all the constituents within a geographic area to transcend political boundaries and rally around a common cause. More efforts such as these should be encouraged and supported with funding.

9. Encourage and support new and innovative partnerships. Through the Merrimack Project some new and unique partnerships were formed between state and private entities. The Merrimack Business Environmental Network (MBEN) and the NHDES Merrimack River biomonitoring project are two examples. Efforts such as these are a very effective way to maximize resources and promote pollution prevention. EPA should work with the states to create and foster more partnerships between government and private entities.

CONCLUSIONS

This project has been essential in helping the New Hampshire Department of Environmental Services jumpstart the process of institutionalizing pollution prevention. Through this project the department has been able to experiment with different approaches and frame the questions which need to be addressed. The project has also provided an forum to identify opportunities and barriers in implementing pollution prevention in a regulatory agency.

Working collaboratively with staff from the MA Office of Technical Assistance has been a very satisfying and rewarding experience. This project has proven that agencies from two different states can work together to accomplish common goals and objectives, even though their program structures and regulatory status may be different. Likewise, working with EPA staff on the Merrimack Project has been very beneficial. EPA staff provided flexibility as well as guidance, both of which were greatly appreciated. Establishing new relationships and forming innovative partnerships is what this project was all about. It seems almost certain that the relationships that have been established will continue well beyond the life of the Merrimack Project, and extend into many other projects and activities.

POLICY RECOMMENDATIONS - Massachusetts

The Merrimack Project has resulted in the formation of working relationships between private companies, POTWs, state enforcement officials, local officials, and trade and commercial associations, and an increased emphasis by all of the above on pollution prevention. An integral part of these relationships has been an ongoing discussion concerning suggestions for policy initiatives, changes, and reviews. It is common to speak of changing the corporate culture that emphasizes business as usual in order to reorient towards prevention. A corresponding culture change in government operations is also necessary. Carol Browner's recent pollution prevention policy declarations are dramatic examples of what can happen. In June, 1993, Browner issued a Pollution Prevention Policy Statement which said in part: "We must not hesitate to seek changes in federal environmental law that will encourage investment in source reduction."

Massachusetts recommendations for incorporating pollution prevention into the regulation of wastewater discharges are set forth below.

1. **Review categorical discharge limits wherever they are now set according to expectations of what an industry can achieve, where those expectations have been measured in the past by the observed performance of conventional treatment methods, and reset them according to what known pollution prevention technologies and practices can economically achieve. Follow technological developments and afford opportunities for regulated entities to supply cost information. Ratchet limits down when technologically and economically feasible, according to frequent reviews.**

Rely on stringent water quality-based local limits to drive movement towards preventive techniques, but consider a flexible approach which allows for compliance on condition that a company pursues aggressive prevention and provides documentation of such a preventive program with frequent updates. Require such updates as a condition for obtaining any waivers or flexibility for economic infeasibility. In states where there is a requirement for P2 planning, these may be incorporated into orders.

The OTA's first program of delivering technical assistance was successful in large part because the targetted community was facing a substantial tightening of limits on NPDES discharges. The pressure of regulation drives companies into the camp of the technical assistance programs. A certain sector does P2 because they are well informed and understand its value. A larger sector does P2 because they have to.

Effluent limits should be set according to what is technically achievable. But pollution prevention opportunities may be very process or company specific. Some benchmarks can be obtained by evaluating what is technologically achievable by implementation of known technologies to prevent pollution or for recovery of materials, such as:

Electrolytic recovery
Ion exchange
Reverse osmosis
Ultra and other forms of filtration
Enclosed evaporation
ROMAR process (see attachment)
Electrodialysis

In addition, companies have achieved substantial discharge reductions by implementing water conservation, process monitoring and control of process parameters, drag-out capture, advanced rinsing techniques such as cascade, reactive, fog, high-volume low pressure rinsing, and the use of air knives and vacuums to remove contaminants before rinsing.

There are also material input substitution opportunities in many industries, due to rapidly developing product reformulations to avoid pollution liabilities.

EPA could incorporate evaluation of what these known technologies can achieve to the process of setting standards, and should frequently revisit the issue in order to capture rapid developments in this field.

The Massachusetts Toxics Use Reduction Act gives the state the authority to set performance standards for particular processes or industries. This is to be done upon a finding that most companies performing a particular process step are able to do so with low effluent rates, and that other companies performing the same step should be able to achieve the same low rate. Companies are given the opportunity to demonstrate that they cannot achieve these rates due to their special conditions or economic situation. (The burden is upon them to make such a showing). This approach is more equitable than requiring that they meet a performance standard that may not be pertinent to them, or close up shop.

OTA recommends that performance standards be flexible, taking into consideration the difference in applicability of pollution prevention options that involve process changes. Such flexible standards put the burden on a company to show that it cannot meet a standard and stay in business; once a company does this, an interim limit less than the standard can be set for the company, with the stipulation that the firm provide frequent progress reports demonstrating that it is aggressively pursuing P2 opportunities. Such a system allows the regulatory agency to set limits as tight as they need them to be for environmental protection, but avoids putting companies out of business when they have demonstrated that they are making a real effort to achieve compliance.

2. **Assert the importance of equitable principles in the enforcement of environmental laws. (This point refers not to "environmental equity" as the term "environmental justice" is popularly used, but to ensuring that enforcement of environmental laws is perceived as fair by the regulated community). Conduct a dialogue with the regulated community designed to enhance the evolution of environmental requirements.**

The environmental agencies must retain the power to shut down businesses in order to protect the environment, but if this power is designed carefully so as to prevent its inappropriate application, it is less likely to be challenged, resisted, or eroded. If companies perceive the law as reasonable, they will better accept it and focus their energies on compliance, rather than fighting the law itself on a political stage. Companies perceive inflexibility, combined with the power to shut down business, as unfair. There are many ways to address this problem, and many different mechanisms that could be used to ensure that the use of the power to shut down business is fair and that agency officials have and use appropriate flexibility in the use of all their powers.

Companies frequently comment that enforcement is inequitable in that those known to the agencies are visited repeatedly, whereas the agencies are not perceived to be sufficiently aggressive in finding those who are gaining economic advantage by not spending money on compliance. Whether or not this is true, agencies need to address a widespread perception.

Companies comment that rules are hard to find and understand, that agencies do not do enough to inform of their existence, or make them easy to follow. Companies also find frustration in unresolved inconsistencies concerning policy, and a wide variation in requirements and policies between jurisdictions.

Another equitable issue is that the limit for any discharger can be lower than what comes into their facility from municipal supplies. OTA frequently encounters business claims that the city water they take in would not meet discharge limits. City officials and environmental regulators typically respond to this problem by commenting that they are aware of the problem but there is nothing they can do about it. Perhaps a waiver system could be developed for situations where the violation is due to incoming water.

Continuous dialogue with the regulated community would seem to be the place to begin an effort to address perceptions of inequity, if it is conducted as an attempt to address problems and not manage perceptions. Enforcement agencies can commit to clarification of requirements, and to better notice, communication, and uniformity of policy. Agencies can commit to ongoing evaluation of how well their rules are working to accomplish their ends. Agencies can adopt a strategy that admits the regulatory system is not perfect. (The Common Sense Initiative is a welcome example). This must be done without relinquishment of authority. It is imperative that environmental agencies engage in the business/government dialogue in furtherance, not in derogation of, agency missions.

The agency should anticipate issues and come to the table as well prepared as possible with potential options and alternative solutions. If at a dialogue meeting industry representatives take officials to task for delays in granting recycling permits, the agency should be prepared to respond. If the agency has set up a task force to look at this or related problems, reporting of this fact would be helpful. If the agency has determined ahead of time that it welcomes input to this task force from outside of the agency, it would be able at that meeting to invite the participation of those offering criticism.

3. **Establish technical assistance programs that integrate with enforcement in a manner that does not compromise either. Expressly declare that EPA is adopting the new, proven tool of technical assistance.**

The consideration of the provision of technical assistance has led, in Region I EPA, to a vigorous discussion of how such programs would relate to enforcement. Often, in these discussions, there has been a mistaken assumption that technical assistance detracts from enforcement, or that providing technical assistance means curtailing or interrupting enforcement activities. OTA believes that enforcement should remain vigorous and visible, as it is a prime motivator for companies to focus on pollution prevention and to seek out technical assistance.

However, when OTA has been perceived by the regulated community as exchanging onsite visit information with the enforcement agency, there has often been a lack of trust, and a reduced rate of use of OTA's services. In order to encourage companies to use its services, OTA has often had to expressly counter the assumption that it provides information to enforcing agencies. The Toxics Use Reduction Act requires that OTA keep the company-specific information from its onsite visits confidential, and citing this provision has been invaluable in helping the program to win trust and acceptance. OTA has worked state-wide with more than 400 companies since 1990, which is a very high rate of utility. Other programs have cited the inability to provide an assurance of confidentiality as a hindrance in gaining company cooperation.

EPA could declare that it is formally adopting technical assistance as a new tool. This tool is a proven method of achieving environmental progress. EPA New England has established an assistance team.

A separate, dedicated program is only one method of technical assistance delivery. OSHA's Consultation program represents another tested method. This program consists of voluntary requests for assistance, which are followed up by site visits to ensure that violations are rectified. There is no penalty for violations at the first visit. There are potential variations on this theme. (Please see attached article on models of interaction between technical assistance and enforcement). In addition, there is the option of training inspectors to make P2 suggestions. Inspectors must be careful not to phrase these suggestions in terms of a command. We recommend that if this option is chosen, great emphasis be placed on the use of inquiry, rather than provision of advice, to prompt pollution prevention awareness. Inspectors can be trained to ask appropriate questions, such as "have you investigated methods of recovering those metals from the waste stream, rather than precipitating them into a sludge", or "are you aware that there is equipment for condensing vapors, which if it is appropriate and cost-effective in your process, could obviate the need for a scrubber or thermal oxidation unit."

Enforcement personnel can also refer to technical assistance programs when they notice violations or opportunities for P2; the TA program staff can train inspectors in how to spot these opportunities. MA DEP now includes such referrals in its notices of noncompliance.

The technical assistance tool demonstrably improves the relationship of the government to the regulated community. Its very existence promotes the idea of cooperation and common endeavor, which is relevant to addressing environmental problems because they affect everyone. The assistance mode also promotes the better education of enforcing agencies, because government personnel learn not only about the technical aspects of practices which are the source of pollution, but they learn how regulations work in practice from the perspective of the regulated entities. Those receiving assistance are more likely to discuss problems in real terms, rather than couch them in terms designed to protect them from liability. Thus information concerning how well government programs are working flows from assistance programs and can benefit enforcement programs. For example, OTA has learned that many companies are reluctant to cease water discharges, because they might become subject to RCRA enforcement for treatment without a part B license. This "closed loop closed door" problem was never confided to enforcement personnel, but only to staff of the assistance program. Massachusetts DEP has formed a committee to investigate what can be done to remove the obstacles to zero discharge water systems.

If enforcement agencies do attempt to establish technical assistance programs, they should be permitted flexibility in EPA's basic grants program. Options under the grant agreement might include offering credit for multimedia inspections, credit for educational activities, credit for technical assistance, credit for research, and credit for taking the time for reorganization. Basic grant compliance measurements that adhere to a number of enforcement actions should be reviewed. It is possible to observe that each enforcement action is a failure, not a measure of success. Success should be measured by rates of compliance, or reductions of pollution.

Basic grants should be provided for technical assistance programs without the current fifty percent match provision. This approach was based on the idea that a state should be willing to commit to the program. But technical assistance programs should be made an integral part of the environmental effort, and this can happen if they are seen as necessary. If so, they deserve basic grant funding, no match requirement, year after year; the same kind of funding as the basic media programs. Only stable funding will produce healthy programs.

This grant money should not be provided only to the enforcement agencies. States should be given the option to establish the technical assistance in other bodies, such as quasi-governmental entities, as affiliated with universities, as affiliated with trade groups, or centered out of a nonregulatory government agency. Notices to states of the availability of money for these purposes should be given wide distribution.

4. **Use enforcement activities which require and/or encourage P2 and/or P2 reporting.**

Compliance orders should never simply order control technologies, but should do one of two things instead: either require P2 investigations or provide optional methods for coming into compliance. The Chicopee POTW has issued compliance schedules which have allowed companies to select one of three options for coming into compliance: they can implement control technologies, recycling, or prevention.

Enforcement agencies can issue orders which require P2 investigation. The Fall River wastewater treatment facility has tried this with some success. Textile finishers were required to investigate P2 rather than to conduct treatability studies, as conventional orders require. The companies did conduct P2 investigations and did accomplish substantial reductions. The levels that they had to achieve were one third of previous copper discharges. The pollution prevention techniques they employed did not get them to that level, but this should not obscure the fact that the P2 investigations were required and were pursued and did accomplish substantial reductions.

Enforcement personnel may ask for information concerning chemical purchases, in order to establish better controls at the discharge site on material accounting and handling, and to avoid undetected discharges. Although POTWs may not have the authority to require this information, they may still request it. Louis Valle of the Newburyport POTW has requested that some companies submit to him information concerning raw materials that they bring onsite. He had no authority to require this, but requested it, and received it. He has since written this requirement into permits, which now gives him the authority to require the information. A company that receives this scrutiny is probably more likely to control each container of chemicals received. Total mass loading information is also useful. Companies can be requested to calculate their total mass loading and submit this information. If it were made public, it would perhaps serve as a significant incentive for reduction.

Companies can be offered the mass loading alternative in order to encourage them to adopt water conservation. If there is no treatment on site, and a company is relying on water volume to dilute concentrations to acceptable limits, then water conservation is not a viable option for that company, unless they take the extra steps of installing treatment or water recovery. But short of that, a company has no incentive to reduce their water use when it gives them a favorable dilution factor. In some situations, it may be useful to consider a mass loading measurement as an alternative limit - if the new concentration does not adversely affect receiving waters.

A facility that drops below the flow limits that define it as a "Significant Industrial User" may no longer be subject to local limits, unless the facility can establish that they may have an impact on the ability of the facility to meet its limits or function properly, or the facility has a system in place for "minor permits". Many have no such system, although some do. There is no consistency in the Merrimack Region among facilities concerning how "minors" are regulated.

However, the facility can still impose a "monitoring only" permit, which enables them to maintain scrutiny over operations, and reestablish limits if necessary. In this context, POTWs can ask for total pounds of material discharged as well as concentration, and if the concentration is not a practical concern, the point at which scrutiny is accelerated (further monitoring required, or perhaps actions to redefine the source as an SIU) would be a mass-based number.

"Junior" or "minor" permit systems, bearing fees large enough to cover administrative costs, would have the advantage of educating all dischargers concerning their responsibilities towards their local resources. These may be monitoring only permits, or may be based on the notification requirements of the Domestic Sewage Study regulations. But perhaps EPA should consider

giving POTWs the authority to institute limits on dischargers that fall below the SIU level.

Some of these small sources are not small, but still fall below the established designation for SIU. A total mass loading definition for SIU could bring some noncategorical companies into the SIU designation if they are below the flow limit but do have high quantity discharges.

5. **Address Nonpoint and Small Pollution Sources (Diffuse Sources), and establish a program to analyse the constituents of consumer products.**

EPA's 1986 Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works (EPA/530-SW-86-004) observed that once pretreatment standards are met, "the domestic contribution of hazardous metal will increase from 8 to 63 percent of total metals loadings." It is increasingly recognized that as regulations evolve concerning industrial wastewater sources, the proportionate contribution of contaminants from other sources rises. A 1992 study for the Massachusetts Water Resources Authority (Evaluation and Estimation of Toxic Pollutants, February 1992) estimates that residential wastewater accounts for "over 20 percent of the estimated annual total system load for copper, lead, zinc, chloroform, and surfactants", as well as some organic compounds and petroleum hydrocarbons. In addition, source water was shown to contribute significant loadings of copper and chloroform, and tap water was found to have "large percentages of total quantified copper, lead, and zinc." Urban runoff was estimated to contribute "over ten percent of total quantified lead, and significant loadings of copper, zinc, and bis(2-ethylhexyl)phthalate." The study recommended more complete sampling of these sources. The City and County of San Francisco's Consumer Products Heavy Metals Inventory, (August, 1991) concluded that with the exception of silver, 20 to 88 percent of the city's total heavy metals originate from residential sources." These studies are indications that the contribution to contamination of our water resources from nonindustrial sources is currently significant.

To address these sources, we recommend greater scrutiny: monitoring, testing, and actions to increase public recognition of responsibility for local resources. Establishment of regulations concerning discharges should be made applicable to nonindustrial sources where they are not now, but enforcement of residential sources must be carried out in a manner quite different from that applied to industrial and commercial sources.

One strategy is to provide financial assistance to homes and communities making changes in water delivery systems to meet new Safe Drinking Water Act requirements. This program could focus first on schools. Another strategy is to ban or restrict certain products. An example is the registration to market drain cleaners is required by the state of Connecticut for drain cleaners. Drain cleaners containing chlorinated solvents are simply not registered. This is an inverse ban method - establishing a requirement for allowing discharge, and then not granting the permission to certain products. This is also not a direct enforcement program focussed on households, but a method of keeping certain products out of the household.

We recommend a devotion of resources not just to putting requirements in place but also to education and the provision of services for hazardous consumer product collection. This should

begin with recyclable products, such as antifreeze, oil, paint, solvents, and photographic chemicals. Recycling these products will reduce the cost of collection.

Household and small generator collection and recycling centers may be funded by assessing a fee on manufacturers, who may opt out of program if they are willing to introduce take-back centers. The fee may be coordinated with a red dot or red label informing the consumer that the product is a hazardous waste upon disposal, and that there is an opportunity for recycling or collecting this waste.

For the small pollution source, it is not sufficient to establish requirements, because choices for proper management may not be cost effective. At the same time, policies should discourage use of certain products as well as convenient collection and disposal. For large companies, it may be sufficient to put in place restrictions that raise the cost of management and disposal, and thereby act as disincentives on use and waste generation. However, for households and small businesses, the option of entering the commercial hazardous waste management system is not feasible, because of its high cost. Actions should be taken to encourage the establishment of low cost and convenient management systems.

In early 1993, OTA submitted a grant proposal to EPA Region I for a consumer product evaluation program. The proposal was to establish a testing program which would look for certain toxic constituents in products that often go down the drain as a result of ordinary use. (The term Household Hazardous Waste (HHW) is not adequate to describe residential contribution. Suppose a homeowner paints his house: the paint and thinner left over in a can is household hazardous waste, but the paint and thinner washed off the brushes in the bathroom sink will never be collected in a community HHW program). The proposal was to offer the testing to a select community, and to manufacturers who wished to demonstrate that their products were environmentally friendly. EPA Region I counsel expressed concerns about this proposal, so it was withdrawn. The concerns were that EPA cannot be involved in the endorsement of any product. Our intention was to avoid endorsements, and simply to let the analytical facts speak for themselves. We urge EPA to review this issue. We suggest that chemical analysis is unobjectionable, and that the public needs to know what they should buy. There is a lot of misinformation on the market concerning what is environmentally friendly. An analytical program would rectify a lot of false green marketing and reward those companies that do provide better products.

EPA should work with the Federal Trade Commission to develop truth in advertising guidelines for environmental labelling. This need not wait until such time as a labelling program or law has been developed. Policy intended to curb outright falsehoods and base claims upon some form of analysis can be put into place short of passing a green label law. FTA declarations that false advertising will be curtailed will have a chilling effect on such practices.

Increasing analysis of loadings from communities, residences, apartment buildings, and areas of concentrated runoff would also provide the basis for better programs to address these sources, and contribute to a raising of consciousness about the effect on resources of ordinary activities.

6. **Increase perception of the environmental receptor as a resource and as an amenity.**

At the June, 1993 Merrimack Initiative conference "Solutions for the Future, Actions for the Present" many attendees cited in working sessions the need to provide the connection between people's actions and the river itself - as well as other resources affected by their actions. Part of this is education of the sort that explains to people that when they dump oil on the ground or in a storm drain, it pollutes their own immediate environment; or that if they are concerned with economic growth in their town, they should be concerned with reducing flows and loadings to the local sewage treatment facility, or with reductions in nutrient loadings from septage or lawn fertilization. But another part of this is related to one of the original environmental programs, now not as prominent as it once was: beautification.

Beautification, parks, green buffer zoning, boat races, and programs designed to increase appreciation of an amenity such as the Merrimack River, increase the likelihood that people will voluntarily curtail actions that affect the resource they have come to enjoy. The Merrimack Business Environmental Network conference was held on a bluff overlooking the river at Maudslay State Park. This meant renting a tent, and endless complications related to holding a conference in such an unusual place. There was, however, a tremendous positive reaction on the part of the attendees to being in such a beautiful place, and there was much discussion about how pretty the river is. We provided the opportunity for a boat ride (paid for by attendees) up the river after the conference. This did seem to provide a solid connection with the resource, and a focus for the activities of the group.

For some time, OTA considered a larger event, focussed not just on businesses, but including the populations of towns by the river. There was much discussion of an environmental fair, with folk singing, environmental art and poetry contests, a trade show for environmentally friendly products, and an environmental crafts show. There was discussion of arranging for tall ships to sail up the river, and events in each town to draw people down to the river banks. There was discussion of promoting flower plantings and other beautification efforts all along the river.

These plans were dropped when there were some reactions at EPA to the concept of project money being used for "a party". The plans were also dropped because the concept may have been too grandiose and difficult to arrange. However, the concept of celebration of a resource is important. If people have a strong attachment to a resource, they will act to defend it.

7. **Provide POTWs with the money to investigate the sources of discharges and nonpoint pollution, and the resources and assistance to install improved capabilities for tracking discharges up the pipe to the source.**

POTW operators have told OTA about problems they have had in the past with slug, sudden, or illegal discharges received at the plant. These problems sometimes require painstaking work in sampling, going up the pipe to each junction, and sometimes after months, when the insult is repeated, finding the source. Sometimes these are companies or fly-by-night operations that are

not in any phone book, commercial list, or the POTW's own records. Sometimes they are nonpoint sources. Many times the source is not discovered.

Fast response to these incidents is necessary to enforce existing requirements and to avoid future incidents. But the current process is costly and time consuming, and it is not clear if a POTW is to devote time to this effort over time spent reinspecting known sources.

Better information regarding illegal discharges, companies manipulating self-monitoring, and unidentified sources would have a significant preventive value.

Similarly, not much information yet exists on nonpoint sources. Are POTWs mandated to develop this information? Do they have the resources to do so?

8. **Regulatory agencies should reorganize to the extent that functional activities can be coordinated with the goal of avoiding cross media transfers in permitting, inspections, enforcement, and in all policy formation and statements.**

DEP and EPA Region I both have experimented with multimedia inspections. Businesses are interested in one-stop shopping for permits. These efforts are intended to reduce the complexity and difficulty of environmental regulation, and to prevent cross-media transfers of pollution.

To follow this trend to its logical conclusion is to envision agencies organized by function - permitting, inspection, enforcement, policy - rather than by environmental medium. The difficulty with this proposal is that reorganizations can cause disruption, and it is possible to lose some of the advantages of the current system. Thus what we are proposing is not an across the board reorganization, but reorganizing just to the extent that cross-functional coordination is possible.

Such an organization could perhaps contribute to more effective targetting of scofflaws, and better knowledge of pollution sources: companies asking for a permit because of water discharges would automatically be scrutinized for hazardous waste and air emissions as well.

9. **Adopt a reformist posture concerning agency programs and policies.**

As long as regulatory agencies concentrate on an adversarial posture, they may ignore issues concerning their own need for improvement. This defensive posture is necessary in relation to litigation. However, if agencies admit that their regulations need streamlining, that their delays are a legitimate cause for concern to commercial entities, that their own requirements can theoretically and sometimes actually be barriers to good environmental practice, and that their own regulations often need clarification, then a process can begin whereby advice on reform can be sought from the regulated population and other concerned parties, and progress can be made in a cooperative context. Businesses are more likely to accept the policies of the enforcing agencies if they have been consulted, have participated in the policy formation, and understand

the logic of the various rulings and the premises, limitations, and mandates of the agency. The spirit of openess must come from above, or agency employees will continue to feel bound by loyalty to react defensively to any criticism.

There are regulatory impediments to good environmental acts. One example is the fee necessary in MA for modification of an air or water permit. If the modification is one that is for reduction of toxics, the fee is a barrier. Recycling regulations are very complex, and OTA has encountered many companies confused about whether or not they need a permit for various reuse, recovery, and recycling operations. When presenting various options to companies in the course of OTA's assistance, many companies have reacted negatively when we have mentioned that a particular recycling operation may need a permit. When we point out that the fee is small, they often cite the paperwork and expected delay. Companies frequently comment that they are unwilling to ask the enforcement agency for clarification of its regulations, because they fear they will open themselves to enforcement actions.

Discussed elsewhere in this report is the ROMAR process, which some companies are using to remove heavy metals from wastewater. This process results in a sludge that is upwards of 80% pure metal. It is sent off for refining, which replaces the landfilling of hydroxide sludges. Because it is F006 waste, it must be managed as a hazardous waste. Is it not possible to further encourage this kind of process by treating it as a recovered material? There are other examples of recovered materials that must be treated as hazardous wastes, although they are useful materials. These restrictions inhibit the use of waste exchanges.

Elsewhere in this report is a discussion of the "closed loop closed door", which results when a company that has been treating wastewater implements complete water recovery and ceases discharge. Zero water discharges may not be exempt from RCRA as are discharges under a Clean Water Act permit, and thus the treatment of the wastewater is now arguably treating without a part B TSDF license. This, and uncertainty about the status and regulation of evaporators, including enclosed evaporation systems, has had a chilling effect on over a dozen companies known to OTA that had been considering zero water discharge technologies.

(NOTE: this section was first written in 1994. Since then, "regulatory reform" has taken on the aspect of repeal. Thus, NBEN's business/government dialogue (see Merrimack Report, part 1) used the term "Regulatory Improvement Opportunities", not "reform").

10. **Make water quality and discharge data as accessible as TRI data.**

OTA staff found it difficult to use water quality and discharge data to target sources of pollution. We found it difficult to find, gather, and interpret the information. We believe that if we could not adequately assess the data, the average concerned citizen also is unlikely to be able to use the information. This is a lost opportunity to raise public consciousness about discharges. It is difficult to assess total loadings to a receptor, because this involves use of flow and concentration information to derive mass. The sheer number of calculations, and the imprecision built into such estimates, rule out having any data of this sort in an accurate form. This data also widely varies

from facility to facility and POTW to POTW, because every site has different requirements for testing. The data is only for significant industrial users and categorical sources, which is only a small percentage of the number of sources of pollution to a receptor. Data on organics is lumped under Total Toxic Organics, or toxicity testing. It is not easy to assess the loadings of particular organic constituents.

Monitoring data is public, but most use of this information appears to be either by commercial entities or environmental organizations. This information could be made more accessible to the general public - to neighbors and citizen groups. The TRI program has demonstrated how strong a motivator public scrutiny can be. The water quality monitoring data exists and can also be used in this manner.

Programs to encourage citizen monitoring, such as what New Hampshire's Merrimack Project is implementing, and MA DEP's Bureau of Resource Protection is working on, would enhance the involvement of local citizens in protection of their resources and would increase knowledge and use of existing data.

11. **Make regulatory system more uniform.**

OTA occasionally receives calls from companies or consultants asking for a summary of the POTW regulations or local limits which apply throughout the state. We are forced to reply that to our knowledge no such summary exists. There are over 100 authorities in this state that have their own rules, and in addition the state and the EPA also have jurisdiction. In one city, a company can discharge a particular metal at 2 ppm, in another they have to meet 0.1. Most people find this frustrating, even when they understand how such limits are set, and why they are set according to the characteristics of each receiving system. However, it may be that greater uniformity is possible. If there were greater uniformity, jurisdiction shopping would be reduced and compliance would be enhanced, due to better understanding on the part of the regulated population of just what is required. If increased uniformity is not achievable, then resources should be provided to the states to gather the information on local limits in each district into one document which would be accessible, or distributed (perhaps to chambers of commerce).

12. **Encourage the formation of self-help groups for POTW personnel, and interaction with other agencies.**

OTA has been impressed by the formation of the Massachusett Pretreatment Forum, a forum for discussion of POTWs, by and for POTW officials. This forum was founded by pretreatment coordinators in a number of facilities, including the South Essex, Greater Lawrence, Haverhill, and Upper Blackstone POTWs. It has served a very useful function in helping these officials stay up to date with CWA requirements and with new technologies. It served as a very convenient method for OTA to train these personnel in pollution prevention techniques and concepts, and to gain cooperation with OTA for its projects, notably the Blackstone Project, the Merrimack Project, and the Critical Parameters project. This group should be regarded as a model, and resources should be provided for the continuance of the group, and the establishment of similar

groups. The amount of money necessary is quite small. EPA recognition of the group would also serve to encourage and reinforce its activities and mission, of increasing the effectiveness and professionalism of its members. (For further information contact John O'Hare of the Greater Lawrence Sanitary District, North Andover, MA).

One of the positive developments resulting from these various projects is the increase in communications between DEP and the various POTWs. Many POTW officials have commented that before this time, there was virtually no communication at all. There should be programs in place, such as multimedia inspection programs that include POTWs, to ensure that POTW officials are linked to other environmental agencies. Without such formal links, these agencies may work at cross purposes; with them, the agencies may be able to be more effective.

THE MERRIMACK PROJECT

APPENDICES

Part IV

The appendices to the Merrimack Project report are organized as follows:

New Hampshire attachments

Massachusetts papers

Observations on Accomplishing Pollution Prevention

P2 Self-audit checklist

Models of Interaction between Technical Assistance and Enforcement

Regulatory Improvement Issues (1992)

Proceedings, Regulatory Improvement Opportunities (May, 1995 Draft)

Merrimack Business Environmental Network

Northeast Business Environmental Network

Letters of Invitation to the Regulatory Improvement Opportunities (RIO) Forum

RIO Forum Attendees

Published Merrimack Project case studies

Relevant patents

THE NEW HAMPSHIRE BIOMONITORING PROJECT

Please see companion report, Merrimack River Quality: The Effects of Franklin's WWTP on Macroinvertebrate Communities.

The sampling sites for the biomonitoring project were in two areas: Franklin and Nashua. At both areas sites above and below the wastewater treatment facilities were sampled. At the Franklin sites the predominant method used was kick-net sampling, which is most appropriate for shallow riverine areas with cobble bottoms. Artificial substrates were also used on an experimental basis, but were not very successful because they fell apart.

Aside from the problems experienced with the artificial substrates, the Spring and Fall 1993 sampling events at the Franklin site were considered successful. Macroinvertebrates were collected, and analyzed for numbers and types. A report on the biomonitoring project is appended.

The Nashua sites presented some difficult problems because: (1) the river is much deeper and cannot be waded; and (2) there is a significant amount of boat traffic. Due to the characteristics of the river the decision was made to conduct sampling using artificial substrates, called multi-plate samplers. Below the treatment plant outfall the samplers were secured to a bridge abutment where they were suspended in the water column and left for 6 weeks to colonize. Above the treatment plant they were secured to a pile of rubble which was the former site of a bridge abutment.

Although sampling at the upstream Nashua site was fairly successful, problems were experienced at the site below the outfall. The artificial samplers were vandalized sometime during the 5th week of the 6-week sampling period. The samplers were lost, and it is unknown whether they were actually removed or just cut loose. Unsuccessful attempts were made to find them by dragging the bottom and scuba diving. Due to the difficulties experienced at this site the fall sampling event was not conducted, and an alternative approach will be developed.

NH Department of Environmental Services

LETTER OF DEFICIENCY - MODEL LANGUAGE

It is the goal of the Department of Environmental Services to promote the prevention of pollution at the source as the preferred option for meeting established environmental quality goals. The Department strives to ensure that pollution prevention options are considered first, followed by recycling, treatment and disposal. I am requesting that the Department's Pollution Prevention Coordinator contact you, if appropriate, to discuss possibilities for waste minimization or source reduction at your facility. In the meantime, if you have any questions about pollution prevention please feel free to contact the Pollution Prevention Coordinator at 271-6398.

Final - August, 1993

New Hampshire Department of Environmental Services

POLLUTION PREVENTION DEFINITION

"Pollution prevention is the use of materials, processes, or practices that reduce or eliminate the creation of pollutants or wastes at the source, or minimize their release to the environment. It includes practices that reduce the use of hazardous materials, energy, water or other resources. It also includes practices that protect natural resources and human health through conservation, more efficient use, or effective release minimization."

Pollution Prevention is an approach that:

- encompasses any pollutant;
- encompasses all segments of society, including individuals, government, business, industry, and agriculture;
- avoids shifting pollution from one environmental media to another, whenever appropriate;
- includes improvements or modifications which bring a facility into compliance with regulatory requirements, or reduce waste or emissions beyond the regulatory requirements;
- emphasizes source reduction or release minimization practices which eliminate or reduce the amount, toxicity, or impact of pollutants released to the environment PRIOR to recycling, treatment or disposal;

GOAL

It is the goal of the Department to promote pollution prevention actions consistent with the definition as the preferred option for meeting established environmental quality goals. We recognize, however, that in some cases pollution prevention may not be feasible at this time. In those cases the Department will strive to ensure that pollution prevention options are considered first, followed by recycling, treatment, and disposal. Decisions that do not support efforts to prevent pollution at the source of generation or release will be re-examined periodically in an effort to continually strive toward our pollution prevention goal.

New Hampshire Department of Environmental Services
Multi-media Pollution Prevention Task Force

MEMBERS

Office of the Commissioner:	John Dabuliewicz	Assistant Commissioner
	Gretchen Rule	Enforcement Coordinator
	Chris Simmers	Chief Environmental Planner/Chair
Air Resources Division:	Rudy Cartier	Small Business Assistance Program
	Richard Andrews	Air Toxics, 33/50 Program
Waste Management Division:	David Bowen	Hazardous Waste Compliance Program
	Paul Lockwood	NH Pollution Prevention Program
	Vincent Perelli	Haz. Waste Capacity Assurance Program
Water Supply and Pollution Control Division:	George Carlson	Industrial Pretreatment/NPDES
	Brad Foster	Municipal Water P2 Program
	Sarah Pillsbury	Groundwater Protection Bureau
	Eric Williams	Nonpoint Source Program
Water Resources Division:	Katie Merriam	Wetlands Bureau

STAFF

Office of the Commissioner: Stephanie D'Agostino Pollution Prevention Coordinator

MA OTA OBSERVATIONS ON ACCOMPLISHING POLLUTION PREVENTION

Process review

Pollution prevention is accomplished by process review. The basic tools are analysis of current practice and potential alternatives. These are the same tools that are used for improving operations from any standpoint, not just environmental. The outcome of a pollution prevention program should be better informed operators and managers, better able to implement measures to improve productivity and efficiency, as well as safety, health, or the environment. Pollution prevention can easily be treated as an add-on, make-work activity, peripheral to the business of making money. Emphasizing the essence of P2 as better understanding of process underlines its relation to the business' core activities.

Motivation

P2 involves questioning assumptions and making changes. It sometimes involves investments of time, energy, or money. It involves a certain element of chance, and sometimes people are on the line if the project doesn't work. Therefore, many aspects of a P2 program can be threatening to job or financial security. P2 seems to have been accomplished where companies were influenced to use P2 to remove themselves from regulatory pressures, either because they were under substantial pressure of fines or fees and control was not an easy option, or they saw the value in the P2 approach as a response to such pressure. This point is brought out by the substantial accomplishments of companies seeking to eliminate freons and VOCs as a result of the Clean Air Act.

P2 was also accomplished when company officials happenned to be innovative people, who recognized the possibilities in the P2 approach. These officials and companies are of the type that really only need to be introduced to the approach and then are able to develop programs on their own. One example is Jim Klecak of Americraft, who took a significant risk when he committed to expenditures for a printing system using non-alcohol fountain solutions. (See attached case study for a summary of his success). Another example is Ed Surette of M/A-Com, who after getting started on P2 by OTA, has instituted process review and materials accounting programs at company facilities across the country because of their value in building efficiency and eliminating waste of all kinds.

There are those who need the combined effect of the push of regulations and the pull of technical assistance. This does not seem to be in many cases because of a lack of civic or environmental responsibility, but often because of the daily pressures of work, ignorance of P2, shortages of resources, and the existence of internal barriers to change. Such barriers may be the resistance of officials to questioning or change, or the commitment to a particular way of operating because it was the result of a substantial investment of time. It may also be due to personal investments in particular practices, and there may also be a hesitation to solicit or accept suggestions from certain parties (such as the difficulty inherent in an environmental officer making process change recommendations to a process engineer). Such considerations as how to suggest changes without criticising existing practices or threatening "turf" are very real when one attempts to implement P2 at a facility.

Having a government official who is nonthreatening ask questions and provide suggestions is very useful in providing support to those in the company that would like to see change. It is also very useful when there is no one in the company that is attempting to implement P2 changes. Government technical assistance providers may ask questions that those familiar with practice never ask, simply because they take current operations for granted. TAP programs visiting a company provide a fresh point of view.

Questioning assumptions

By having someone with a fresh viewpoint walk through and review process steps, unnecessary activities can be eliminated. (See company #24 in the "True Tales" section of this report). Questioning assumptions about how a process best operates can lead to the resetting of optimal operating parameters. Once parameters such as temperature, pressure, pH, specific gravity, or concentration have been redetermined (they may exist from many years before, when different equipment or materials were used, or may have been arbitrarily set in the first place), process monitoring and controls can be used to extend the life of any chemical bath.

During one walkthrough, OTA staff asked company officials to explain a large container of about 10 gallons of oil. An official said that it was oil used to preserve a large housing shipped from out of state. OTA asked what would happen to the oil and was told that it would be poured into a sump. The next question was where does the sump lead, and it turned out it eventually led to a water/oil separator that was turned off, and was a major reason that the company could no longer discharge to the local POTW, but had to pay thousands of dollars each week to ship out the water/oil combination. OTA asked why add to the problem by dumping the water in in the first place, and pointed out that even if the separator were working, all the company would be doing was using up energy to separate what didn't have to be combined. OTA then asked if the oil was still useful for the same purpose, or was useful for any other purpose. The company officials commented that they did not know, but had never considered this possibility. One official remarked that he walked onto this floor every day for over ten years and had never stopped to ask questions concerning this practice.

Unanticipated benefits

The technical assistance programs have often found many surprise benefits that feed off of each other. For example, a company that does water conservation finds that it now has opportunities to use electrolytic recovery of metals on a more concentrated waste stream. Or a company that has recovered materials from its wastewater discovers that it may now reuse the water. Finally, a company that is reusing its water may find that it is of a purer and more consistent quality than the city water or pumped groundwater it formerly used.

Range of available options

The main task of technical assistance is to elucidate the range of options available. Staff must also attempt to avoid recommending only one course of action. Quality and other restrictions on the changes a company may make must always be kept in mind, however these considerations cannot be allowed to prevent for all time the possibility of changes, but should be continuously revisited. Even military specifications can be changed, and customers and clients can agree to

modifications. Staff must attempt to anticipate potential adverse consequences of any recommendation, understand the regulatory, financial, technical and social context of the recommendations they make, and refrain from making categorical statements concerning regulations or product quality.

Materials accounting

Convincing a company of the utility of materials accounting should be an important aim of any program to promote pollution prevention. If material use and waste can be quantified, a (rough or precise) mass balance can be derived. This can contribute to the calculation of useful productivity measures, which can help focus activities in the most economical, as well as environmental, manner.

According to one Merrimack project staff member, "Waste is an indicator of operating inefficiency". Environmental problems are clues to opportunities for process improvements.

The Socratic Approach

Asking questions has been a recognized method of educating since Socrates popularized the approach. Questions that can be asked about virtually any process include whether a company is investigating alternatives, whether a company is inventorying or tracking its material use, whether a company tracks its pollution management costs and attributes them to their source, and whether a company uses available information about the health, safety and environmental impacts of the materials they use. Whether or not a company sees P2 as an ongoing, continuous effort is key to whether or not P2 will be achieved. Another key aspect is whether or not employees are solicited for information. Does an environment exist at the site where suggestions are encouraged, or rewarded? Is it even safe to make recommendations?

The following is a draft self-audit checklist.

WHAT'S BEING DONE TO PREVENT POLLUTION?

Pollution Prevention is about avoiding: Occupational Exposures * Air and Water Pollution * Hazardous Waste Shipments * Need for Treatment * Toxic Torts Superfund Liability * Fines and Penalties * Risks of Spills or Accidents

It's now the law of the land. Is it practiced where you work? Ask the following questions.

1. IS THERE A PROGRAM IN PLACE?

It should be ongoing, not just a one-time event. It should have upper management support. It should involve people from all different, relevant parts of the organization. It should involve people on the line, and solicit ideas. It should give these people credit for their good ideas, and it should have the power to MAKE THINGS HAPPEN.

2. IS IT SAFE TO ASK QUESTIONS, REEXAMINE ASSUMPTIONS?

The best way to discover pollution prevention opportunities is to take people unfamiliar with the operation on a walk-through of the facility, to utilize their fresh and/or professional viewpoints. What's needed is a process that questions things people take for granted. Steps should be taken to ensure that this remains a positive experience for everyone - that people don't feel, and aren't, threatened by the questions. If there is a team looking for pollution prevention opportunities, does the team sit in a room or does it get out into the facility?

3. IS THERE WASTE ON THE SHELF?

Are there procedures to avoid excess purchases, unwanted deliveries which become unused materials, shelf-life expirations and spoilage in storage? Does the control system flag and reduce purchases of materials which become disposal or management problems? Does the system track the costs of management and disposal of materials? Is there in place a system for tracking the distribution and use of materials in the facility so that such use can be controlled and a match (mass balance) of the quantity of each material coming in and its ultimate fate can be achieved?

4. DO PEOPLE KNOW WHAT POLLUTION COSTS?

Is there in place any method of cost tracking, which can attribute environmental, safety or health costs to their sources, and is there any feedback mechanism of incentives or disincentives to reduce those costs by changes in the source activities?

5. IS EACH ACTIVITY NECESSARY?

As time goes on, the reasons that process steps are instituted may have disappeared - but the step is continued because it has become routine. Or, a cleaning step may be eliminated by eliminating the soiling. The key is to ask why is something done, at each discrete step, and reevaluate the reason.

6. ARE MEASURES TAKEN TO EXTEND MATERIAL LIFE, OR FOR REUSE?

Are materials prematurely discarded? Can the process life of a material be extended by filtration, oil separation, a protocol for addition of fresh materials, prevention of drag-in, reduction of oxidation or bacterial degradation, periodic equipment cleanouts, or preventative maintenance? Are chemicals dumped when they are spent, or according to a set time-frame? Is full advantage taken of available technology for improving the efficiency of all processes? (Aeration, turbulation, ultrasound, high pressure spray). Are the used materials useful on or off-site for any purpose? Can they be rehabilitated?

7. WHAT ARE THE OPTIMAL OPERATING PARAMETERS?

Are operating parameters determined, monitored and controlled? (Flowmeters, level controls, dispensing rates, concentration, temperature, times).

8. IS THERE TRAINING, AND IS IT LINKED TO OTHER ACTIVITIES?

Good housekeeping measures are low-cost, high-gain pollution prevention activities. To prevent spills, leaks, evaporation, over-use of chemicals, bad batches, and mixing of things that shouldn't be mixed, everyone must be involved. Is there a connection between this effort and any other training, or incentives, for quality improvements, standard operations, water and energy conservation, safety, and productivity?

9. IS THE LEARNING PROCESS CONTINUOUS?

Is there any process of evaluation of alternative materials, eqiupment or practices, or is change regarded as overly risky or threatening? Is there any mechanism in place to keep up-to-date on new technologies and practices for prevention, recycling, recovery, efficiency? Does the facility have the latest information about the health, safety and environmental consequences of the use of each material at the facility? Does the facility solicit information from available resources, whether commercial, governmental, trade, professional, or literature?

10. DO PEOPLE REALLY CARE?

Is there an attitude in the organization that excellence in the areas of environmental, safety and health issues is essential to the core activities of the organization, and that a program of avoidance of adverse consequences is a method for improving organizational efficiency and productivity? Or are all these things regarded as a nuisance, peripheral, and a drain on money and time? Is your facility a good neighbor?

Models of Interaction between Technical Assistance and Enforcement

Since the establishment and success of technical assistance programs to increase the adoption of pollution prevention, regulatory agencies have considered incorporation of such activities into day-to-day operations. A "White Paper" issued by EPA Region I dealt with questions raised by this effort. The approach of the White Paper appeared to focus primarily on how enforcement personnel should conduct technical assistance. Staff of dedicated technical assistance programs responded with concern to the approach recommended by the White Paper, commenting that it did not take a broad enough view of the potential utility of technical assistance and particularly did not ensure confidentiality of technical assistance efforts, a key factor in gaining industry acceptance. A consideration of several possible models of interaction between technical assistance and enforcement efforts may be useful in making appropriate administrative decisions concerning optimal programs to provide technical assistance.

Before considering various models, it is important to address a widely held concept that the provision of technical assistance (TA) necessitates the suspension of enforcement, or disinvestment in enforcement. Administrators deciding to transfer resources from enforcement to technical assistance may do so as a result of budgetary limits and policy priorities, however there is nothing inherent in the concept of technical assistance that requires the disinvestment in enforcement. In fact, many TA personnel regard enforcement as a necessary driver for industry participation in TA programs. The most widely cited model of interaction between TA and enforcement, the Blackstone Project, did not result the suspension of enforcement activities as concerns companies receiving technical assistance. Rather, the model of the Blackstone recommends that enforcing officials consider allowing companies the flexibility to perform pollution prevention, if necessary. TA personnel point out that such flexibility should not be granted simply because a company has begun working with them, but upon a showing that time is necessary for the pursuit of pollution prevention options. The Fall River, MA POTW issued an order to several textile companies in 1990 that required them to pursue pollution prevention options, giving them extra time to comply with new copper discharge limits. This order provided for regular reporting on milestones to demonstrate that such P2 option research was ongoing. Without such a showing, the companies were held to standard time limits for coming into compliance.

Some options for integrating TA into regulatory actions can be described briefly as follows:

1. Using enforcement to encourage and require the adoption of P2 techniques, seeking P2 information in inspections, permits, providing guidance on P2, and establishing enforcement policies and mechanisms to encourage P2.

2. Establishing a P2 auditor, who performs audits rather than inspections, but is part of the enforcement agency. The level of confidentiality provided can vary from none to various standards of seriousness. Audits and inspections for violations can be conducted in a "two-step" fashion as in the first three of the following approaches:

    a. The audit is followed by an enforcement inspection after a certain period of time.

b. A company receiving an inspection can request an audit after the inspection.

c. The auditor reinspects after a certain period of time and refers violations to enforcement after the second visit.
d. Auditors are available on request.
e. Auditors make surprise visits.
f. Auditors visit as inspectors, but call ahead of time.
g. Auditors make cold calls offering their services.
h. The agency publicizes a highly visible program of enforcement in an area, and recommends utilization of the auditors before the onset of the program.

3. Establishing a nonregulatory TA program. Many of the programs already established on this model provide complete confidentiality except for imminent threats, in order to gain the cooperation of the regulated community. Many of the options for interaction with inspectors are the same as for the auditor, but some additional options should be considered because of the confidentiality component. Dedicated TA P2 specialists cannot be expected to report back on the companies they visit, so that if companies are to receive flexibility or credit for P2, which information may be required so that the agency can receive credit, then the companies must either waive confidentiality or report directly to the enforcing agency.

Combinations of these models are also possible. A system can be devised that gives an inspector the ability to recommend to a violating company that it may: request an audit, or a visit from a nonregulatory program. Another option is to give enforcement personnel the option of ordering the company to consult with P2 experts. Inspectors could have the option of ordering or suggesting companies work with either auditors or assistance personnel, or perhaps with an outside party.

Issues related to establishment of technical assistance in any of these modes include:

Accounting for agency activities (the "beans" issue).
Allowing for time to develop P2 recommendations and for companies to pursue P2.
Resources of the regulatory agency.

One of the primary issues when considering establishing technical assistance is what levels and/or kinds of assistance are necessary to effectively increase the adoption of pollution prevention activities. Many programs have found that more than just engineering technical assistance is necessary to aid companies in actually performing pollution prevention. One important area is financial help - assisting in the financial analysis of proposed P2 projects; obtaining loans or other funding sources; working with financial sources to encourage the provision of funding; developing loan guarantee, grants and loan programs; structuring tax credits, depreciation for operating expenses, and other incentives. Another key area is addressing regulatory confusion, ignorance of regulatory requirements, and occasionally, impediments to adoption of P2 activities. Regarding regulatory confusion and ignorance, many programs have enhanced relations between regulators and industry by providing forums for the discussion of regulatory requirements. Some programs have also served to identify problems that companies have getting regulatory clearance

to perform pollution prevention. If a closed-loop process which eliminates a water discharge is technically "treating without a license" under RCRA, a company needs to know this, and regulatory agencies may wish to provide for such operations. Permit modifications may need to be obtained, and companies may need help negotiating other paperwork or "bureaucratic" requirements that may arise.

There are many ways to build P2 into enforcement actions, including:

Inspectors asking questions designed to elicit information and prompt thinking about process change.

Requiring or requesting the submission in permit applications (or other opportunities when communications are made to agencies) of process flow diagrams that include material balances, showing where materials become wastes.

Requiring or requesting that companies research and report to the agency on process changes, chemical substitutions, employee training, and other P2 actions and options.

These actions directly impact on the current agency accounting issue. Qualitative reporting to the granting authority may have to replace, or explicate, some quantitative measures. Modification of the accounting process should be considered so that credit can be given to agencies for evidence of compliance, which is different from getting credit for the number of enforcement actions taken. If the work of technical assistance for pollution prevention is successful, compliance rates will increase and the number of citations and enforcement actions may drop off. Therefore, it may be necessary to credit the agency for various actions such as:

Issuance of orders which include P2 recommendations, require P2 investigation, require or refer to P2 auditors or separate assistance personnel, or which have a multimedia nature. These may be fewer in number because they will take longer to develop, but they may be more substantive and perhaps more effective.

Company actions that go beyond compliance could be given credit under a reformed accounting system.

The agency could receive some credit for public education.

The agency could receive some credit for referrals to technical assistance or P2 auditing. This could be conditioned upon actual work being performed and a showing of progress.

To summarize:

Maintain visible investment in enforcement.

Broaden measure of successful regulatory action. Give credit for multimedia, P2 inspections, TA activities, public education.

Consider all the options for technical assistance and promotion of P2: by inspectors; by dedicated separate technical assistance staff providing confidentiality; and/or by auditors, (more closely tied to enforcement).

Consider all the tools for working with these models: timing inspections and/or audits or TA visits to follow, or vice-versa; requiring or suggesting contacts with auditors or separate assistance staff; providing flexibility to do P2, upon a showing; providing financial and regulatory assistance as well as technical.

In conclusion, it is important to consider all the models and options for integrating technical assistance and enforcement while setting policy and designing programs to achieve this objective. The White Paper did not make clear what model it was addressing, or even that there is more than one model. Agreement on confidentiality and other policy issues could probably be reached if the policy issues were tied to particular models of TA delivery.

Richard Reibstein
Office of Technical Assistance for Toxics Use Reduction
Massachusetts
November 30, 1992

Memorandum

TO: Ed Kunce, Bob Bois
FROM: Rick Reibstein, Director of Policy, OTA
RE: Regulatory Improvement Issues
DATE: December 23, 1992

At your request, these are some of the issues we have identified in our work with industry. Foremost on our list is when a company modifies its process to achieve toxics use reduction. It may have to pay a fee for modification of the air or water permit. DEP bases its fee rates on administrative costs. This practice conflicts with the policy of promoting process modifications for TUR.

Second on our list is when a company goes to zero discharge. This arguably takes them out of the Clean Water Act and puts them under RCRA, where there are restrictions concerning treatment or recycling operations. Many companies are currently doing this and are consciously taking the risk of being penalized for treating without a TSDF license. Some companies have decided not to go closed loop for this reason. Some keep a discharge permit but discharge nothing. It is not clear whether the wastewater receiving authority has the authority to permit in this matter, because a shop with closed drains could not arguably affect that receiving authority's operations.

Third on our list is the extreme confusion in the regulated community concerning recycling, which serves as a disincentive both for recycling and for complying with the law. The same situation exists as concerns evaporators and other dewatering operations, and virtually all material reuse operations. No one seems to be clear about the function or meaning of the term "integral", or when a material becomes a waste, or what materials require a recycling permit, or which permit. The kind of clarity that DEP has provided concerning basic RCRA requirements in its "Summary of Requirements for Small Quantity Generators of Hazardous Waste" is lacking in the recycling area. This serves as an impediment. The body of this memo addresses itself primarily to these matters.

Fourth on our list is the TUR waiver policy under TURA. This provides for flexibility in compliance schedules, basically attempting to eliminate the situation where a company will slap on a black box because it's quick and it is a proven process, in preference to trying more innovative technologies or less tangible activities (such as good housekeeping or process monitoring improvements). With no formal policy in place, the ability of companies to take advantage of this is limited.

This memo is an attempt to present to you most of the issues that are presented to us. We did not attempt to narrow things down to a few matters. The most important to us are the four cited above. We appreciate your request for this information, and understand that it may not be easy to simply change current practice or policy.

Uncertainty and Confusion

Many of the issues described below may simply be a lack of understanding of the regulations on our part. However, we report them because they reflect a widespread lack of understanding on the part of industry. All of the questions cited herein have arisen not from our own considerations but have been asked of us. These are the questions we have not been able to answer. There is a good deal of uncertainty regarding:

What recycling of hazardous waste (HW) requires a permit.
What is integral HW recycling?
Can hazardous waste treatment systems be allowed when there is zero water discharge?
Is in-process hazardous waste recycling or treatment restricted?
When is a recycling material no longer a hazardous waste, but a useful material?
How may waste exchange be facilitated, when usable materials must be managed as hazardous waste?
Is there no appropriate treatment we may allow under RCRA?
What protection from Superfund liability can be offered "arrangers for disposal"?
Is there the option of putting a recycling system in place at the same time as the application for a permit?

Promotion of Recycling

The focus these days is on toxics use reduction, pollution prevention. As we make progress in this regard, we should not forget recycling. Much effort has been spent in the past to make toxics users aware that a material can still be useful even after it has been run through a process. But many are totally confused about whether or not they need a permit, and we run into stills and other recycling equipment that are not permitted. Many, told that there are recycling opportunities and that a permit is not hard or costly to get, prefer not to seek one, often citing an expected time delay. The regulations on recycling are difficult to follow, and requests for clarification have usually resulted in a response that rulings will be made on a "case by case" basis. It would be useful to know what are the principles used in making case by case rulings.

Is Recycling Included under Integral Treatment?

It seems that one can only recycle what is permitted under 310 CMR 30, or what is part of a treatment process before permitted disposal to a sewage treatment plant. The regulations state that integral treatment needs no permit, but it is not clear as to whether that includes recycling. So, is it true that if you add a recovery operation to an integral treatment system, that you now need a permit?

Must a useful material be considered a waste?

Is it so that one can not ship a "hazardous waste" to someone else who will use it unless they are a permitted recycling facility, a TSDF, or if they are out of state and they give a certification (a process that I don't think anyone even knows about). As we understand it, one has to ship recyclables with a licensed transporter. This basically makes waste exchange prohibitively expensive. Is there a way to ship hazardous waste for recycling or reuse more cheaply?

The Romar process, recently patented, presents an interesting situation. This process can be used instead of conventional treatment for removing heavy metals from wastewater. Instead of creating a metal bearing sludge for landfilling, the process yields 90%-plus pure metal. It is not pure enough to be reused on site by platers and others who need very pure metals in their process. But it is purer than the ore sent to refiners. Thus, it is better than what is now shipped to the refiners for smelting. But it is, apparently, a "waste from a plating process" and thus a listed hazardous waste, and it seems may not be shipped to the refiner except with a manifest and by a licensed transporter, which may be expensive enough to discourage people from doing this. Most important, the refiner will probably not take a "hazardous waste". Can it be a material, and not a waste?

Do recycling regulations and treatment restrictions apply to in-process activities?

There is much confusion now about in-process treatment and recycling of hazardous waste, especially concerning mixtures of listed wastes. There seems no clarity concerning how to regard activities that physically or chemically affect materials when the activity is part of the process. It may be enclosed or not. Sometimes it seems that regulatory actions apply to in-process activities, sometimes it seems they only apply to waste treatment after the process. We know of people abandoning activities they have performed for years, which recover or remove materials in the process, because they are worried that they will be hit for treating hazardous waste without a license. This is happening with photoresists in printed circuit board manufacturing. One state ruled that photoresist skins were a listed hazardous waste because they came from a plating operation. EPA refused to rule on the matter, and photoresist manufacturers wrote to their customers that they should now handle this waste as hazardous. Most have in-process filters to remove the skins from wastewater. Because the companies did not wish to obtain hazardous waste treatment authorization or hazardous waste recycling permits, they simply stopped removing the skins from wastewater and now discharge it. In our visits, we frequently find that companies do not know whether their in-process filtering of hazardous materials is recycling for which they need a permit. Most assume that the permit is only necessary for something that is added on at the end of the process.

Another example of the above is a query received just yesterday from a company that wishes to install an electrowinning system. We are not sure if this is considered waste treatment, requiring a licensed treatment operator to monitor it. We are not sure if there is a difference if the system is placed on dragout tanks or rinse tanks. If the entire shop went to zero discharge, would the system have to be permitted?

Sham recycling

What if a company wants to remove a certain pollutant from their waste stream, but they cannot remove it effectively enough to reuse it on site? What if they are only removing a small percentage by weight of their waste? What if they have to pay for the material to be disposed of or refined, however, doing the removal means that a great volume of waste is thereby rendered nonhazardous? All of these are under a cloud as "sham recycling" and are in a gray area which no one seems to understand, and yet all of these are environmentally beneficial.

The attempt by companies to get recycling permits for activities which are really treatment (and thus they are labelled "sham recyclers") may not always be a matter of deviousness. These companies sometimes wish to perform appropriate treatment and are simply trying to fit it into a recycling scheme because there is no treatment allowed without a TSDF license, impossible for most businesses to get.

The closed-loop closed door

If a company is treating hazardous wastes under a Clean Water Act permit and then closes the loop, begins reusing water, and has no more water discharge, they are now arguably under RCRA and are supposed to have the TSDF permit. If we wish to discourage companies from simply slapping on evaporators, that is one thing. But we should not be discouraging companies from doing many sophisticated water purification and material recovery and removal processes which can greatly benefit our resource use and waste generation profile.

One of the first great success stories in the pollution prevention field in this state was the Robbins Company, which managed to close its loop, recovering all the metals out of its wastewater. The system uses in-line cyanide destruction (treatment), carbon adsorption (treatment), ion-exchange (recycling?), electrowinning (recycling?), and evaporation (treatment?). Theoretically, this company could be slammed for treating without a license, and Beverly Migliore, a Rhode Island environmental official, has expressed frustration to this state, because companies in Rhode Island wish to emulate Robbins but Rhode Island has a strict policy against evaporators - regarded as treatment without a license.

Evaporators, etc.

We do not necessarily wish to encourage the use of atmospheric evaporators - and we recommend enclosed, integral evaporation technologies - but we do think it is necessary to clarify what RCRA does require concerning evaporators. A similar issue is the filter press, or the neutralization tank - where are these authorized under the law? Many companies have them, but neither they nor we are clear on where the law allows for their use.

To summarize:

If you add a recycling operation to an integral treatment system, you appear to have additional regulatory requirements, although this is something that should be encouraged.

If the recycling you add is not economically beneficial, are you engaging in sham recycling?

If you change your process or treatment system so that a waste that was sent for landfilling can now be sent for off-site recovery or exchange, it appears that you still have to ship it as a hazardous waste, which means there is no savings in transportation or regulatory compliance costs, and the recycling center (refiner) or other potential user of the material may not be able to receive it.

If you pull something out of your process before the end of the process, must it be integral, and if you are recovering the material, must it be permitted under recycling?

If you cease discharging wastewater because you are reusing it, is your treatment and/or recycling prohibited under RCRA? (We have had a score of requests concerning this situation, one from a sewage treatment facility which has granted half a dozen "zero discharge permits" to cover such facilities).

In addition, there are these other, related issues.

Arranging for Disposal

Several organizations have abandoned plans to arrange for disposal of hazardous wastes generated by their members because they have learned they become subject to liabilities under Superfund. These include communities planning hazardous waste collections for small generators. These include trade associations. Milk runs and dedicated collections are effective ways of reducing waste costs and getting wastes taken care of properly. They are inhibited by Superfund-induced trepidation. This may be a federal issue over which DEP has no control, but perhaps the state could petition for a change.

Sewer-use connection permits

Another frequent source of frustration is the issue of sewer use connections, which is a largely duplicative state-local activity. Many companies out of compliance are reluctant to apply for such permits because they are afraid they will be fined for having been out of compliance. One company reduced its discharges and lost its grandfathered status, thus having to pay the connection fee, because it had "changed the character" of its discharge. If the company is in compliance with its discharge limits, should it be penalized?

Getting everyone into the system

Another major item is that DEP is restricted through grant agreements with EPA to reinspecting the same facilities year after year. Businesses in compliance frequently complain that they are spending money that businesses not in compliance are saving. We certainly understand the relationship here between DEP and EPA, and are raising this issue because we here about it so frequently out in the field.

Streamlining reporting requirements

Finally, it is important to note that the state has established under TURA a mechanism for eliminating duplication of regulations. The TUR Administrative Council's job is to review where reporting requirements can be streamlined. They also, in conjunction with relevant agencies, are to review how existing policy, activities, and regulations and proposed regulations and laws may be changed to promote toxics use reduction.

We certainly want to thank you for this opportunity to present these issues. We appreciate any clarification or resolution that you may provide, which we will pass along.

DRAFT

Proceedings of the Regulatory Improvement Opportunities Business/Government Dialogue

A project of: The Northeast Business Environmental Network/Merrimack River Initiative/EPA New England/Massachusetts Office of Technical Assistance for Toxics Use Reduction

May 9, 1995

Regulatory Improvement Opportunities (RIO) is a project conducted by the Northeast Business Environmental Network (NBEN) with funding from the Merrimack River Initiative (MRI), an EPA-sponsored effort to promote innovation in the environmental area. NBEN, which holds monthly discussion groups designed to keep its members informed about environmental requirements and pollution prevention, and which provides opportunities for business, government and environmental organizations to discuss these matters together, was awarded a grant of $10,000 by the MRI to conduct a "Business/Government Dialogue" on improving environmental programs. The Massachusetts Office of Technical Assistance for Toxics Use Reduction designed the project for NBEN.

The first event was a half day of public discussion on April 27 on issues identified by invitees, and facilitated by NBEN members, employees of EPA and the Toxics Use Reduction Institute of the University of Massachusetts at Lowell. Seven thousand businesses in Massachusetts and New Hampshire received an invitation to this event co-signed by the Massachusetts Secretary of the Environment, the Commissioner of the New Hampshire Department of Environmental Services, the Commissioner of the Massachusetts Department of Environmental Protection, and the Administrator of EPA New England. There were approximately 100 attendees, mostly from business, and some from government, and a minor turnout of "other". Several late registrants were told there was no more room.

About twenty-five invitees submitted issues before the event, and these were provided to the attendees in four categories. Four breakout sessions were held to cover each category. The intent of these sessions was to clarify or elaborate on already identified issues and find potential solutions, and to further identify issues worth addressing. Before the breakout sessions were held, several presentations served to frame the discussion.

Representatives of the governmental agencies briefly discussed actions they are taking to improve environmental regulatory programs, and to improve communications with the regulated community. OTA and NBEN explained the ground rules for discussion.

The basic ground rule was that all parties should attempt to hear and understand each other's points of view. This meant that on the one hand those criticizing environmental laws could learn about the positions of and constraints on the government agencies, and on the other hand the agencies had an opportunity to learn about the real world effects of their policies and programs. The intent of the program was to increase mutual understanding, find areas of agreement if possible, and do some constructive thinking. In this context, it was necessary to reframe certain questions.

For example, a presenter was asked "which breakout session should I go to to discuss eliminating regulations?" The presenter asked if he could reword the question as pertaining to "obsolete or unnecessary regulations", as that was a way to cast the discussion in such a way that agreement might be reached, but the other way was more likely to create impediments to constructive discussion. The questioner agreed and afterwards told the presenter he appreciated the emendation.

A consensus did seem to emerge as a result of the preparation and explanation of the ground rule of mutual respect, that attempts to improve regulations are more conducive to discussion and follow up than wholesale attacks on regulations. The illustration used during the introductory presentation concerned an issue wherein agency officials agreed with an aggrieved party, but were unable to convince legislators to bring the matter to the floor of the legislature for amendment because allowing the law in which the unjust rule was contained to come to the floor of the legislature would abet an attempt to repeal the entire law. Several attendees commented that they had never before considered this point.

RIO serves as a demonstration that much useful information concerning the optimal functioning of environmental programs can be exchanged when a context of constructive discussion is carefully established. Extremely positive feedback was received from the attendees concerning the way in which the questions were framed and the facilitators acted to ensure all sides had a chance to be heard. One government employee said it was painful to hear so many criticisms of the government, but that it was good to hear them. Another was surprised that so many businesspeople were readily able to understand the government's point of view. Many businesspeople were pleased to hear about the innovative approaches the agencies are pursuing, and were glad to have the opportunity to be heard.

This draft document will be provided to all attendees and other interested parties. Attendees will be asked to provide comments, clarifications, and further ideas, and to participate in continuing RIO in the form of working groups dedicated to the issues identified herein.

Please respond to: Rick Reibstein, Office of Technical Assistance for Toxics Use Reduction, Room 2109, 100 Cambridge St., Boston, MA 02202, (617) 727-3260 x 688, fax (617) 727 3827.

How these proceedings are organized:

The breakout sessions were designed to elicit specificity concerning the issues cited, and ideas for solutions. The following materials set forth the issues as preidentified by invitees, (a substantial percentage reframed by OTA with the agreement of the proponent to be more specific or constructive), and flip chart recordings of the discussions of these and related issues as they occurred in the breakout sessions.

Session on:

Authorizations (Where a license, permit, certification, or other form of authorization is necessary)

Issue #1: Too many continuing education contact hours required to maintain license. Example: wastewater treatment.

Who's Affected: Primarily: small companies, sole proprietors, managers who must take time away from production in order to fulfill environmental requirements, people who only need to do certain specific operations (for example: boiler operator) shouldn't have to learn wastewater treatment inapplicable to their job.

How Affected: Unevenness of costs. Competitiveness with companies in other states who do not have to take this time away from business. Money spent on the education. Paperwork increased. Requirements not always linked to necessary expertise. Experience or equivalent training elsewhere doesn't qualify - only sanctioned courses. No value added when boiler operator keeps up with wastewater information not relevant to his/her job.

Origin or Purpose of Requirement:. Wastewater treatment technology and rules continuously change and evolve. To do wastewater treatment effectively, must keep up to date.

Potential Solutions: Expand opportunities to qualify for contact hours. Reduce contact hours somewhat to make more even with other states. State offer more free courses at more convenient times. Expand recognition of experience as qualification. Establish appropriate certification levels for specific wastewater pretreatment, such as boiler operators. Self-study option. Qualify by examination.

General Comments. NOTE: DEP and TURA Administrative Council reviewing this issue, looking at standardizing approvals and offering workshops with joint accreditations. Need more information on original purpose of establishment of the requirement. RELATED ISSUES: OSHA, Hazardous waste, TURA.

DISCUSSION OF ISSUE #1:

- 30 contact hours first year; 10 every following year
  - cost is couple hundred dollars/hour
- No other state has same requirement
- Problem for small companies; also for large companies trying to be competitive
- No validity to work experience
- $150/2 years to maintain certification
- Some of the courses are not directly contributing
- Training only in mainstream technologies
- No distinction between pretreatment operator and treatement operator regarding training and certification
- Should the requirement for ongoing training be eliminated? Is it a burden?
- $600-$1000/first year training even if only for pH pretreatment operator
- Is there a way to consolidate the process?
- Course selection may not be appropriate for industry in NE
- Grandfather license as long as there is no change in operation
- College credits can be part of CEU for TURPs and wastewater treatment certification

Issue #2: Full Treatment, Storage and Disposal Facility permit required for many operations which should be encouraged.

Explanation: Appropriate on-site treatment, recycling of water by removing hazardous constituents (if not covered by Clean Water Act permit).

Origin or Purpose of Requirement: Ensure hazardous waste treatment is sufficiently controlled to ensure safety and prevent contamination of environment.

Potential Solutions: Establish minor treatment permit, preauthorizing standard activities and establishing efficient process for notification and authorization of nonstandard. Encourage innovative on-site treatment. Ensure prevention options are investigated before granting. Establish hazardous wastewater recycling permit to cover recycling of water with hazardous waste constituents.

Comment: Hazardous Waste Advisory Committee has recommended methods for encouraging onsite treatment and recycling.

DISCUSSION OF ISSUE #2:

- Hazardous and solid waste recycling almost impossible to achieve
- Classification of waste -- may not be imposed because it can change from waste to usable material
- Heavy metals are not classified as oxides, free, bound, etc.
- It is considered hazardous waste even if used as raw materials off site.
- Interpretation of laws and regulations varies.

Issue #3: Full solid waste facility siting process required for beneficial recycling.

DISCUSSION OF ISSUE #3:

- Siting process is a lengthy process -- subdivide the regulations to shorten process.
- Waste of one is the raw material of others; regulate at the end point when the material leaves the facility.
- Recyclables are shipped to other states due to the difficult process of waste facility siting. Solution suggestion: regulate materials that have value under the solid waste regulations. Raw materials used by other manufacturing facility should not be considered waste.
- Paperwork involved in shipping regulated waste requires hours of work
- Off-site recycling is not considered the same as on-site.
- Permit by rule

Issue #4: Permit modification fee may be required for pollution prevention activities when they alter the conditions of a clean air act or clean water permit.

Explanation: Impediment to pollution prevention.

Origin or Purpose of Requirement: Fee covers administrative cost of processing.

Potential Solution: Establish fee waiver for pollution prevention.

Potential problem with potential solution: Income to cover administrative costs will be insufficient. Administrative costs incurred by time needed to determine whether something qualifies for the waiver.

DISCUSSION OF ISSUE #4

- Duplication of effort and addition of cost when changing the oil in a boiler plant or adding lubricating oil as an on-site recycling measure
- Implemention of P2 before full process is complete
- Get away from slowing down stages during regulatory review of permit applications
- Acknowledgement
- Performance-based permits
  - Self-monitoring
  - Third party monitoring
- To replace modifications that don't gain environmental benefits
- 702 modifications -- changes that are beneficial result in complete reexamination of the facility
- Experience of inspectors has to be improved, more professional knowledge of the industry they inspect
- Inspectors deal with multimedia
- Train businesses on regulation interpretation by the regulatory people
- Certify inspectors

Issue #5: delays in getting permits.

Comment: DEP has cut permit processing time 25%. More aggressive goals have been set. Committees established to review permit process.

DISCUSSION OF ISSUE #5:

- Buying another facility to expand existing one requires a process the same as starting a new company

- DEP encourages companies to come to pre-permitting conferences; shortens the review time by half

Issue #6: Laboratory proficiency testing on a semi-annual basis imposes unnecessary costs on laboratories, which are passed on to customers.

Potential Solution: Laboratories which consistently report satisfactory proficiency testing data should only be required to participating in the testing program on an annual basis. Semi-annual testing should be reserved for those laboraties which do not perform successfully in the determination of one or more of the unknown analytes.

DISCUSSION OF ISSUE #6:

- Laboratories' equipment and operator turnover is fast; by conducting semi-annual tests, DEP can keep good records

Issue #7: Hard to get information on the status of an application for a permit or other authorization.

Potential Solution: Establish a single point of contact person for each application.

Comment: DEP is planning implementation of an SPOC policy.

Issue #8: BACT can discourage use of innovative or new emissions reduction technologies. Missed opportunities to perform research or implement small scale emissions improvements.

Examples: A. Switching to natural gas or other cleaner fuel from oil must go through BACT. B. Refurbishing, upgrading an existing pollution control device must go through BACT.

Potential Solution: Exempt research projects and activities presumed to be better than current operations.

GENERAL COMMENTS IN THE SESSION ON AUTHORIZATIONS

- If NOx emissions are closest to the limit of 50 tons, opting out is rejected
- No where to go before there is a facility regarding air, water, etc.
- No willingness/flexibility to accept more valid model than the standard
- Expansion of residential areas closer to older industrial areas leads to different interpretation of the environmental laws by the communities -- how can we deal with this
- State programs to guarantee loans associated with risky, innovative projects
- If a facility is close to the threshold of 50 tons of NOx -- would their permit be rejected?
- More input from different groups -- businesses, environmental groups, regulatory agencies before enacting laws
- Identify and help implement the changes
- Laws in lay terms for better understanding of the businesses/users

Session on:

Required Activities/Enforcement

Issue #9: Hideouts. Enforcement agency focus on companies they know about, sense that companies unknown to the agencies not being found. Perception that agencies could use help bringing small and noncompliant sources into system.

Who's Affected and How: Those already in basic compliance, those who self-identify. Enforcement against those already in the system focuses on ever smaller infractions. Those who self-identify are enforced against rather than encouraged to come forward. Those not in the system continue to hide out. Those spending money on compliance at unfair disadvantage - economic playing field not level.

Purpose of Requirement: Agencies are required to perform specific actions in their agreements with the federal authorities. Revisits are required. Purpose is to assure accountability concerning the expenditure by states of federal grants for these programs.

Potential Solutions: Agencies get credit from federal authorities for time spent on finding companies not in the system. Agencies get assistance from businesses and industry experts on how to find companies not in the system. Agencies establish policies favoring self-reporting. Facilities in compliance over extended period of time may shift to self-audit and third party certification system.

General Comments: Actual universe of fly-by-nighters, those not in system, still unknown. Some survey techniques may have to be developed. Some businesses have stated it should be easy to find outliers, and will supply agency with advice, but unwilling to tell on specific companies.

DEP has received a demonstration grant from EPA to implement a new strategy for compliance and enforcement that will decrease the current focus on already highly regulated entities. Common Sense Initiative projects of DEP and EPA also have similar intent.

DISCUSSION OF ISSUE #9:

- Active discovery program; examine SARA data
- Better targeting mechanism
- Look at OSHA inspection mechanism

- Develop outreach/amnesty program (expand small business program)
- Workable fact sheets (in plain English)
  - distribute locally
- Look at SARA for mismanagement
- Annual inspections
  - seen as unnecessary
- Look at DEP policy to see why it takes so long to respond to a complaint
- Educate and try to help
  - also, have businesses educate agencies
- Hospital/university affiliates
  - set example of (illegible) relationship
- 507 program to other media
- Use resources such as POTWs
- Quick succinct info. on all aspects of compliance (DEP electronic guide)

Issue #10: Is the regulatory structure flexible enough to be tailored to evolving information about proportional contribution to the overall load from specific sources?

Explanation: Problem of equity and efficiency arises when new information indicates that a population that was a target of enforcement is not a substantial contributor. Enforcement targets and limits should be adjusted.

Origin and Purpose of Regulation: To take action on the basis of information we have. To act on those the agency has authority to act on.

Example of Potential Solution: Work with industry to develop information on sources and solutions, and use compliance schedules to keep on schedule (Example: MWRA/Hospital mercury working group MOU).

Comment: Common Sense Initiative of EPA and DEP has same focus.

DISCUSSION OF ISSUE #10:

- Look at cumulative effects
- Flexibility on waivers
- General rule with self-enforcement
- Work with vendors -- alternative products
- Not enough education
- Common sense approach not being applied (takes too long)
- Advocating more MOU approach
- Use discretion throughout structure
- Incoming water quality
  - look at community partnerships including water depts. with WTPs (water treatment plants?)
- Baseline and incremental increase
- Look at non regulateds to get data on loading (education with industry partners)
- Listed wastes -- with remediation waste
  - Delisting process is too formal and costly
  - "Contained in" policy not enough or varied interpretations mixture and derived from rules
  - Use characteristics instead of listing

Issue #11: Self-audit discouraged by fear information will be used against auditor.

Explanation: Self-audits without attorney supervision are not privileged. Auditors protect themselves by not committing observations and facts to writing or by not conducting an audit or a complete audit. Audits used by inspectors or in private suit discovery may be utilized in argument that auditor was "willful" violator because had knowledge of problem and failed to correct.

Why it is this way: Enforcement officials need to use whatever information they can find to show willful neglect of a safety or environmental matter.

Potential solution: Establish audit privilege but qualify it so that it will not hinder the prosecution of willful, serious or criminal violations.

Comment: Proposal currently before legislature goes too far in that it will enable violators to gain immunity from enforcement simply by notifying DEP. Solution that is crafted must produce a level playing field which will not provide this kind of an out to those who have gained an economic advantage from avoiding compliance.

DISCUSSION OF ISSUE #11:

- Third party and adverse publicity
- Be careful about what is written
  - Self-audits as form of defense
- Privilege is needed, channelling through attorney hard for small business
- Incentives
- Immunity vs. privilege (associated with lawyers)
- Third party verification
- Advantages
  - Networking
  - Benchmarking
  - Resources
  - Compliance is rewarded
- Issue is timely correction
  - Find and fix debate
- Audit Service Bureau (MN)
  - Mitigated if corrected

Issue #12: Under Clean Air Act, certain air sources may not be able to qualify for exemptions because of past activities. (Known as "once in, always in", or "once major, always major").

Why it is this way: Because a company that once broke major thresholds may do so again. It is necessary to continue to regulate strictly so that the company stays below thresholds.

Problem: Missed opportunity to encourage pollution prevention by reducing regulatory requirements to reward further reductions.

Comment: EPA's Office of Air Quality Planning and Standards currently reviewing policy. DEP currently reviewing this policy.

DISCUSSION OF ISSUE #12:

- RACT -- Keeps you in the system
- 70-page form in '93 (restricted emissions status)
  - DEP again in '94
- Who is DEP contact?

Issue #13: Toxics Use Reduction Act applies to processors of materials for which there are no reasonable substitutes, or materials which are not toxic in ordinary use. (Example: fabricators of stainless steel, repackagers, preparers of standard photographic formulations).

Comments: Delisting through TURA's Science Advisory Board and Administrative Council may be way to address this.

DISCUSSION OF ISSUE #13:

- Attempt to withdraw it is a barrier to amending it
- Increasing communication (expanding mailing list)
- Information not disseminated widely enough
- Delisting too slow (cumbersome process)
- Need to sort out issues
- Identify stakeholders
- Form R for TURA chemicals (even though Fed. does not require it)
- Create one form

- "Money-back" guarantee system

- NaOH issue back under TURA
  - Look at Fed. experience

- Fees double cost of process
  - Look at fees and adjust to process

Issue #14: Discharge limits set at or near detection limits cause too many false positives, resulting in unfair charges of noncompliance.

Comment: Ways exist to deal with false positives that do not involve raising limits.

DISCUSSION OF ISSUE #15:

- Charges based on concentration

- Threshold below which there would be no charge

- How sensitive is sample vs. MDL

- Limits set unnecessarily low (Hg, Cr)
  - (sludge concentration)

- Product is compared to 51 limits

- Toxicity limits

- Limits realistic -- more communication

- Cost-benefit analysis

- Develop relationship with POTWs

- False positives
  - Look at compliance history
  - Tiered approach?

- Mass vs. concentration approach
  - Material gets into water body

- Setting limits
  - POTW unwilling to let industries negotiate limits with EPA
  - Public hearings involved
  - Works with checks and balances (e.g. Cu)

Issue #15: How may the regulatory system assess comparative risks, costs, and benefits?

Potential Solution: Adopt process to quantify risks, costs, and benefits.

Comments: Difficulties in assessing unknowns, complexity of the issues, and inability of environmental receptors and future generations to be adequately represented can create inequities and inefficiencies. Cumbersome system for assessing these factors may become a barrier to getting anything done. Process for assessing these factors must be efficient and fair to all parties, including those without a voice.

DISCUSSION OF ISSUE #15:

- Set environmental priorities
- During agency promulgation, open up discussion (upfront consideration in an efficient manner of costs, and if a prima facie case can be made of undue costs relative to benefits, reconsideration allowed)
  - more negotiation
- Mutual approach -- get stakeholders together
- Burden of proof on government
- Prior to (at beginning of) process, get all groups involved together (including citizens' groups)
- Make decisions based on common ground
- Create partnerships
- Prevention-based
- Provision in regulations
- Remove focus on minutiae and reward successes

Issue #16: Encompassing hazardous waste definition inhibits waste exchange, some recycling and reuse.

Comment: Hazardous Waste Advisory Committee recommendations addressed this issue.

Issue #17: Backflow prevention devices required where not needed.

Example: Fire sprinkler systems on buildings.

Origin or Purpose of Requirement: Necessary in industrial or other settings where pollutants could enter piping system and infiltrate drinking water.

Comments: Argument that it is needed is not based on any study that sprinkler systems are potential pollution sources, but based on extension through language of regulation. Sprinkler systems are engineered so that backflows do not occur.

Potential Solution: Immediately investigate whether requirement is necessary. Use plumbing codes and eliminate redundant environmental requirements for fire sprinkler systems.

Comment on larger context: Use as example for care in writing requirements.

Issue #18: Storage times for hazardous waste too rigid.

Explanation: Large quantity generator reduces waste but is still in LQG category and still must ship every 90 days. Per unit cost of shipping waste has now gone up although company has reduced waste. Impediment to waste reduction.

Comment: See HWAC recommendations.

Issue #19: Concentration-based discharge limits inhibit water conservation.

Potential solution: Use mass-based limits.

Potential problem with potential solution: Difficult to do.

Issue #20: Encourage alternatives to enforcement actions. Use inspections for education, not just punishment.

GENERAL COMMENTS IN THE SESSION ON REQUIRED ACTIVITIES/ENFORCEMENT

- Enforcement and interpretation of gray areas; look at big picture
- Look at system -- why are "micro" types of issues looked at

- Positive measures of success (offer suggestions for corrections)
- Gov't agency reps. work in industry
- Differentiate between minor and major non-compliers
  - Definition of "significant noncompliance" is broad
- What about a list of great compliers?
- Look at measures of success (is bean counting behind focus on micro level)
- Joint goal setting
- Rank priorities -- Big Picture

Session on:

General/Practical Issues

GENERAL AND PRACTICAL BRAINSTORM

- Eliminate unnecessary regulations
- Cost benefit
- Examine how regulations are made
- Risk assessment methods need to be looked at again
- Continuing Education - too many hours
- TSDF status regulated for activities that should be encouraged
- Improving existing regulations
- Small business - impact of pollutants vs. cost of compliance
- Better science into decision-making
- Duplicative requirements caused by not looking broadly when writing regulations and enforcing them. There is a need to look for duplication across programs
- Statewide storage of all radioactive waste
- Market based approach (ie. CAA trading) should be used in other areas
    - Agency and adjudicatory process is complex and costly
- Future discussion - EPA/MWRA, Regulated pollutants and their sources

I. ELIMINATE UNNECESSARY REGULATIONS **multivote result: 18**

COST/BENEFIT
RULEMAKING
RISK ASSESSMENT
BETTER SCIENCE
IMPROVE EXISTING REGs

PRESENT REALITY

- Big Cost
- Common sense has been ignored
- Common sense and cost benefit are in direct conflict (because you can not place dollar value on human life)
- Need to understand intent behind the law
- No documented harm (backflow prevention device on fire sprinklers - see example on last page)

- Current regulations eliminate possibility of innovative tech. (ie. definition of hazardous waste)
- Regulators have no rewards for exercising judgement but are held accountable for not following reg. to the letter.
- Regulating agency measured by # of enforcements
    - who's measuring success?
    - how to measure success?
    - why not learn from duplicate studies (other states)?

POTENTIAL FIXES

- Quality assurance for regulation writing/review
- Govt should have to comply before anyone else
- More research - Cost benefit/risk analysis
- Better understanding of business by Government
- Open Government rulemaking process
    - must be good faith
    - equal representation
- Industry must commit to being more involved in rulemaking process
- Some discretion for inspectors
- Review basic intent regulations
- Max use of focus groups/industry. input prior to draft regulation / early warning

II. AGENCIES NEED TO KNOW MORE ABOUT HOW A MANUFACTURING/BUSINESS WORKS

multivote result: 17

PRESENT REALITY

- Fear prevents sharing info.
- Agencies know very little now about industrial processes
- Inspectors are mostly asking basic process questions during inspection
- There is a flow of personnel from government to industry but not the other way
- No specialists in agencies (industry specific specialties)
- Lots of innovative technologies not being shared
- Some government people think they are specialists; write reports that show they aren't
- Industry needs to tell government what the problems are

POTENTIAL FIXES

- Agencies hire more people with industry experience
- Need industry specialists in agencies

- Form for industry to communicate problems to government
- Move away from adversarial work/toward common goals

III. COORDINATED INFO SERVICE IS LACKING

multivote result: 11

PRESENT REALITY

- There is no single source of information
- Calling in is difficult - different information given by different people - who to call for spill? (2 or 3 different hotlines)
- Dread of voice mail system
- Agency budget cuts - people are cut - makes it (giving information) harder to be responsive. (Agency) Information giving is one area that needs work
- Information to general public is lacking - public doesn't know EPCRA information is available (especially people new to environmental work)
- There is not enough information for making informed judgements - what information is there is very hard to find
- Big environmental push seems to have passed - public now less interested than during 1990 Earth Day

POTENTIAL FIXES

- Need general information person as first contact in agency to guide to right person (a generalist who is articulate and helpful)
- Industry has to get out, visit agencies, ask specific questions in person, not much luck over phone.
- Re-inspire public about this new phase of environmental protection (cooperation and pollution prevention)
- Go to a program like TURA first, industry can get some advise/help from their public servants
- Getting information on-line (electronic)

IV. SMALL BUSINESS SOURCES, NON-POINT & RESIDENTIAL

multivote result: 12

EXAMPLE

- MWRA - Solvent limits on business less than household sources

PRESENT REALITY

- Impact of pollutants vs. cost of compliance for small business
- Always going back to point sources. Other sources may be more load
- Some limits to MWRA less than drinking water standards
- Household doesn't see themselves as polluters

- Example: MWRA fines for pH, oil and grease (2 quarts over two years) even though state knew they were working on a problem (with concentration based limits)
- Punishment does not fit the crime
- Disproportionate emphasis on point sources
- We educate the public but beat industry over the head to get compliance
- Government is there to punish, not help (has OSHA helped anyone?)

POTENTIAL FIXES

- Example: auto emissions, commercial products industry is not helping to identify and educate about these non-point sources
- More work on educating non-point sources
- MWRA/EPA need to communicate how point sources are targeted
- Educate public - what is wrong - statewide system for household hazardous waste, oil, etc.
- Get everybody - do a better job with existing programs
- Need appeals court/board (what about cost? No lawyers)

V. GLOBAL IMPLICATIONS: HOW DO WE ADDRESS MAJOR COMMUNITY/LOCAL ENVIRONMENTAL PROBLEMS?

multivote result: 6

PRESENT REALITY

- Bacteria change material into metabolites that are available to bugs - some mimic estrogen this causes our trouble
- More work needs to be done to understand this
- Get people to understand what global problems are - consensus
- People need to feel some connection to global problems
- Need to bring broad problems to local level so people can realize their effects on them - and their abilities to help

POTENTIAL FIXES

- Educate the public
- Shoot the "doomsdayers"
- Put problems into realistic explanations
- Pay careful attention to what is happening - recognize that it is different from the past
- Find ways to stop bugs from converting materials to something that mimics estrogen (Research)

VI. FEAR OF CONTACTING REGULATORY AGENCIES FOR INFO

multivote result: 3

PRESENT REALITY

- Can be anonymous - so not always a problem to contact
- Some still not trusting of contacting agencies - need to test system
- Experience of calling agency only to be questioned about compliance status - causes fear
- Conflicting information - especially hard for new businesses

POTENTIAL FIXES

- Training of agency staff
- Improve customer service
- Open up lines of communication
- New England Environmental Assistance Team - EPA - patterned after OTA (see handouts)

VII. MA ONLY

EXAMPLE

- Fire sprinkler - back flow - Boston $22 million cost: $1000/inch

CLEAN WATER

- We all care about clean water
- Commercial property managers
- Back-flow prevention devices
- Reg - DEP - Clean Water Act: Have to look here for intent of regulatory language
- Worked on Advisory committee and got some revisions
- But fire sprinklers
  - already have plate in their product design. This was adequate. There has not been **one** case of contamination due to back flow through fire sprinklers.
  - look back to CWA language "No Risk." This guided decision to include fire sprinklers.

EXAMPLES

WWT permit based on potential risk now

Preidentified issues for General/Practical Session:

Issue #21: Agencies need to know more about how manufacturing works. Businesses are willing to help but cannot obtain assurance from agency that if they come out to facility on educational visit, will not enforce against technical violation.

Who's affected and how. Businesses that want to help agency to shape its rules and practices to optimally reflect business and industrial realities. Agencies that want to receive this help are prevented from receiving it.

Purpose of requirement. Agencies have to address pollution in a consistent manner.

Potential Fix to system. Establish policy that visits for educational purposes will be exception to the rule. Visiting inspectors may suspend enforcement role. Substantial violations or threats to safety, health and environment will still be covered.

Alternative Approaches. Make visits to facilities in another state, exchange program with inspectors from that state.

General Comments. Agency personnel have attempted to arrange these visits and have failed to obtain permission to give assurances sufficient for company hosts. Need to clarify what is sufficient assurance and if it may be obtainable.

Issue #22: Market based approach, e.g., allowance trading under Clean Air Act, should be applied to other areas.

Issue #23: Central or coordinated information service lacking.

Example: Divergent answers to requests on EPCRA compliance information received from EPCRA hotlines, local LEPC and others. Information seeker puzzled about who to contact and what actions to take in event of a spill.

Potential Solution: Develop internal agency coordinating office for resolving conflicts. Compile commonly asked questions. Empower office to resolve conflicts within agency. Designate office as representative of agency in seeking to resolve conflicts with other authorities.

Comment: DEP has established INFO Line and Regional Service Centers. Office of Business Development also performs customer service for regulatory assistance. Boston Bar Association permit streamlining committee recommends central office to address these problems.

Issue #24: Fear of contacting regulatory agency for information.

Example: Response to call to EPA for compliance information consisted of close questioning pertaining to compliance status of the caller.

Issue #25: Define the method of biotransfer of metabolized pollutants into the environment.

Explanation: Metabolic form of many pollutants mimic estrogen.

Issue #26: Agency adjudicatory process using all the elements of a legal trial and an administrative law judge costly to appellants of agency orders.

Potential solution: Provide a means of alternative dispute resolution. Allow consideration of economic impact of agency orders.

Comment: Need to do this without establishing ability to endrun or delay enforcement actions. Need to maintain incentives to encourage compliance and negotiation with regulatory authorities.

Issue #27: How do we address major long-range or global environmental problems? (Examples: erosion, population growth, climate change, loss of habitat, loss of cropland, depletion of fishing stocks).

Potential Solution: Create sense that environmental regulatory system can work well, so that it can do more, and a working consensus on the balances to be struck.

Issue #28: How to address contribution from small sources, nonpoint sources, and residential sources?

Explanation: In many areas industrial or point sources are now overshadowed by small sources. Authority in law does not cover such sources.

Comment: Solution must be politically acceptable. (Public will resist major inconveniences).

Example of Solution: Systems for convenient disposal of household hazardous waste. Watershed-based approach currently being pioneered by EOEA/DEP and similar place-based approach considered by EPA may afford opportunities to effectively address small sources.

Session on:

Recordkeeping/Reporting

Issue #29: Reporting requirements complex and onerous.

Who's Affected and How: Companies reporting under CWA, EPRCA, RCRA, TURA, CAA, TSCA, to fire marshall, localities, etc. would like easy guide to requirements, opportunity to consolidate when several reports are required because of one activity.

Potential Solution: Computerize all reporting requirements. Make electronic submission feasible. Review purpose of each requirement and identify use of information. Make information accessible. Eliminate requirements that have no identifiable utility. Provide inspection checklists to regulated community.

Comment: Regulatory or legislative changes may be necessary to allow elimination of some reporting requirements. EPA developing X12 protocol for electronic reporting. TURA Administrative Council and DEP looking at reporting streamlining. Toxics Use Reduction Institute focus group on this issue. DEP seeking EPA funding for pilot study to develop a consolidated reporting form that would encompass all federal and state reporting requirements. See recommendations of Legal Committee asked by EOEA to address this issue.

DISCUSSION OF ISSUE #29:

- Who is affected - regulated and regulators, public stakeholders, NGOs
- Purpose of requirements?

PROBLEMS:

- Why apply them to everyone? e.g. non toxics use, broad chemistry categories including metals, metals in alloys must be reported

- Why duplicate Form R on Form S
  - different chemical lists (delisted by Feds why not automatically delisted by state?

- Why so many different chemical lists? Consolidate into one.

- Why do all forms come out so late?

- Why do changes in forms require changes in regs?

- Inconsistencies in reporting periods between media

- Too much time cuts down on P2 efforts

- Electronic reporting to date has glitches

- Need manifest for every state you ship waste to

- Generators writing landbans for TSDFs is useless
    - duplicates waste profile
    - different retention times

- Why can't you write on the back of Form Rs -- waste of paper

- Numerous overlapping training requirements

- Speed up responses to petitions to delist; exempt certain industries, users

- Consolidate into one report/electronic
    - Report all sampling done in a year on one annual report (except for non-compliance instances)

- When writing regs, makes them easy to understand, flexible enough for reportng methods

- Every report have a space for time it required

- Repeal (MA) RTK since it is not funded or used

- Analyze/review the reports/data usefulness

- Use ISO approach of management and practices

- Self certification system

- Do away with reporting -- have companies keep own records and let agencies come there to see them

- Consolidate training requirements

- Uniform national manifest with check off for landban

Issue #30: Inform regulated community of changes in requirements.

Explanation: Current system of publishing in Mass or Federal register inadequate to inform regulated population. Environmental managers have insufficient time to read all that is required.

Potential Solution: Send out letter to all reporting entities concerning changes.

Comment: High cost of many mailings: must find funding.

DISCUSSION OF ISSUE #30:

PROBLEMS:

- Changes to phone #s
- Adding chemicals to lists
- Definitions in regs (e.g. USTs report had ASTs added)
- Fire marshall -- changes overspill

POTENTIAL SOLUTIONS:

- "What's New" section in all correspondence for the next year
- Give more time between notification and when it goes into effect
- Agency outreach to those newly affected
- Use other resources -- trade associations
- E-mail and fax back systems
- Industry specific list of all regs/reporting requirements with time lines

Issue #31: Permittees seek assurance of accuracy of agency testing.

Potential solution: allow inspectee to take split effluent sample so that they can obtain an independent analysis.

Comment: some inspectors will allow this, some won't.

DISCUSSION OF ISSUE #31:

PROBLEMS:

- Who does this effect?
  - effluent -- maybe only MWRA who won't allow this
- Limits near detection limits
- POTWs apply/interpret regs differently

POTENTIAL SOLUTIONS:

- Limits must be realistic, based on risk assessment and analytical capability
- Address issue with MWRA

Issue #32: Air registration sources have to file annually even if there are no changes in their processes or emissions.

Who's Affected and Why: Paperwork for reporters increased, time spent with no value added.

Why it is this way: To ensure that agencies have information on use of materials causing emissions.

Potential solution: Simplify the reporting, establish "No change" notifications. Copy last year's submission and change date at the top. (If it really is the same).

Comment: DEP developing policy on this issue. Decreases in emissions will result in decrease in compliance fee. Annual reporting is opportunity to reduce fees if you have reduced emissions.

DISCUSSION OF ISSUE #32:

PROBLEMS:

- Who is effected -- major sources

- Comapnies that drop below major level must still file annually

- Why? Different states apply fed. requirements differently to calculate compliance fees

POTENTIAL SOLUTIONS:

- Why report at all?

- Why differences between states? (e.g. NH)

- Why not use consolidated report we developed in #29 since so much of this data is also on Forms R and S

- Why not just every three years?

- Revision to Mass. SIP?

Issue #33: Spill and release notifications, and emergency plans, are duplicative.

Explanation: Spills may have to be reported to DEP RCRA, DEP 21 E, LEPC, SERC, National Response Center, EPA. Emergency plans required by CWA, RCRA, EPCRA may be redundant.

Who's Affected and How: Those making notifications may be penalized for failing to notify one of the required recipients.

Potential Solution: Establish well-publicized 800 number which can mobilize all necessary response actions and disseminate information to agencies as needed. Clarify that existing regulations allow consolidation of plans, if so. If not, change requirements to spell out how consolidated plans may be acceptable.

DISCUSSION OF ISSUE #33:

PROBLEMS:

- Who's affected?

- Who's notified? Fire dept., State EPC, LEPC, DEP, POTW, NRC, town Cons. Comm. -- too many people

- Fire prevention involved different agency

POTENTIAL SOLUTIONS:

- Consolidate notification to one agency, maybe DEP, to notify all others

- Consolidate chemical lists

- Have one contact person to help you with all spillplans similar to permitting

SUMMARY OF ISSUES:

- What is relevant to report?

- Who needs the information?

- How can it be usefully reported?

- How do we determine if the environment is healthy?
    - emphasize env. health and monitoring vs. reporting

- Recordkeeping and reporting is defensive; how do we take on offensive approach to doing P2, improving the environment?

- Once a firm has established credibility and demonstrated its recordkeeping capabilites, no periodic state reporting should be required

- ISO, NRC, UL -- Reward good performance; have a system to do it

GENERAL COMMENTS FROM THE SESSION ON RECORDKEEPING/REPORTING

Major Issues

- Takes too much time, especially for small companies (Issue #29);
  - takes half the year
  - no deminimis means you spend a lot of time on small quantities; where is the benefit?

- Consolidate reporting into the "Mother of All Reports" -- one report

- What are they doing with all this data? (Issues #29, #32) -- DEP is proposing moratorium

- Report calculations for applications (Source Reg.) when you've just done

- Electronic reporting
  - expand where you can do it
  - problems: computer/printer supported glitches

- Uniform national manifest

- Landbans are repetitive (to have generators fill them for TSDFs)

- Bring in OSHA on mutual issues (DOT is also involved)

Facilitators of RIO breakout sessions received the following guidance.

KEEP IT CONSTRUCTIVE! GET TO SPECIFICS! ASK FOR EXAMPLES, ILLUSTRATIONS!

Facilitators must let the breakout sessions go where the group wants to take them, but try to use the established formats. Prelisted issues do NOT have to be used. The group can make up its own.

About the scribes: Members of the audience who feel the scribes have not captured their comments correctly should be encouraged to meet with the scribes afterwards to clarify.

Facilitators should emphasize that we will not address all existing problems or cover all aspects of the problems or potential solutions. This is just the beginning of a business/government dialogue. They should write their comments down and submit them to NBEN, either using the form provided or at any other time. They should be encouraged to join a working group. They may be reminded that the agencies have other avenues for receiving comments - advisory committees and comment periods.

Questions to keep in mind during discussions. DON'T HOLD UP THE DISCUSSION TO ANSWER ALL OF THESE.

Is it clear or precise enough?

Does it involve legislation, regulation, policy, interpretation, practice?

Have we correctly identified the authorities and stakeholders?

Can we eliminate an unintended or unnecessary adverse economic effect?

Can we eliminate a barrier to pollution prevention, recycling, innovative technology, or other environmentally beneficial activity?

Are there obvious next steps? Quick fixes?

What are the pros and cons of the proposed solutions?

Is there consensus on any issue or aspect of an issue?

Do we need more information on something?

How Companies in the Merrimack Valley Built a P2 Self-Help Network

Richard Reibstein, Cynthia Barakatt, and George Frantz

The recent growth of nonregulatory technical assistance programs has created a window of opportunity to expand government-industry cooperation. Simultaneously, businesses are supporting each other to improve environmental performance. Recognizing these trends, the Massachusetts Office of Technical Assistance invited twenty manufacturers based in the Merrimack Valley region to form an environmental self-help network for business. The Merrimack Business Environmental Network, started as an experiment two years ago, has evolved into a successful model of government, industry, and community partnership.

THE MASSACHUSETTS OFFICE of Technical Assistance for Toxics Use Reduction (OTA), like government agencies in many states that provide nonregulatory technical assistance, has had to work hard to gain the trust of the business community.

When hazardous waste source reduction specialists from OTA first offered free on-site consultations in 1986, there were few takers from industry. The passage of the state's Toxics Use Reduction Act in 1989, which includes a strong guarantee of confidentiality to anyone working with OTA, helped ease business fears that OTA staff were really regulators in disguise. Still, even with more than one hundred public events, many conferences, and repeated endorsements by business and political leaders, many companies are not sure that government can simultaneously enforce laws and offer useful advice.

Today, the number of businesses working with government agencies to avoid pollution is growing. By the end of 1993, the Massachusetts OTA had provided assistance to more than 400 businesses and industries across the state. OTA has also been a catalyst to help improve the relationships that businesses have with each other. In fact, a key factor driving the growth of nonregulatory technical assistance in the state has been the willingness of companies to share their pollution prevention (P2) strategies with peers.

Seeing the opportunity to further expand its technical assistance efforts by tapping positive trends in business-to-business and government-to-business cooperation, the OTA decided to try an experiment. Typically, nonregulatory assistance is defined as government helping business, but in this instance OTA proposed the creation of a nonpartisan regional business networking organization in which companies, rather than OTA, could take the lead in disseminating technical and management support.

The group would be supported through a federal Environmental Protection Agency (EPA) grant awarded to OTA for innovative pollution prevention strategies in the Merrimack River watershed region in northeastern Massachusetts and southeastern New Hampshire. The organization's primary purpose would be to serve as a self-help resource for business, but members from the government assistance

***Richard Reibstein** is assistant director, **Cynthia Barakatt** is Merrimack project coordinator, and **George Frantz** is a senior project manager for the Massachusetts Office of Technical Assistance for Toxics Use Reduction.*

programs and the environmental community would also be included.

In the fall of 1992, OTA asked twenty manufacturers based in the Merrimack Valley region to join them in forming the Merrimack Business Environmental Network (MBEN). The New Hampshire Department of Environmental Services' pollution prevention section and the Merrimack River Watershed Council (an interstate nonprofit environmental group) were also invited to become members.

Nearly two years after the first meeting, MBEN has proved to be a resounding success. It has attracted over seventy businesses of all sizes and from many industries. Small metal-finishing companies, international high-technology manufacturers with facilities in the Merrimack Valley (AT&T, Hewlett-Packard, and Tri-Star), a chain of dry cleaning stores, and a wood stain manufacturer are among the network's members. Moreover, an ongoing dialogue outside of workshops and site visits has developed between businesspeople and OTA's technical assistance specialists. And although MBEN maintains a strict pledge to refrain from any political activities, it has become a recognized source of business views on local and regional environmental issues and projects.

How MBEN Works

By consensus, the group first developed the following mission statement:

> The Merrimack Business Environmental Network is a coalition of businesses, agencies and associations which is committed to a shared concern for the Merrimack Valley, its rivers, and the Valley's quality of life. This Association has made a long-term commitment to seek and implement solutions to promote pollution prevention through improved management and technology, while enhancing the economic viability of the business community.

...the MBEN agenda has quickly broadened to address industry's impact on all media and, importantly, economic concerns.

Initially, members focused on how they could better coordinate their efforts to clean up and prevent industrial contamination of the Merrimack Valley's river resources. But the MBEN agenda has quickly broadened to address industry's impact on all media and, importantly, economic concerns.

Corporate members rotate the responsibility of hosting monthly meetings at their facilities. At these meetings, and additional MBEN-sponsored workshops and seminars, business members exchange ideas on compliance management, ways to achieve competitive advantage by getting ahead of the regulations, technical successes with pollution prevention, and other information that will help them deal with day-to-day business challenges.

For example, several MBEN companies were alerted to chlorofluorocarbon (CFC) labeling requirements when Ed Surette, environmental engineering manager at M/A Com Inc., a microwave manufacturing firm in Lowell, brought it to their attention at a meeting. Because of Surette's presentation, many members were well-pre-

pared weeks later when they began receiving letters from clients wanting to know if they used ozone-depleting chemicals in their manufacturing processes. Surette's presentation also motivated many members to begin work on finding alternatives to CFC refrigerants, scheduled to be phased out starting in 1995.

MBEN members also received a preview of the state's training in toxics use reduction planning and were, thus, able to begin the process ahead of schedule.

At another monthly meeting, James Klecak, manufacturing manager at Americraft Carton, Inc., discussed his firm's use of a prototype P2 system that reduces volatile organic compound (VOC) emissions through reduced use of isopropyl alcohol in the printing process. By using an alcohol substitute, Americraft Carton lowered its emissions by several tons and saved thousands of dollars.

The group's first conference was held at a state park on the banks of the Merrimack River. The conference attracted nearly one hundred representatives from regional businesses who came to hear their peers' views on the latest in proven P2 strategies and technologies. Lee Wilmot, environmental manager at Hadco Corp., a New Hampshire-based firm that manufactures printed circuit boards, gave a presentation about a locally-developed (Beverly, Massachusetts) patented process that his firm uses to recover from 60 to 85 percent pure copper from wastewater streams. The system saves copper by recycling it and eliminates the generation of hazardous sludge from this process.

In addition to attending presentations, conference participants had the option of taking an evening boat ride on the river, a ride specifically intended to remind them of the primary resource that MBEN is interested in protecting.

Why a Business Network?

OTA identified two compelling reasons to start MBEN.

Business trusts business

One was the fact that, even though OTA was having some success convincing businesses to listen to its recommendations concerning pollution prevention, it was clear that companies trusted each other more than a government office. At every OTA conference or workshop, industry attendees seemed most responsive to presentations given by local companies. If an OTA representative suggested a way to reduce acid waste by switching from acid dipping to mechanical cleaning of a metal surface, the idea might or might not be well-received. On the other hand, when an employee of a company stood up and said, "This works and this is how we did it," the audience was much more receptive. Lee Dane, who provided source reduction consulting for the state, called this the "Joe down the block syndrome." It has been noticed time and time again.

...industry attendees seemed most responsive to presentations given by local companies.

To make the most of this "syndrome," OTA staff members have

made a point of contributing to the organization as facilitators, rather than leaders, of the group's activities. Staff members from OTA organize and moderate the meetings, but it is MBEN members who determine the agenda and make organizational decisions by consensus.

Different from trade groups

The second factor was the absence of a business organization in the area that was specifically created to bring together companies from many industries with a mutual commitment to environmental excellence and with no other purpose than to share their strategies.

There is an Environmental Business Council in the region that promotes companies that make environmental products or provide environmental services. By contrast, MBEN discourages members from using its events to establish sales contacts. In fact, MBEN does not allow vendors or consultants selling products or services to attend meetings, except by invitation.

Although trade associations also typically serve companies in a specific industry sector, the MBEN membership includes a full spectrum of large and small manufacturers and service businesses.

In this way, MBEN can stick to its mission and its role as a resource for any kind of company that is faced with environmental requirements or has environmental consequences arising from its activities.

...MBEN differs from trade organizations, because it does not engage in lobbying or other political activities.

Most significantly, MBEN differs from trade organizations, because it does not engage in lobbying or other political activities. Although individual members may offer testimony or comment on proposed regulations or legislation, the group as a whole can not.

Strict adherence to political neutrality has been particularly critical to sustain the organization's emphasis on providing a nonpartisan forum in which businesses can informally discuss issues of environmental concern with other firms, government officials, and environmental groups. OTA has made it clear that, if MBEN ever crossed the line to influence the legislature or the public on a vote or policy decision, OTA would be forced to withdraw as a member.

Measures of Success

Getting companies to attend and host monthly meetings and support MBEN's other activities is not easy. The spark that keeps industry's attention in many cases is the kind of information MBEN delivers.

Spotlight on industry

Because of contacts made through MBEN, business members routinely call each other to ask about P2 techniques or check on the reputation of vendors or products. They seem to particularly relish the opportunity to show off what they have done—not only to prevent pollution from manufacturing processes, but also to show the im-

provements in process efficiency. Indeed, putting the spotlight on what other companies are doing has proved to be exactly what corporate members are looking for.

James Klecak of Americraft Carton recalls that, since his presentation on alcohol substitutes to reduce VOCs in his firm's printing process, a number of printers have visited Americraft's plant to see how it works. "We feel we've played a role in helping other printers in the area get involved in pollution prevention," says Klecak.

Performance yardstick

MBEN members have also noted that, by belonging to an alliance of environmentally progressive companies, they can use fellow members as yardsticks against which to measure themselves.

"When you get involved with a group of people who share a lot of the same beliefs, it is easier to evaluate yourself," says Charles Anton, vice president of Anton's Cleaners, a forty-store chain of dry cleaners. "I think I am environmentally responsible, but until I share my ideas and rub elbows with people who feel the same way, I won't know the level I'm really at."

Informal bridge to regulators

OTA has reason to be pleased not only with the number of businesses reached through this program, but also the improved relations between business and government. Companies and the state's twenty technical assistant specialists now routinely exchange phone calls. In addition, OTA P2 specialists have become an informal conduit of information between businesses and the state's regulators, while respecting the TURA provision of business confidentiality.

New Hampshire has also seen benefits from the establishment of MBEN. "It is definitely helping to break down the barriers," says Chris Simmers of the New Hampshire Department of Environmental Services commissioners office. "I believe that MBEN has led to companies feeling more comfortable about contacting us with questions."

This informal, non-threatening link between regulators and the regulated community is... a major attraction of MBEN.

This informal, non-threatening link between regulators and the regulated community is, for many businesses, a major attraction of MBEN. Mark Chrisos, environmental manager for Raytheon's Missile Systems Division in Bedford, said that his previous contact with government officials was only through regulatory inspections. "It is great to be able to exchange information about regulatory issues in a relaxed, casual atmosphere," says Chrisos.

Business links to environmental community

The membership of the Merrimack River Watershed Council has also proved to be beneficial to businesses and the Council. The Watershed Council has co-sponsored several technical workshops with MBEN. At these events and regular meetings, companies are reminded of environmentalists' concerns in protecting the river, and

the Watershed Council gets to meet businesspeople with a strong interest in seeing industrial pollution prevention efforts succeed in the Merrimack River Valley.

A known source for business views

MBEN is becoming known throughout the region and the state. The Massachusetts Executive Office of Environmental Affairs turned to the network when it was looking for business participation in a statewide watershed management conference last fall. And MBEN recently agreed to accept two seats on the management committee of the Merrimack River Initiative (MRI), a two-state, regional comprehensive watershed protection and planning effort led by EPA's Region I office. This was after several unsuccessful tries by MRI to solicit business input on the Initiative.

In addition, MBEN has caught the attention of environmental groups and others interested in working with business on pollution prevention issues. One Salem-based group interested in watershed protection and management has attended MBEN meetings and met with OTA to seek advice on how to set up a similar organization.

The Network's Future

Once the federal EPA grant ends in the fall of 1994, OTA staff support will be curtailed. As a result, MBEN is in the process of becoming an incorporated nonprofit organization to continue its work as a nonpartisan networking organization. The group is expected to derive much of its operating income from membership dues and fees for workshops and seminars. In addition, MBEN plans to solicit grant funding for special projects and is looking into the possibility of finding a "partner" to share office space as well as administrative and overhead costs. The group plans to hire a full-time staff person to coordinate meetings, workshops, and conferences.

It remains to be seen how MBEN will fare after it incorporates. There is no doubt, however, that what began as an experiment has evolved into a working model for building a network of government agencies, businesses, and environmentalists dedicated to protecting the environment. ◆

M B E N

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Gillette

AMERICRAFT CARTON, INC.

HADCO

MACOM

Raytheon

Ideal Tape Co.

ACT

NHDES

MERRIMACK RIVER WATERSHED COUNCIL

Merrimack River Initiative

AT&T

Merrimack Valley Pollution Prevention Project

Dear Merrimack Valley Company:

August 25, 1993

MBEN... Who We Are

We are members of the Merrimack Business Environmental Network (MBEN), and we invite you to join with us. Our group is not for profit. It is composed of Merrimack Region businesses, coming together to help each other understand how best to deal with environmental regulations, and improve our environmental performance. The network is not a money-making organization. The members share their experience, their successes, their problems, and make use of available expertise.

The group has a relationship with government technical assistance agencies, and has access to regulatory officials through these assistance offices. This gives us up-to-date information on environmental developments and also a chance to make our views known to those making the rules. The group is dedicated to both maintaining and promoting the viability of businesses in our region, and protecting the resources that make this area beautiful. Some of the members have saved money by taking action to prevent pollution, rather than treating it after its creation, and are willing to share this experience with others.

MBEN Mission Statement

The Merrimack Business Environmental Network (MBEN) is a coalition of businesses, agencies and associations committed to a shared concern for the Merrimack Valley, its rivers, and the Valley's quality of life. This Association has made a long-term commitment to seek and implement solutions to promote pollution prevention through improved management and technology, while enhancing the economic viability of the business community.

Enclosures:

1. MBEN Environmental Survey
2. Survey return envelope (c/o John Gihlstorf, Chairman)
3. MBEN Membership (or additional information) application
4. MValley Business Environmental Conference flyer
5. Conference Registration form (please copy for additional registrations)

About the MBEN Survey

Enclosed is a survey that we have devised to give us a sense of the needs of Merrimack region businesses, so that we can target our events to serve those needs. As you can see, **the survey is designed to be confidential** if you so desire. We ask for a small amount of generic information up front, so that we can know what kind of company you are, and then if you want to join the group or register for our first conference (see announcement), you can fill out the name and address information on the separate sheet and send it in.

Please do not take an inordinate amount of time filling out this survey, just do your best. We have provided an envelope, with postage paid, so that sending it back is as easy as possible.

A word of clarification is necessary to dispel any fears that this survey is a sneaky effort by the government to get you into trouble. It is true that the Merrimack Business Environmental Network was originally formed by the Massachusetts Office of Technical Assistance for Toxics Use Reduction, and the New Hampshire Department of Environmental Services Pollution Prevention Program, working together under a grant from the EPA.

Anyone who knows these offices, however, knows that they are not enforcement agencies - they are specifically dedicated to helping businesses, and keep their information confidential. From the beginning, the idea of the group has been that these government agencies do not own or direct this work. The group belongs to the business members, and the members make decisions on a participatory basis. The technical assistance agencies are just there to help, and will continue to do so as long as the group maintains its dedication to the purpose of environmental improvement.

Therefore, your name and the information in this survey will not be used for enforcement or compliance purposes.

However, we will want to announce the summary of survey results (without any company names) at our first conference on September 23, and publicize the results as part of our membership drive. So please a take moment to fill out the survey, and consider joining MBEN. **At this time, there is no charge for membership.**

Merrimack Business Environmental Network (MBEN) Survey

Confidentiality: **Returning the survey will not target your firm for regulatory enforcement actions!**

Any information that you provide will be kept confidential regarding association with your company's name. To ensure this promise, your name and address is requested on a separate sheet from the rest of the survey questions. You may even choose to return the two forms under separate cover.

As for the information that you provide in the survey questions, we will compile this data to create a summary "profile" of the business community in the Merrimack Valley. If you complete and return the survey, you will receive a summary of the profile results.

Please complete the generic information below. If you are interested in participating in MBEN or wish additional information, please complete the separate membership information sheet and return either under separate cover or enclose with the attached survey.

TYPE OF BUSINESS and PRINCIPAL PRODUCT (please indicate SIC code if known) _____

_____

NUMBER OF EMPLOYEES _____

CITY _____ STATE _____ ZIP _____

For completing and returning the survey, you will receive a summary of the profile results.

Thank you for taking the time and effort you took to complete the survey and support MBEN in its objective of helping business with environmental compliance and economic viability.

Please return completed forms to:

John Gihlstorf, MBEN Survey Chairman
c/o Cabot Stains, Inc.
100 Hale Street
Newburyport MA 01950

MERRIMACK BUSINESS ENVIRONMENTAL NETWORK SURVEY

Please circle or check the appropriate answer or clearly write in your answers to the questions below, being as detailed as possible. All answers apply to the facility or facilities in the Merrimack watershed area (see enclosed map and list of towns) under your control.

1. Do you need help "sorting out" environmental compliance issues?

   YES NO UNSURE

2. How many people does your company employ at this facility?

   0-10 11-50 51-100 101-250 251-500 501-1000 >1000

3. Do you have any staff dedicated to addressing environmental and health/safety (EHS) issues?

   ( ) One or more full-time ( ) One part-time ( ) NONE

4. Have you set aside money for environmental, health & safety (EHS) regulatory compliance?

		YES	NO
a.	Are you aware of your cost of compliance?	( )	( )
b.	Would you be willing to indicate the range of your cost of compliance?		
	( ) $1k-4k ( ) $5k-10k ( ) $ 11k-24k ( ) $25k-50k ( ) $50k (+)		
c.	Do you have a dedicated EHS budget?	( )	( )
d.	Does your present accounting system separate or somehow track environmental costs?	( )	( )

5. If you answered YES in question #4 above, how do you categorize the accounting of your environmental costs – as:

   ( ) a. Capital Investment
   ( ) b. Production costs
   ( ) c. Overhead
   ( ) d. Environmental cleanup costs?

6. What percentage of annual total budget does this make up?

   0-1% 1-3% 3-5% 5-10% >10%

7. Has your company made prior environmental expenditures in anticipation of upcoming regulations (e.g. removal of underground storage tanks, on-site wastewater treatment, or switching from CFCs to non-ozone depleting chemicals {non-ODCs})? YES NO

8. If yes in question 7, expenditures for what activities? _____

9. Do you have an active pollution prevention program? For example, have you reduced or eliminated the use of a toxic chemical by substituting it with a safer material, or by using the chemical more efficiently, or by redesigning a process or a product, or by other means? If so, please explain. _____

_____

10. Do you believe that pollution prevention activities can save your company money?

By reducing potential fines or required fees?	YES	NO
By reducing waste disposal costs?	YES	NO
By reducing materials costs?	YES	NO

11. Which environmental areas would you like to understand or manage better? Rate the items a-m below on a scale of 1 to 4, with:

1 = greatest importance to you 2 = important
3 = limited importance 4 = unimportant or doesn't apply

Rating Issue

____ a. New Clean Air Act
____ b. Refrigerants and CFC Labeling
____ c. Hazardous Waste Laws
____ d. Changes to Superfund Law
____ e. Toxic Chemical Use Reporting and Planning (SARA,TURA)
____ f. Volatile Organic Chemical Emissions
____ g. Clean Water Act
____ h. Stormwater Discharge Permits
____ i. NPDES permitting
____ j. Packaging Requirements
____ k. Recycling Opportunities
____ l. Health & safety issues for workers (OSHA regulations)
____ m. Other _____

12. Which environmental laws do you find especially difficult to meet compliance requirements or find to cause inefficiency in your company's activities? _____

_____

_____

13. Are you involved in a group (eg, trade association) that helps keep you informed on environmental issues?

YES NO Don't know what's available

14. Do you recycle any of the materials listed below? (circle)

water paper cardboard acids rubber solvents ink plastic

precious metal scrap metal wood scraps other _____

15. Have you ever used a waste exchange or other materials exchange program?

YES NO Don't know what it is

16. Would you find a materials and used equipment exchange listing useful (to list or obtain used items or equipment)?

YES NO

17. Please use the space below to list any material you would like to recycle, or a particular feedstock material you use that could be obtained as a waste from someone else.

_____

_____

18. Are there other factors that are preventing you from accomplishing more pollution prevention?

_____

_____

19. Are there other environmental problems that you think should be addressed? _____

_____

20. How do you currently get information about environmental matters or new products or processes that would help you avoid creating pollution? (Please check all that apply)

( ) Trade Magazines
( ) Newspapers
( ) Vendors
( ) Friends in business
( ) Trade Associations
( ) TV or Radio news programs
( ) Government agencies (MA OTA or NH DES/P2)
( ) Chamber of Commerce

21. Would you be willing to share information with other area businesses about environmental information you have gathered or steps which you have taken to avoid creating pollution?

YES NO

Business

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THE SUN, LOWELL, MASSACHUSETTS

Merrimack Valley companies pool anti-pollution knowledge

By MICHAEL O'CONNELL
Sun Staff

LOWELL — In the past couple of years, Ideal Tape Co. of Lowell has pushed forward with a pair of programs designed to reduce pollution and, in the process, save the company money.

One process involves reusing solvents, which cuts down on the amount of toxic waste it has to truck out. Another, which is in its early stages, will create a new type of water-based tape adhesive that doesn't use volatile compounds.

"A lot of us recognize the seriousness of preventing pollution before it gets to the source," said Richard M. Carbone, the 120-employee company's environmental manager. "We've done it by recycling the solvent and by reformulating (the adhesives) so no toxics get in the formulation. In the process we've seen an economic benefit."

The newly-formed Merrimack Business Environmental Network, consisting of representatives from government and business, is holding a conference Sept. 23 to urge companies such as Ideal Tape to share ideas on pollution prevention.

Actually, the network has already started to share ideas and boost membership. Organizers hope the conference, which will be held outside at the Maudslay State Park in Newbury, can hasten the process.

The Merrimack Business Environmental Network formed about a year ago when the state's of Massachusetts and New Hampshire received a $120,000 federal grant to work with businesses on reducing toxic materials. The two states focused their energies on companies in the Merrimack River's watershed area.

"We chose the Merrimack because it's a drinking water resource for people, there's a lot of potential for cleaning it up and there's an ongoing initiative (on the Merrimack by the U.S. Environmental Protection Agency)," said Rick Reibstein, assistant director of the Massachusetts Office of Technical Assistance, which helps run the network.

The network currently has 20 members from business and government. Business members include M/A-Com Inc. of Wakefield, Raytheon Co. of Lexington and Gillette Co. of Boston — each of which operate plants in the Merrimack Valley.

For more information about the conference or the group, contact the Environmental Network at 617-727-3260, extension 631. Membership to the group is free.

BUSINESS

'By holding the conference, we are spreading the word that MBEN is out there and dedicated to pollution prevention and the viability of businesses in the Valley.'

GEORGE C. FRANTZ
Merrimack watershed project manager
Mass. Office of Technical Assistance

Business gets aid clarifying environmental laws

By Davis Bushnell
SPECIAL TO THE GLOBE

As corporate environmental engineering manager for M/A-Com, Edward Surette finds that he has to wade through an ever-increasing pile of state and federal environmental regulations.

"There are so many things we're faced with that it's crazy," said Surette, who is based at the electronics firm's Lowell facility.

In an effort to gain a better understanding of environmental laws and to share information on pollution-prevention programs, M/A-Com became one of the initial members of the Merrimack Business Environmental Network, a little-known public-private partnership formed in September 1992 and funded by grants of $120,000 from the US Environmental Protection Agency.

A pilot program, the network is open to businesses and business associations in the Massachusetts and New Hampshire Merrimack River watershed. The Massachusetts Executive Office of Environmental Affairs and the New Hampshire Department of Environmental Services are providing technical assistance.

In Massachusetts, the network's outreach stretches from Amesbury and Salisbury in the north to Harvard and Boxborough in the south.

So far, though, business response to the network has been lukewarm.

Only 21 companies have joined the partnership, according to the Massachusetts Office of Technical Assistance, part of the Executive Office of Environmental Affairs. Besides M/A-Com, other member companies include Raytheon, Wang Laboratories, Gillette and AT&T. There is no membership fee.

And returns of a environmental survey mailed last month to more than 4,000 firms – three-quarters of them in Massachusetts – are only trickling in. As of early last week, only about 50 completed forms had been received by John Gihlstorf, Merrimack Business Environmental Network's survey chairman. Gihlstorf is manufacturing manager for Cabot Stains Inc., a Newburyport producer of exterior wood stains.

But company managers like Surette and Gihlstorf, along with state officials, say they are hopeful that a conference Thursday at Maudslay State Park in Newburyport will shed more light on the network's purpose and, at the same time, pump up membership.

Participants at the daylong conference will be charged $20 apiece for meals.

"By holding the conference, we are spreading the word that MBEN is out there and dedicated to pollution prevention and the viability of businesses in the [Merrimack] Valley," said George C. Frantz, Merrimack watershed project manager for the state Office of Technical Assistance.

A sampling of 25 survey forms that were returned, he said, reveals that a majority of the respondents want help in complying with environmental laws and would be willing to share information on what they have done to prevent pollution.

As followups to the conference, six workshops will be held between November and May on how to be in compliance with laws such as the Massachusetts Toxics Use Reduction Act and the federal Clean Air and Clean Water Acts, Frantz pointed out.

Clearing the air on the ramifications of environmental regulations is important, but the essential component of the network has to be information-sharing by member companies, Surette suggested.

"We can all use each other's resources for the benefit of the companies involved and the environment," he said. Already, he added, M/A-Com and Raytheon are divulging the types of "alternative chemicals" that can be used safely for producing printed circuit boards and semiconductor devices.

However, to make a significant impact, the network will have to sign up in the near future at least 40 percent of the 4,000 firms that were sent survey forms, he asserted.

Federal funding of the public-private partnership will continue through August of next year, noted Richard Reibstein, assistant director of the Office of Technical Assistance.

"After that," he explained, "we would like MBEN to be self-operating. And if it is, we will look at other areas of the state that could benefit from a similar network."

Regardless of what happens, a precedent has been set, maintained Gihlstorf of Cabot Stains.

"This is the first time that business and environmental enforcement agencies have sat down and said, 'Let's try to solve the problems.' Before, there was always an adversarial relationship between business and government."

▶ *Merrimack Valley firms that would like to be represented at the Sept. 23 conference at Maudslay State Park in Newburyport have until Wednesday to make their reservations, said George C. Frantz of Massachusetts Office of Technical Assistance.*

Reservations, he said, may be sent by fax to (617) 727-3827.

Protecting nature and the bottom line

Andrew P. McCloy/*Eagle-Tribune*

Mark Chrisos, the environmental manager at Raytheon Co., and Anne Reynolds, environmental engineer with AT&T, stand before a vista of the Merrimack River with their awards from the Merrimack Business Environmental Network.

◆ Companies are finding that controlling pollution can help control costs as well.

By Andrew P. McCloy
Eagle-Tribune Writer

NEWBURYPORT — People from about 75 companies gathered yesterday on a bluff overlooking the Merrimack River to learn ways to protect both the environment and the bottom line.

The Merrimack Business Environmental Network sponsored the meeting at which area companies like AT&T and Raytheon received honors for their work in adopting environmentally friendly operations.

"When you talk about pollution control, you're conserving, not spending," said George C. Frantz, manager for the Merrimack Watershed Project.

"That's very attractive when you can talk to business about compliance and an economic benefit. You're talking a language they like."

Mr. Frantz helped organize yesterday's day-long gathering held at Maudslay State Park, which marked the first-year anniversary of the Merrimack Business Environmental Network.

The network formed to help meet a demand among businesses for more information about pollution control and environmental regulations.

The Massachusetts Office of Environmental Affairs and the New Hampshire Department of Environmental Services have joined forces to act as a clearinghouse of information to business.

"If we can work together to prevent harm to the environment and avoid spending more money, then why don't we do it all of the time?" said Robert W. Varney, commissioner of the Department of Environmental Services in New Hampshire. "We have to recognize we have common objectives."

Mark Chrisos, environmental manager for Raytheon Co.'s Missile Division, said the company has taken huge steps in reducing the number of harmful chemicals in the production processes.

In 1990, Raytheon Chief Executive Dennis J. Picard directed the company to eliminate the use of ozone-depleting chemicals, used to clean circuit boards in the production process.

The company had been the biggest user of the ozone-depleting chemicals in the Merrimack Valley.

By 1992, Raytheon had replaced these ozone-depleting chemicals with safer, non-toxic ones.

"From a cost-savings perspective, the new system was less expensive," Mr. Chrisos said. "We went from being the largest user to basically off the list."

Anne Reynolds, an environmental engineer at AT&T's Merrimack Valley Works, said she found the Merrimack Business Environmental Network helpful in keeping abreast of the many environmental regulations.

"It's a good place to come to interface with government and keep up with the regulations," Ms. Reynolds said.

Mr. Frantz said one benefit of the network is companies can find out about state and federal regulations without feeling threatened.

"Some people are really gun-shy about going to a government agency at all, because it might just generate an enforcement action," Mr. Frantz said.

MANCHESTER UNION LEADER SUNDAY 10/17/93 N.H. BUSINESS REVIEW

WASTE / ENVIRONMENTAL

A common ground on environmental issues

Network links business, regulators, activists in forum to deal with change

By Bob Sanders

If someone asked you to drink from the Merrimack River a decade ago, you might have thought he was joking. Today 300,000 people depend on the river to quench their thirst. And as the river cleans up, business is starting to view it as more than a place to carry off waste.

"I fish," explained Alan Karg, environmental manager of Diceon Electronics Corp., on the banks of the Nashua River that feeds into the Merrimack. "The color of the river used to change daily depending on what paper they were making. It was an open sewer. Now the water quality is surprisingly good."

Diceon is one of the first of 50 companies in New Hampshire and Massachusetts to join with regulatory officials and environmental groups in forming the Merrimack Business Environmental Network, or MBEN, which kicked off its first convention last month to revive the river basin.

Companies like Diceon don't join MBEN just to be environmentally correct. They want to have some input into environmental regulation.

"We might as well have a look at the rules and regulations before or as they are being formed, rather than reacting to them after fact," said Karg.

And regulatory officials hope to use the organization to educate business. "We wanted to bring business together through educational outreach," said Stephanie D'Agostino, pollution prevention coordinator for the N.H. Department of Environmental Services. "A lot of companies want to be good citizens and if led in the right direction will do the right thing. We want compliance through understanding."

So far, some 60 businesses have joined up, a dozen from the New Hampshire area, including Hadco Inc. and Diceon.

"We are always trying to provide environmental stewardship," said Ron Blanchette, senior safety environmental specialist for Hadco's Hudson facility. "We want to reach out and expand the membership to small and medium size companies. We can't begin to comply with regulations that they don't even know exist."

So far, some 60 firms have signed up in Mass. and N.H.

Or can afford. Some companies spend as much as 10 percent of their budget on environment and worker safety, according to a recent MBEN survey. Five of the 27 firms polled paid more than $50,000 to reach compliance, said George Frantz, director of the Massachusetts Office of Technical Assistance, who compiled the results of the poll.

"That's a heck of a lot of money for a small company. They either are in big environmental trouble, or out of control in their budget."

The Merrimack River flows 180 miles through two states, trickling from the jutting profile of the Old Man of the Mountain, spilling out of its mouth in Newburyport, Mass., to the sea.

Its 5,000-square-mile watershed, the fourth-largest in New England, touches 200 communities, including Nashua, Manchester and Concord, but also places like Laconia, Kingston and Contoocook.

For years, the river has been neglected. But now that it is becoming cleaner, everybody is interested in it. And that's part of the problem, said Barbara Rich of the Merrimack River Initiative, funded by the federal government to the tune of $400,000.

While communities and developers both want to use the river for its aesthetic and recreational values, municipalities and industries still need a place to dispose of sewage and environmentalist want to keep it clean.

The initiative will pull together information scattered through numerous government agencies into a database and conduct a resource inventory and value study, said Rich. Some local testing, using trained volunteers, will augment the study.

"We want to provide guidance on how to lessen the impact along the river, as well as figure out how best to spend the federal money," she said.

MBEN, she hopes, will play a role in that effort.

But MBEN businesses are interested in more than just the river. When polled about the issues of most concern, along with water pollution they mentioned the Clean Air Act and occupational health and safety, toxic chemical right-to-know laws and training requirements.

They also expressed interest in hooking up with a waste exchange program; one business said that it used one already.

And everybody said they would be interested in sharing information on pollution prevention techniques.

"The idea is that they can learn more from each other than they can from us," said D'Agostino, of the state DES. ■

Raymond named to LBG position

Leggette, Brashears & Graham Inc (LBG), a professional firm specializing in hydrogeology and groundwater and environmental engineering services, has named Charles P. Raymond technical business development manager in its Nashua office.

Raymond will be responsible for sales and marketing for LBG's northeast region encompassing New Hampshire, Maine, Massachusetts and Vermont. LBG provides technical services in such areas as ground water supply; soil and ground-water remediation; UST investigation, closure and state reimbursement programs; and environmental engineering.

Raymond has been involved in the environmental field for more than 11 years both as a technician and in business development.

Registration

Name _____

Title _____

Company _____

Address _____

City _____

State _____ Zip _____

Phone _____ Fax _____

Only the first 250 conference registrations will be accepted.

Checks must be made out to:
Friends of Maudslay State Park

☐ Please sign me up for the MValley Business Environmental Conference. Enclosed is my check for $20 to cover the cost of lunch and breaks.

- OR -

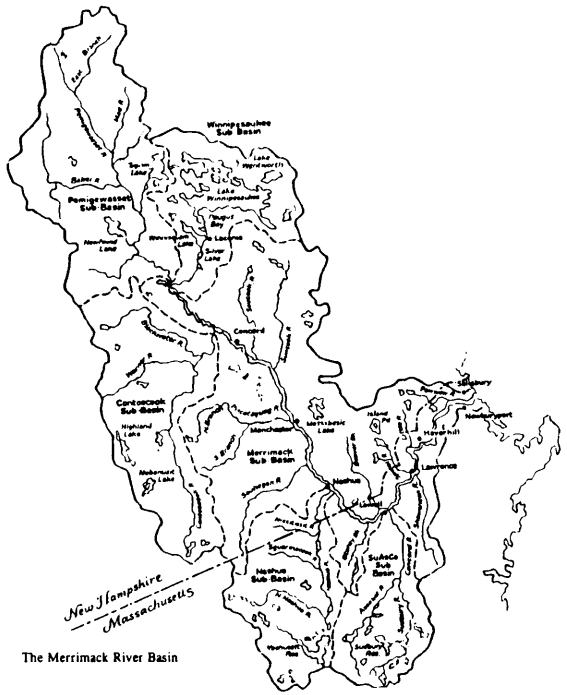
☐ Sign me up for the conference and also for the optional Riverboat tour following. Enclosed is my check for $32 covering lunch, breaks and the boat tour.

- OR -

☐ Fax your registration to OTA (in MA) or DES/P2. Your place will be reserved, and you can pay in cash or check at registration .

(MA OTA) 617-727-3827
(NH DES/P2) 603-271-2867

Merrimack & Subwatersheds



The Merrimack River Basin

Directions: Maudslay State Park

From north/south: I-95 to Rt. 113 East; follow 113 east 1/2 mile to Nobel St. Left on Nobel. Right at Stop sign onto Ferry Rd. Follow signs to park. (3.3 miles from I-95)

From east/west: I-495 to exit 55 (Rt. 110 East). Follow 110 for 1 mile to Merrill St. (Right at 2nd light) Continue on Merrill/ Spofford St. for 1.5 miles. Right before stop sign onto Ferry Rd. Follow signs to park. (4 miles from I-495)

printed on recycled paper

M B E N

MValley Business ENvironmental Conference

Merrimack Business Environmental Network

Maudslay State Park
September 23, 1993
8:30 AM to 4:30 PM

Sponsored by:

Merrimack Business Environmental Network

c/o M/A COM
1011 Pawtucket Boulevard
Lowell, Massachusetts 01853-3295
Phone: 617-727-3260 (MA);
603-271-3533 (NH)

MERRIMACK ENVIRONMENTAL BUSINESS NETWORK (MBEN)

River Valley Environmental/Business Conference
September 23rd; Maudslay State Park
(near Newburyport, MA)

For area businesses concerned with:

1. Complying with environmental regulations
2. Increasing economic competitiveness
3. Improving the quality of life in the Merrimack River (and tributaries) watershed areas

If you're in business and having problems understanding or implementing environmental policies and practices in your company, join us for a different type of conference by a different type of group.

MBEN's *"River Valley Environmental/Business Conference"* will be a relaxed, inexpensive and very informative look at what plans businesses need to develop and implement in order to comply with environmental regulations in the 90's. Since MBEN is an organization of business partners, we view things from a business perspective... simple, action-oriented, do-able.

The conference will be held in a beautiful park-like setting (well protected by a large tent, in case of rain) and in a relaxed (but professional) atmosphere at Maudslay State Park, on a bluff overlooking the Merrimack River. A delicious catered picnic lunch is included with registration.

After the close of business, approximately 4:30 PM, we have arranged for an optional 2-hour tour of the Merrimack River aboard a tour boat out of Newburyport. Cost of this is only $12 and can be included with your conference registration. Relax while you remind yourself exactly how beautiful and important the River is to the region's quality of life.

MBEN... Who We Are

We are members of the *Merrimack Business Environmental Network (MBEN)*, and we invite you to join with us. Our group is not for profit; it is composed of Merrimack Region businesses, coming together to help each other understand how best to deal with environmental regulations, and improve our environmental performance.

The network is not a money-making organization. The members share their experience, their successes, their problems, and make use of available expertise.

The group has a relationship with government technical assistance agencies, and has access to regulatory officials through these assistance offices. This gives us best-available information on environmental developments and also a chance to make our views known to those making the rules.

We are dedicated to both maintaining and promoting the viability of businesses in our region, and protecting the resources that make this area beautiful.

Many of our members have saved money by taking action to prevent pollution, rather than treating it after its creation, and are willing to share this experience with others.

MBEN Mission Statement:

The *Merrimack Business Environmental Network* is a coalition of businesses, agencies and associations committed to a shared concern for the Merrimack Valley, its rivers, and the Valley's quality of life. This Association has made a long-term commitment to seek and implement solutions to promote pollution prevention through improved management and technology, while enhancing the economic viability of the business community.

Agenda / Speakers

Robert Varney, *Commissioner of Environmental Affairs, State of New Hampshire*
Charles N. Steele, *Undersecretary of Environmental Affairs, Commonwealth of MA*

Several US Senators and Representatives are invited; other speakers include Federal and state environmental experts and a range of business leaders discussing pollution prevention plans implemented in their companies.

8:15 Arrival and a pleasant ten-minute walk to the meeting site. *(Shuttle transport will also be available.)*

8:45 Introduction

9:00 Morning session features a review of environmental regulations which affect most businesses, viewed from a pollution prevention perspective, including:

* *Clean Air Act Issues*
* *Clean Water Act and Industrial discharges;*
* *Hazardous Waste regulations,*
* *SARA and TURA reporting, including plans for materials management and tracking,*
* *Emergency Response and Worker Health & Safety, including spills, emergency plans, and a summary of OSHA regulations*

12:00 Catered picnic lunch followed by awards to several MBEN companies

1:00 Case study presentations by local businesses highlighting their efforts and successes in pollution prevention activities. *Some firms have saved significant money in P2 programs.*

4:00 Breakout sessions, to discuss questions and implementation of practices discussed today.

4:30 Conference concludes

5:30 Tour boat departs from Newburyport

THE NORTHEAST BUSINESS ENVIRONMENTAL NETWORK

The Northeast Business Environmental Network, Inc. (NBEN) is a non-political forum for businesses, government agencies, and environmental advocates who support environmental excellence in business operations as a means of achieving a healthy economy. As a group, NBEN members:

- participate in an on-going dialogue among business, government and environmental advocate members on environmental issues
- share the latest information about pollution prevention and other technologies with member companies of all sizes and product type
- hold monthly meetings as well as workshops and conferences on topics selected by members

All those applying for membership are asked to review and sign NBEN's Statement of Purpose as a condition of joining NBEN. The signed statement should be returned to Membership Chairman Ed Surette with your dues payment. (See enclosed membership application)

NBEN has two classes of membership, Senior and Associate Members:

- **Senior Members** are companies whose operations have the potential to directly impact the environment, such as product manufacturers. Non-regulatory government agencies also are allowed in this membership category. Senior members may serve as NBEN officers or executive committee members.

- **Associate Members** are other types of businesses, such as service companies and consulting firms, as well as environmental organizations and regulatory government agencies. Associate membership will be granted to potential marketers upon written agreement that they will market their products and services only by invitation of the Board of Directors.

All members receive discounts on registration for NBEN-sponsored workshops and conferences.

If you have any questions or would like additional information about the benefits of NBEN membership, contact Ed Surette, NBEN Membership Chairman at M/A COM, 1011 Pawtucket Blvd, Lowell, MA 01851. Ph: 508-442-4283 Fax: 508-442-4187.

NORTHEAST BUSINESS ENVIRONMENTAL NETWORK INC.

Statement of Purpose

The purposes for which the corporation is formed are as follows:

a) To educate and assist organizations and businesses whose activities have the potential to affect the environment in preventing pollution and avoiding damage to natural resources in an effort to preserve and promote the environment and public health.

b) To support and encourage the adoption of environmentally safe practices through the distribution of accurate and objective information including but not limited to:
   1. environmental regulatory requirements
   2. environmental health of local resources, and
   3. current opportunities to protect and/or enhance natural resources.

c) To promote the conservation and protection of natural resources through presentation of the latest technologies, practices and techniques for avoiding pollution and through demonstration of cost-effective methods of complying with environmental requirements and safeguarding local resources.

d) To encourage Members to form collaborative alliances with governmental agencies and environmental organizations which will result in a greater awareness of potential environmental problems and more efficient means of reaching solutions.

e) To engage generally in any activity which may lawfully be carried on by a corporation which is organized under Chapter 180 of the General Laws of Massachusetts and which is exempt from federal income taxation under sec. 501(c)(3) of the Internal Revenue Code of 1986, as both may be in effect from time to time.

I have read the above Statement of Purpose and pledge that as a member of NBEN the company or agency I represent will abide by these principles.

Signature:_____ Date:_____

Title: _____

Company:_____

NORTHEAST BUSINESS ENVIRONMENTAL NETWORK, INC.
Membership Form

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ **STATE** _____ **ZIP**_____

TEL _____ **FAX** _____

TYPE OF BUSINESS AND PRINCIPAL PRODUCT _____

_____

_____

SIC CODE _____ **No. of Employees** _____

Membership dues: Please enclose a check for membership dues with the completed application and signed Statement of Purpose. Annual dues per company are as follows:

SENIOR MEMBERS:

Fewer than 50 employees	$90	101 to 499 employees	$250
51 to 100 employees	$125	500 or more employees	$500

ASSOCIATE MEMBERS:

All for-profit companies regardless of size $500

Please send the completed form, signed copy of NBEN Statement of Purpose and a check for membership dues to NBEN Treasurer William Lindsey, Environmental Affairs Manager, Veryfine Products Inc., 210 Littleton Road, P.O. Box 670, Westford, MA 01886-0670.

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c) To promote the conservation and protection of natural resources through presentation of the latest technologies, practices and techniques for avoiding pollution and through demonstration of cost-effective methods of complying with environmental requirements and safeguarding local resources.

d) To encourage Members to form collaborative alliances with governmental agencies and environmental organizations which will result in a greater awareness of potential environmental problems and more efficient means of reaching solutions.

e) To engage generally in any activity which may lawfully be carried on by a corporation which is organized under Chapter 180 of the General Laws of Massachusetts and which is exempt from federal income taxation under sec. 501(c)(3) of the Internal Revenue Code of 1986, as both may be in effect from time to time.

I have read the above Statement of Purpose and pledge that as a member of NBEN the company or agency I represent will abide by these principles.

Signature:_____ Date:_____

Title: _____

Company:_____

If your company uses hazardous materials in its day-to-day business operations, it is subject to a variety of environmental and health and safety regulations established by state and federal laws including the Emergency Planning and Community Right-to-Know Act (EPCRA); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the Resource Conservation and Recovery Act (RCRA); and the Occupational Safety and Health Administration's (OSHA) rules. In addition, there are state laws regulating the use and disposal of hazardous materials. Because of the number and complexity of regulations, a facility manager's job responsibilities include:

❑ **Understanding and communicating the risks involved with the use of various hazardous chemicals;**

❑ **Taking steps to minimize risks to employees, the community and the environment by reducing the handling and use of hazardous materials where possible;**

❑ **Knowing your reporting and management responsibilities if an emergency situation occurs.**

"Reducing the Risk" is designed as a primer for facility managers and environmental officers of companies that use hazardous materials. Participation in "Reducing the Risk" offers you:

❑ **The opportunity to hear presentations by state and federal officials, industry, consultants and other experts in the field of hazardous materials management. You can ask questions during discussion sessions, as well as speak to the presenters informally during lunch and coffee breaks.**

❑ **The chance to meet and talk to your peers from other companies who are dealing with the same compliance issues and health and safety concerns that you are.**

Join us for a day of practical information presented in a manner that is easily understood and can be directly applied to your work duties.

To register, complete and return the attached registration form today. Deadline for advance registration is Friday, October 14, 1994

The Northeast Business Environmental Network (NBEN) is a non-profit coalition of businesses, agencies, and associations dedicated to the combined goal of environmental protection and economic vitality. NBEN members have made a long-term commitment to promote pollution prevention and toxics use reduction as a means of both protecting the environment and strengthening the economy. NBEN sponsors meetings and conferences designed to educate businesses and others about achieving environmental excellence in business operations.

For more information about the conference, contact Cynthia Barakatt, Merrimack Project Coordinator, at the MA Office of Technical Assistance. Tel: 617/727-3260 Fax: 617/727-3827. For information about NBEN membership, contact Edward Surette, membership chairman, 508/442-4283 Fax: 508/442-4187

REDUCING THE RISK:

A Conference for Companies That Use Hazardous Materials

The Second Annual Fall Conference of the Northeast Business Environmental Network

Thursday, October 20, 1994
8 a.m. to 3:30 p.m.

Boston University
Corporate Education Center
Tyngsboro, MA

Presented in cooperation with the Massachusetts Office of Technical Assistance for Toxics Use Reduction, Executive Office of Environmental Affairs, and the New Hampshire Department of Environmental Services

Printed on Recycled Paper

AGENDA

8:00 A.M. **Registration**

8:30 A.M. **Introductory Remarks**
Mark Chrisos, Environmental Manager, Missile Systems Division, Raytheon Company NBEN Chairman

8:45 A.M. **Assessing and Communicating Risk**
Moderator: Anne Reynolds, Environmental Engineer, AT&T

Ken Geiser, Director, Toxics Use Reduction Institute, University of MA, Lowell

Anne Marie Desmarais, Principal, Environmental Insight, and Adjunct Professor of Civil and Environmental Engineering, Tufts University

10:00 A.M. **Break**

10:20 A.M. **Reducing Risk: Preventing Accidents and Reducing Toxics Use**
Moderator: Rick Reibstein, Assistant Director MA Office of Technical Assistance for Toxic Use Reduction

Joseph Dufresne, Corporate Environmental Engineer, Teradyne Inc., Nashua, NH

Juan Gomez, Manufacturing Engineering Dept., General Electric, Fitchburg, MA

John Gihlstorf, Manufacturing Manager, Cabot Stains, Newburyport, MA

Vincent Perelli, NH Pollution Prevention Manager, NH DES

Charles N. Hardenstine, Environmental Health Scientist, Mabbett & Associates Bedford, MA

12:00 noon **Lunch**

1:00 P.M. **Keynote Speaker**
John DeVillars, Regional Administrator U.S. Environmental Protection Agency, New England Region (invited)

1:30 P.M. **Emergency Planning and Response**
Moderator: Judy Barber, MA DEP Northeast Region - Service Center Director

Len Wallace, Regional Response Team Coordinator U.S. EPA New England Region

Wayne Whitford, 128 Belt Mutual Aid Planning Group

Anthony Guarciariello, Emergency Response Section Chief, MA DEP

William MacFarlane, Vice President Seacoast Ocean Services, Portland, ME

John Tommaney, State Emergency Response Commission (SERC) Coordinator, MA Emergency Management Agency

3:00 P.M. **Closing Discussion Session**

3:30 P.M. **Conference Adjourns**

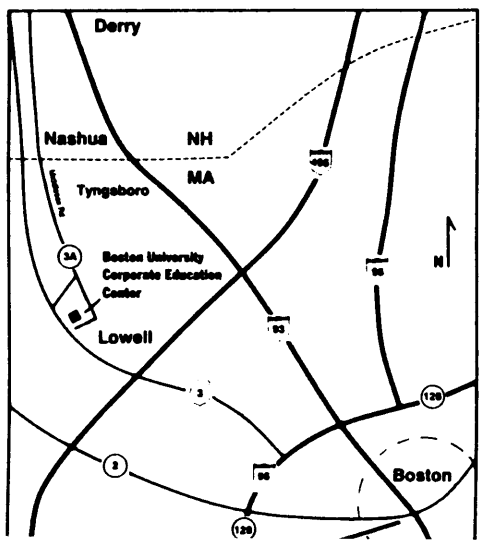
Sponsored by the Northeast Business Environmental Network, in cooperation with the MA Office of Technical Assistance and the NH Dept. of Environmental Services. Special thanks the Boston University Corporate Education

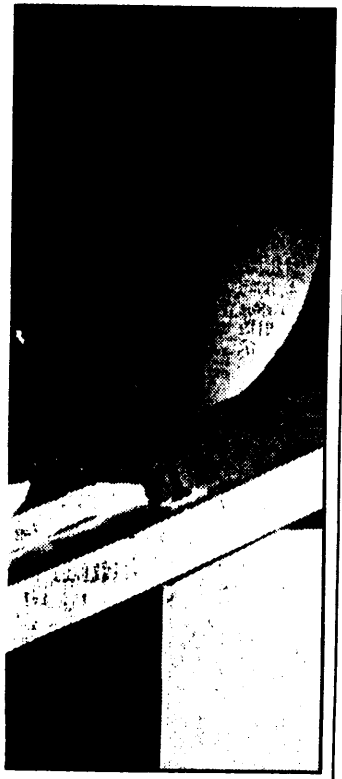
NBEN member companies and agencies include:
Advanced Circuit Technology, Inc., Nashua, NH
Americraft Carton, Lowell, MA
AT&T, North Andover, MA
Cabot Stain, Newburyport, MA
HADCO Corp., Salem, NH
Hewlett-Packard Company, North Andover, MA
M/A COM, Lowell, MA
MA Office of Technical Assistance for Toxics Use Reduction
Merrimack River Watershed Council
NH Department of Environmental Services
Teradyne Inc., Nashua, NH
Tri-Star Technologies, Methuen, MA

NBEN OFFICERS
Chairman: Mark Chrisos, Raytheon Company, Missile Systems Division
Vice Chairman: Gabriel Paci, Raffi and Swanson
Secretary: Connie Morton, Malden Mills
Treasurer: William Lindsey, Veryfine

Directions to the Boston University Corporate Education Center:

FROM THE NORTH: Follow Route 3 to exit 34 (Westford Road, Tyngsboro). Bear right at exit and drive under bridge to Westford Road, then follow directions noted below. FROM THE SOUTH: Follow U.S. Highway 3 North to exit 34 (Westford Road, Tyngsboro). Bear right at exit and continue 0.9 miles to traffic light: the Merrimack River is straight ahead. Turn right just after the old cemetery onto Tyng Road, approximately 1 mile from traffic light. The Boston University Education Center is 0.1 miles on the right.





Associated Press

**Hills called on Mexico
n Free Trade Agreement
America by the end of the
ention in Cancun, Mexi-**

boosts

Valley companies summon experts to prevent environmental disasters

◆ A meeting in Tyngsboro yesterday brought together industry, government and environmental groups to discuss a common threat: toxic waste.

By Andrew P. McCloy
Eagle-Tribune Writer

TYNGSBORO — When Cabot Stains moved its manufacturing plant from Chelsea to Newburyport in the mid-1980s, it had a golden opportunity: to construct the kind of building that could contain the worst of toxic spills.

Located on the banks of the Little River, which flows into the Merrimack, the Cabot Stains plant opened in 1985, featuring state-of-the-art architectural designs and equipment to guard against hazardous waste spills.

By building large in-ground basins to protect against tanker truck spills and designing the plant with a depression at its center to contain chemicals inside the plant, the company was able to reduce the chances of environmental disaster.

After all, once a chemical spill occurs, "it can take a company a long, long time before you ever live it down," said John Gihlstorf, manufacturing manager at Cabot Stains.

Mr. Gihlstorf was one of several speakers at yesterday's annual conference of the Northeast Business Environmental Network, comprising experts from private companies, government agencies and environmental groups. The conference was held at Boston University's Corporate Education Center here.

It allowed the three groups to share ideas and concerns about hazardous waste — from preventing spills to understanding the laws, said Mark Chrisos, environmental manager at Raytheon Co.'s Missile Systems Division plant.

"This is a great place for us to get together in a non-hostile, non-threatening environment," said Mr. Chrisos, chairman of the network.

The Northeast Business Environmental Network currently has about 25 members, a number Mr. Chrisos said he would like to expand to 100.

Originally started as the Merrimack Valley Environmental Network, the network could eventually serve companies throughout the northeastern United States, he said.

The conference focused on taking steps to prevent toxic spills before they happen — whether through building design, as in the case of Cabot Stains, or setting up programs to cut a company's toxic waste use.

"From 1987 to 1994, a large percentage of emissions has been reduced," Mr. Chrisos explained, "but now the challenge is to reduce the volume of the chemicals that are used."

Companies use the network meetings as a clearinghouse for the latest ideas about handling toxic waste and the laws and regulations that govern it, Mr. Chrisos said.

"It's really meant a lot of free consulting services for everyone involved," he said.

Vincent Perelli, pollution prevention specialist with the New Hampshire Department of Environmental Services, said companies need to focus more on preventing toxic waste spills rather than cleaning them up.

According to the U.S Environmental Protection Agency, faulty equipment is the primary cause in 56 percent of all toxic waste spills and human error is at the root of 31 percent of spills.

◆ TOXIC 10

Here are the top 10 states for hazardous waste spills, according to the National Environmental Law Center:

California
Texas
Louisiana
Pennsylvania
Ohio
Kentucky
Illinois
Florida
Michigan
New Jersey

(Massachusetts ranks 22nd and New Hampshire 47th)

April 6, 1995

Dear interested citizen:

We, the chief officers of environmental agencies, invite you to participate in a unique opportunity to share your ideas with us. The Northeast Business Environmental Network is holding a brainstorming session on April 27 to generate ideas for Regulatory Improvement Opportunities (RIO), and we hope you will respond to their invitation to submit ideas. Some of you may also agree to participate in the RIO working group, which will further develop the ideas generated by the brainstorming event.

Although we all feel there is no doubt that environmental requirements have preserved the resources and protected the health of the public and the environment of this region, we recognize that there are many ways in which the regulatory system can and should be improved. We share in a belief that it is absolutely possible to reduce the economic impact of regulations, while enhancing environmental protection at the same time, and we are committed to these twin aims.

Our agencies are doing many things to become more open to your advice, comment, and queries. In the past few years, we have all moved to establish a greater emphasis on assistance and cooperation. We think of RIO as just one event in a larger dialogue that we envision as continuing as long as it is necessary. We hope you will participate with us in all our future efforts to work together for environmental and economic progress. Thank you for your interest.

Sincerely,

John DeVillars
Administrator
US EPA
New England

Trudy Coxe
Secretary
MA Executive
Office of
Env. Affairs

Tom Powers
Acting Commissioner
MA Dept. of
Environmental
Protection

Robert Varney
Commissioner
NH Dept. of
Environmental
Services

Northeast Business Environmental Network

April 6, 1995

To : Regulated Community

I am pleased to invite you to take part in a very important event. On the morning of Thursday, April 27, we will come together in a brainstorming session to identify regulatory improvement opportunities (RIO). The meeting will be held at the Westford Regency, conveniently located at exit 32 off Rte. 495 in Westford Massachusetts. Your participation will lead to the successful identification of regulatory barriers to environmental, as well as economic, improvement.

Reinventing Regulations, Regulatory Reform, Regulatory Relief - these are all current terms which describe the need for government at all levels to review all regulations and remove or amend rules which present barriers to environmental excellence and regional economic growth. We have a unique opportunity to have significant input into this process. The resulting recommendations will be provided to the White House, Congress, EPA New England, the Massachusetts Office of Environmental Affairs, Massachusetts DEP and New Hampshire DES.

NBEN is a nonpartisan organization of large and small regulated businesses, government agencies and environmental advocates committed to economic growth and environmental excellence. We have been selected by EPA New England to conduct this forum as a component of its reinvention initiatives.

The brainstorming sessions will begin with a review of previously identified issues. Your prior written input of topics important to you will facilitate the forum discussion. We will then break out into several groups to further explore individual's input and recommendations for solutions. The stakeholders will then reconvene and each group will report on its progress.

We must have confirmation of your willingness to attend. Please send your name, business or professional affiliation, address and telephone number to NBEN - RIO c/o Gabriel Paci, Raffi and Swanson, Inc., 100 Eames Street, Wilmington MA 01887 or fax to 508-658-3366.

You may submit topics for discussion to Rick Reibstein, Office of Technical Assistance, Room 2109, 100 Cambridge Street, Boston, MA 02202 (phone 617-727-3260 ext. 688 or fax 617-727-3827).

Please call me at 617-933-4200 if you have any question on this dialogue or on NBEN. I hope you are able to join us in this important effort to improve the regulatory process.

Sincerely,

Gabriel Paci

Gabriel Paci, Chairman
Northeast Business Environmental Network
President/CEO, Raffi and Swanson, Inc.

The RIO Forum

William Aloisi Erving Paper Mills, Inc.	Erving, MA
Tom Armen Environmental, Inc.	Wilmot, NH
Kenneth Austin General Scanning Inc.	Watertown, MA
Solo Avram CPF Incorporated	Ayer, MA
Paul E. Bagley Atwood and Morrill Co., Inc.	Salem, MA
Cynthia Barakatt MA OTA	Boston, MA
Judy Barber MA DEP - NERO	Woburn, MA
Donna Frazier Barnes Hewlett-Packard Company	Andover, MA
Richard Barry M/A-Com	Lowell, MA
Kim Bensen United Parcel Service	New York, NY
Eugene B. Benson, Esq. Mass. Water Resources Authority	Boston, MA
R.J. Berlandi	Winchester, MA
Art Berner A. J. Associates	Westford, MA
Peter Biggins W.F. Biggins Associates, Inc.	East Longmeadow, MA
Mark Bornstein OSRAM Sylvania	Danvers, MA
Francis B. Boucher S.S.B. Realty, Inc.	Boston, MA
Ronald B. Child California Products Corporation	Cambridge, MA
Mark Chrisos Earth Tech	Concord, MA

The RIO Forum

Allen J. Cohen Sky Products Company	Peabody, MA
Janet T. Cohen Sky Products Company	Peabody, MA
Gary Conaty Lau Technologies	Acton, MA
Roy B. Crane Lightolier	Wilmington, MA
John Cushman CPF Incorporated	Ayer, MA
Betty J. Diener Environmental Business Council of New England	Boston, MA
Richard Doherty Hydro Environmental Technologies, Inc.	Acton, MA
David Dub Duncan Galvanizing	Everett, MA
Tim Dumas Voltek, Div. of Sekisui America Corp.	Lawrence, MA
Tim Elsevier Erving Paper Mills, Inc.	Erving, MA
David Eppstein MASCO	Boston, MA
Frank V. Ferrara Swank, Inc.	Attleboro, MA
Beverly Fischer Alpha Industries	Woburn, MA
Mike Fiske Hunter, Inc.	Lincoln, MA
John R. Frank H. E. Mason Co.	Hyde Park, MA
Deborah Gallagher MA DEP	Boston, MA
Jack Geissert Genetics Institute	Andover, MA
Tony Gemmellaro Alpha Beta Technologies	

Kristin Gentile Voltek, Div. of Sekisui America Corp.	Lawrence, MA
Doug Gillespie Massachusetts Farm Bureau Federation, Inc.	Bedford, MA
Bob Gingras Earth Tech	Concord, MA
Louis Gitto MA DEP	Boston, MA
Sidney Goldstein Lynn Plastics Corporation	Lynn, MA
Ralph Goodno Merrimack River Watershed Assn.	Lawrence, MA
Randall Goyette Safety-Kleen Corp.	Marlboro, MA
Wallace Hack MA DEP	Worcester, MA
Janna Hadley B. G. Wickberg Company, Inc.	North Quincy, MA
Robert T. Hawes Polaroid Corporation	Waltham, MA
George Hawkins U.S. EPA, New England - RAA	Boston, MA
Mark W. Haymes Standard Uniform Services	Agawam, MA
Jack Healey U.S. EPA, New England	Boston, MA
Jody Hensley Toxics Use Reduction Institute	Lowell, MA
Rick Hillman D/E Corporation	Leominster, MA
Vernon C. Hipkiss Pittsfield WWTF	Pittsfield, NH
George Hrono General Scanning, Inc.	Watertown, MA
Kira Jacobs Environmental Science & Engineering	Amherst, NH

The RIO Forum

Chris Jendras U.S. EPA, New England	,
Carolyn Jenkins NEIPWCC	Wilmington, MA
Steve Jorjorian, Jr. Advanced Plating	Worcester, MA
Barbara Kelley MA OTA	Boston, MA
Phil Kenney Quincy Hospital	Quincy, MA
James Klecak Americraft Carton Inc.	Lowell, MA
W. Ladroga Neles-Jamesbury, Inc.	Worcester, MA
Susan Lanza MA OTA	Boston, MA
Bob Larsen Larson Technologies	Fremont, NH
Cindy Lee Safety-Kleen Corp.	Marlboro, MA
Ira Leighton U.S. EPA, New England - HEL-CAN6	Boston, MA
Gregory Leonardos	Arlington, MA
Anat Lev Malden Mills Industries, Inc.	Lawrence, MA
J. Alden Lincoln	Boxford, MA
Massimo Lombardo ATC Diagnostics, Inc.	Framingham, MA
Steve Luz Tweave Inc.	Norton, MA
Frank Marino Raytheon Company	Lexington, MA
Gina McCarthy MA Executive Office of Enviornmental Affairs	Boston, MA

The RIO Forum

David F. McDermitt Waste Management, Inc.	Wakefield, MA
Dorothy McGlincy New England Power Service Company	Westborough, MA
Hugh McLaughlin, PhD Waste Min Incorporated	Groton, MA
Kenneth W. Milender Miller Engineering, Inc.	Manchester, NH
Jennifer Molin Northeast EDM	Newburyport, MA
Elaine Moore Ogden Environmental	Westford, MA
Jack Moriarty Giltspur/Boston	Avon, MA
Connie Morton Malden Mills Industries, Inc.	Lawrence, MA
Tom Murphy Pernix	Wayland, MA
John-Erik Nelson Braintree Electric Light Dept.	Braintree, MA
Arleen O'Donnell MA DEP	Boston, MA
John P. O'Hare Greater Lawrence Sanitary District	North Andover, MA
Gabriel Paci Raffi and Swanson, Inc.	Wilmington, MA
George Papadopoulos U.S. EPA, New England	Boston, MA
Vince Perelli NH DES	Concord, NH
Peter A. Pignone Micron Products, Inc.	Fitchburg, MA
Hugh Pilgrim MA OTA	Boston, MA
Robert Pond Atom Manfacturing	South Attleboro, MA

The RIO Forum

Rick Reibstein MA OTA	Boston, MA
Anne Reynolds AT&T	North Andover, MA
Jeffery L. Rezin O'Sullivan Corp.	Winchester, VA
Robert Rio New England Power Company	Salem, MA
Bill Roeder Star Plating Company	New Bedford, MA
Edmond N. Roux Merrimac Paper Company, Inc.	Lawrence, MA
Camille Sahely C.G. Circuits, Inc.	Taunton, MA
Tod Schmikus No. Central Mass. Chamber of Commerce	Leominster, MA
Robert J. Sculley New Hampshire Motor Transport Assoc.	Concord, NH
Stephen Sibinich Wheelabrator Millbury Inc.	Millbury, MA
Leo Sicuranza New England Electric	Westboro, MA
M. A. Sigal Solutek Corporation	Boston, MA
Chris Simmers NH DES	Concord, NH
Hal Smith Rubic Properties	Danver, MA
Gina Snyder U.S. EPA, New England - RCA	Boston, MA
David B. Spencer wTe Corporation	Bedford, MA
Charles Storella Dana-Farber Cancer Institute	Boston, MA
Thomas A. Stuhlfire NBS Associates	Walpole, MA

The RIO Forum

Herbert Sturgis Instron Corporation	Canton, MA
Linda Swift Corporate Environmental Engineering, Inc.	Worcester, MA
Wes Tator Shepard Envelope Company	Worcester, MA
Kenneth A. Teal NYNEX Information Resources Company	Middleton, MA
Karen Thomas Toxics Use Reduction Institute	Lowell, MA
Richard Tuck CPC Incorporated	Randolph, MA
Henry Veilleux Business & Industry Association of NH	Concord, NH
Winona Wall Raytheon Company	Bedford, MA
Ralph Wilbur Graphic Litho	Lawrence, MA
Lee R. Wilmot Hadco Corporation	Salem, NH
George Winton Tau-tron	Westford, MA

Office of Technical Assistance
Executive Office of Environmental Affairs
Commonwealth of Massachusetts

Toxics Use Reduction Case Study

ALCOHOL FREE FOUNTAIN SOLUTIONS AT AMERICRAFT CARTON, INC.

SUMMARY

Americraft Carton was using large quantities of isopropyl alcohol (IPA) in the fountain solution for the offset printing presses used to print the paperboard cartons for its client's products — food, health and beauty and children's products. Concern for the health and safety of its employees and the environmental concerns of its clients required Americraft to change its process. Introduction of a $108,000 new fountain solution delivery system has resulted in the elimination of IPA, cost savings that will yield full payback (in materials costs alone) in less than two-and-one-half years, and a likely end to toxics use reporting.

BACKGROUND

Americraft Carton, Inc., in Lowell, Massachusetts, is a $30 million a year folding carton manufacturer and printer. Health and safety issues and environmental concerns of Americraft clients — makers of health and beauty products, children's toys and games, and food products — influenced Americraft's efforts to introduce less toxic printing materials.

Until August 1991, Americraft mixed fountain solution for its presses in the traditional manner — a solution of 15-25% isopropyl alcohol (IPA), tap water, and etch material was measured by hand into a drum and stirred with a wooden paddle. Americraft received bulk deliveries of IPA every two to three weeks and up to six 55 gallon drums of waste solution were generated monthly by the company's four sheetfed offset presses.

There are significant economic, health and safety, and environmental drawbacks to this method of producing and using fountain solution. Inconsistency in the solution can cause press downtime; it increases labor and material costs, and it can require disposal of inadequate, unused, or waste solution at a cost of more than $2 per gallon. Inhalation of alcohol-laden vapors present health and safety concerns for employees. And IPA, an ozone producing volatile organic compound (VOC), increases the cost and complexity of air emission permitting and reporting.

TUR PLANNING

Americraft Manufacturing Manager Jim Klecak knew that inconsistency in fountain solution formulation as well as air emission concerns needed to be resolved. Jim moved quickly to research the available options and, in April 1991, to purchase and install a *Prisco Aquamix Central System* at a cost of $108,000. News of the change was initially received with some trepidation by management because of the expense. Now, because the system has proven cost-effective and efficient, implementation of similar systems is underway at two other Americraft plants, in Memphis, Tennessee, and St. Paul Minnesota. St. Paul utilizes a modified version of the mixing system and is pleased with early results. In Memphis, "black-box" technology that irradiates the water for the dampening system, enables operation with plain water and fountain concentrate, completely eliminating IPA and its

substitutes. In Lowell, when Jim began introducing no-IPA solution, he even had to prove to his pressmen that high standard printing is possible without IPA — he locked the IPA storage area and installed a drum, visible through the storeroom window, labeled IPA but filled with water with a hose leading to the presses. Ten days later, Jim told the pressmen that the system was operating without IPA.

TUR MODIFICATIONS

Americraft installed the Prisco system and (because water quality could vary even from hour to hour) reverse osmosis equipment to filter incoming water and automatically adjust pH and conductivity. These changes made it possible to use IPA substitutes, which are less tolerant to variations in water quality and parameters than is IPA. The reverse osmosis filtration system has five micron carbon prefilters, a reverse osmosis membrane, and a storage and distribution tank. Americraft first replaced IPA with Hi-Tech solution and Alkaless R, a fountain concentrate with 20 percent monoglycol ether, a VOC. Release of VOCs was greatly reduced by using a closed loop system, but introduction of the glycol ethers required reporting under SARA (Title III, section 313) and TURA. Prisco Q-11, a new substitute introduced in April 1993, has nearly eliminated VOCs and will likely end the required reporting.

The Prisco system is a closed loop recycling system connected to all the presses, which can release solution at up to 15 gallons per minute (gpm). Recharging of the solution (made up of water obtained by reverse osmosis, IPA substitute, and used fountain solution) is computer-controlled to ensure that pH, temperature, and conductivity are all precisely maintained. From the press, the solution goes to a return tank where it is chilled and filtered to 25 microns (contaminants are ink, paper, dust, and paperboard stock). The solution is then returned to the main system for filtering to 10 microns and for further chilling as well as solution recharging. The chiller is a holding tank with a 250 gallon capacity to ensure adequate quantities at all times.

RESULTS

Reductions Achieved: Americraft used high volumes of IPA in the last full year before introduction of the Prisco system. Replacement of IPA with Alkaless R, which contains 20 percent VOCs, and the substitution of Q-11 for the Hi-Tech fountain concentrate Presulted in an 88 percent reduction in VOC emissions from the operation. Recirculation also eliminated VOCs from the air in the plant and the substitute had reduced flammability as well (flash point of 110 F versus 72). The system ran for 11 months before spent fountain solution required disposal; waste solution was reduced 50 percent.

Supplies	8/90-7/91 *(old system)*	8/91-7/92 *(new system)*	8/92-7/93 *(Q-11, 8 months)*	7/93 to 7/94* *(Q-11, full year)*
Isopropyl (IPA)	$23,025	-0-	-0-	-0-
Alkaless R	1,292	$5,816	$17,146	$3,877
Fountain Solution, Hi-Tech , Q-11	44,907	23,188	10,986	14,610
Total	$69,224	29,004	28,132	18,488
Savings		**$40,220**	**$41,092**	**$50,736**

*PROJECTED

NOTE: Total Materials Purchase Savings = $132,048 in three years. These calculations do not include substantial additional savings estimated at about $35,000 per year from decreased paperboard waste on startups, a capacity increase due to reduced down time for system maintenance, reduced hazardous waste disposal costs for spent fountain solution, and finally, no, or substantially reduced permit fees as a result of the chemical substitutions and process changes.

Installation of the *Prisco Aquamix Central System* automatically and accurately mixes fountain solution in a closed loop and has resulted in:

- The end of losses and costs associated with hand mixed solution — the cost and disposal cost of unacceptable solution that also sometimes caused press downtime;
- Reduced costs for waste removal by internal recycling of the solution and from converting from weekly solution disposal and pan maintenance to an annual schedule, and
- Significantly reduced use of VOCs and VOC emissions through the replacement of IPA. The introduction in April 1993 of Prisco Q-11, which contains 0 percent VOCs will result in nearly complete elimination of VOCs.

Economics: Americraft invested $108,000 in the new equipment required to reduce the VOC emissions from its offset printing operations. Payback resulting solely from the reduced cost for materials will occur about 30 months after introduction of the new system — there are substantial additional savings from increased press efficiency, reduced wastes, and reduced and eliminated permit costs. Americraft has also found that alcohol substitutes cause the need to maintain and/or replace rollers at a higher rate, but also require lower durometer meaning they may last longer.

The cost of the alcohol replacement (Alkaless R) is 5 times greater than IPA; the cost of Q-11 is comparable to that of the Hi Tech concentrate which it replaces. However, because of the improved efficiency of the mixing system and the new chemistry, a reduction of about 75% in Alkaless R use is projected to occur this year, producing the savings (from materials costs alone) shown in the table above.

OTHER POLLUTION PREVENTION ACTIVITIES

Americraft has introduced other pollution prevention changes. Approximately 85 percent of its products are made from *recycled paperboard.* Printing on recycled board is technically more difficult, but the introduction of a consistent fountain solution greatly facilitates printing on recycled material. Americraft also uses *water-based coatings*, instead of UV-based coatings which may make paper non-recyclable; and Americraft recently switched from petroleum-based ink to *soy-based ink.* Soy-based inks produce a higher quality print and result in substantial further VOC reductions. Finally, Americraft is exploring ways in which to cleanse and recycle its cloth filter bags to reduce its overall waste load and improve disposal methods of the filtered-out hazardous material.

This Case Study is one of a series of such documents prepared by the Office of Technical Assistance for Toxics Use Reduction (OTA), a branch of the Massachusetts Executive Office of Environmental Affairs whose mission is to assist industry in reducing the use of toxic chemicals and/or the generation of toxic manufacturing byproducts. OTA's ***non-regulatory*** *services are available at* ***no charge*** *to Massachusetts businesses and institutions that use toxic chemicals. For further information about this or other case studies, or about OTA's technical services, contact:* ***Office of Technical Assistance, Executive Office of Environmental Affairs, Suite 2109, 100 Cambridge Street, Boston, Massachusetts 02202, (617) 727-3260, Fax - (617) 727-3827.*** - C101-3, 9/93

Office of Technical Assistance
Executive Office of Environmental Affairs
Commonwealth of Massachusetts

Toxics Use Reduction Case Study

WATER AND INK WASTE REDUCTION AT F.C. MEYER COMPANY

SUMMARY

F.C. Meyer Company, a Lawrence, Massachusetts cardboard box manufacturer and printer, has trained its employees in "good housekeeping" practices and significantly reduced ink wastes and wastewater generated when cleaning the printing presses. The improved washing practices include draining and scraping as much ink as possible before washing and minimizing the amount of water used. Most of the ink wash water is now used to dilute concentrated virgin black ink. The decrease in wash water and the reuse of ink wastewater have resulted in a 90 percent savings in waste disposal as well as reduced costs for raw materials.

BACKGROUND

F.C. Meyer employs 200 people and has eight printing presses and operates three shifts a day, five days a week. The company uses a flexographic printing process with rubber printing plates.

In 1989, F.C. Meyer switched from solvent-based inks to water-based inks, and reduced its VOC emissions from 280 tons per year to less than 1,000 pounds per year. Performance quality was unchanged and the regulatory workload was reduced substantially. In 1992, F.C. Meyer began to seek further waste reduction opportunities and looked at the press cleaning procedures. Presses must be cleaned every time the ink is changed. The bulk of the ink contained in the bins and on other parts of the press is poured back into the ink container. The remaining ink was washed off with water-soaked rags and the waste water was put in 55 gallon drums and, before the ink change, taken away by a hazardous waste contractor at $100 per drum. Before implementation of the waste reduction program the company generated 10 drums of hazardous waste a week, now it generates one to two drums a week of nonhazardous waste.

WASTE REDUCTION ACTIVITIES

F.C. Meyer decided that reduction of the volume of water used in cleaning process could be achieved by training workers to use the least amount of water possible. The new washing procedures include draining as much ink as possible back into the containers and thorough scraping of excess ink off the press parts before any water is added, and then using as little water as possible.

In addition to reducing the volume of wash water used, the company asked its supplier to deliver black ink with 10% reduced water content. Wastewater is added to the black ink with no apparent effect on the color quality of the ink. The wastewater can also be added to other colors, such as grey, in smaller amounts than when added to black ink.

RESULTS

Reductions Achieved: Modifying the press cleanup procedure reduced the solids in spent washwater from more than 30 percent to 13 percent. The volume of water used also has decreased by 35 percent. Approximately one pint of water is now used each time a press is washed.

By reusing most of the washwater, the amount of waste which had to be disposed has decreased from ten to one to two 55-gallon drums per week.

Economics: The 55 gallon drums of waste cost approximately $100 each to dispose. Implementing the reuse of ink wastewater has reduced the yearly cost of waste disposal from about $52,000 to $5,200.

This Case Study is one of a series of such documents prepared by the Office of Technical Assistance for Toxics Use Reduction (OTA), a branch of the Massachusetts Executive Office of Environmental Affairs whose mission is to assist industry in reducing the use of toxic chemicals and/or the generation of toxic manufacturing byproducts. OTA's non-regulatory services are available at no charge to Massachusetts businesses and institutions that use toxic chemicals. For further information about this or other case studies, or about OTA's technical services, contact: ***Office of Technical Assistance, Executive Office of Environmental Affairs, Suite 2109, 100 Cambridge Street, Boston, Massachusetts 02202, (617) 727-3260, Fax - (617) 727-3827.***

- C101-2, 8/93

Office of Technical Assistance
Executive Office of Environmental Affairs
Commonwealth of Massachusetts

Toxics Use Reduction Case Study

SEPTAGE RECEIVING FACILITY ELIMINATES ODORS

SUMMARY

The Greater Lawrence Sanitary District (GLSD) added an aeration system to its septage treatment tank and eliminated the noxious odors that previously emanated during the treatment process. GLSD's payback on a $77,000 investment came in less than four months and the facility can now accept septage up to the treatment facility capacity of 100,000 gallons per day. The odor problem prevented acceptance of more than 40,000 gallons per day, even when large quantities of odor controlling chemicals were added.

BACKGROUND

The Greater Lawrence Sanitary District (GLSD) is a 52 million gallon per day, activated sludge, wastewater treatment plant that serves approximately 168,000 sewered residents. In addition to piped wastes from homes and businesses, the GLSD provides septage disposal for communities throughout the Merrimack Valley and southern New Hampshire. GLSD Process Control Engineer Richard Fuller found from operating experience that if the septage receiving facility exceeded 40,000 gallons per day (gpd), especially during warm weather months, unacceptable odors escaped into the surrounding community. The odor control chemical, potassium permanganate, for which GSLD was spending $2,000 a month, was effective up to a volume of 40,000 gpd. With a Department of Environmental Protection approved septage receiving capability of 100,000 gpd, the GLSD was losing up to $2,700 a day in septage revenue by observing its self-imposed limit.

TOXICS USE REDUCTION PLANNING

Wastewater treatment plants typically use mechanical stirrers or bubble diffusers to bubble air or oxygen through the liquid waste as part of the treatment process, and this aggravates the release of hydrogen sulfide (H_2S), principal cause of the noxious odors. The use of oxidation chemicals such as potassium permanganate and hydrogen peroxide can successfully control odors, but only for limited quantities of waste. In addition to the added cost, these chemicals also pose risk of fires and explosions. Concentrated solutions of hydrogen peroxide are also highly toxic and a strong irritant.

Economics dictated that GSLD find a way to treat daily septage volumes up to 100,000 gallons without incurring increased chemical costs or generating excessive odors. Early in 1992, OTA recommended that GLSD contact Gary Smith and Dr. James Maskasky of Venturi Aeration. In April 1992, GLSD conducted a pilot test using a Venturi Hydro-Vac®, which clearly demonstrated the unit's ability to oxygenate the septage and eliminate H_2S release prior to discharge to the treatment plant's influent channel. The benefits of having an oxygen saturated septage continued as the septage moved through and over the primary clarifiers, where the atmospheric release of H_2S gas would have occured.

MODIFICATIONS

The GLSD was the first wastewater treatment plant in the country to install a Hydro-Vac® as a means of oxygenating and conditioning septage. On July 6, 1992, the GLSD put into operation three Model A-500 Hydro-

Vac$_{®}$'s connected to two Model T4A3-B Gorman-Rupp, 25HP, self-priming, centrifugal pumps capable of pumping 500 gpm each. GLSD personnel installed the system, which including all parts and labor, cost $77,000.

The Hydro-Vac$_{®}$ Wastewater Conditioner, a patented apparatus designed to inject atmospheric oxygen into any liquid, works by pumping wastewater or septage through a high velocity nozzle into a low velocity mixing chamber where the material is mixed with aspirated air and the solids reduced to macroscopic size, releasing the embedded grease and gas bubbles trapped within the organic solids. When enough oxygen is introduced into a liquid to combine with all of the available hydrogen ions produced by the anaerobic digestive process, no hydrogen will be available to form H_2S.

RESULTS

Reductions Achieved: Since installation of the Hydro-Vac$_{®}$ GLSD has been able to increase its septage receiving volume beyond 40,000 gpd without creating offensive odors. The operation of the Hydro-Vac$_{®}$ equipment has also eliminated the need for chemical conditioning to reduce the H_2S odors. In addition, with septage pumping capacity increased from 100 to 500 gpm, all septage receiving can be accomplished on the day shift where more operating and laboratory personnel are available to handle and test the incoming septage. By September 1993, after 15 months of operation, GLSD had experienced no mechanical or process problems with the new method of handling septage.

Economics: The original capital investment of $77,000 was paid back by October 1992 (see table), less than four months after the installation was completed, because of the increased volume of septage received and the $2,000 per month savings on potassium permanganate usage. The figures in parenthesis in the "Month" column of the table are the number of days that septage was received; the facility is open Monday through Friday. The "Monthly Capital Cost Remaining" column shows that by December 1992, based on septage volumes greater than 40,000 gpd, the GLSD had increased their septage revenue by $57,985 based on a charge of $0.045 per gallon of septage received.

Hydro-Vac Installation Payback

Month (1992)	Average Septage (gpd)	Daily Septage in Excess of 40,000 gpd	Monthly Revenue from Excess Septage	Monthly Chemical Savings	Monthly Capital Cost Remaining
Jul (23)	57,467	17,467	$18,078	$2,000	($56,922)
Aug (21)	56,552	16,552	$15,642	$2,000	($39,280)
Sep (21)	66,188	26,188	$24,748	$2,000	($12,532)
Oct (21)	70,669	30,669	$28,982	$2,000	+$18,450
Nov (20)	66,598	26,598	$23,938	$2,000	+$44,388
Dec (22)	51,714	11,714	$11,597	$2,000	+$57,985

THE BOSTON GLOBE • MONDAY, MAY 9, 1994

An order of chips and orange juice

By Usha Lee McFarling
CONTRIBUTING REPORTER

NORTH ANDOVER – Here in the wide, white aisles of AT&T's vast microelectronics plant, robotic arms stamp tiny resistors, capacitors and computer chips onto circuit boards. Upstairs, machines sandwich layers of conductors and wisps of insulation onto thumbnail-sized computer modules.

On the high-tech assembly line, technician Gregory P. Tashjian opens a rinse tank for freshly built circuit boards. The smell that wafts out is decidedly out of place: the scent is of oranges.

A new menu has found its way into AT&T's Merrimack Valley Works. Orange rinds, grapefruit peels and cantaloupe flesh offer engineers a natural alternative to solvents, long used to make computer chips, that were found to be destroying the ozone layer.

Once circuit boards are finished, some must be rinsed to remove residue. The insulation placed between layers of conductors on stacked modules also must be rinsed away. For years AT&T, like the rest of the industry, used solvents made of chlorofluorocarbons, or CFCs, and chlorohydrocarbons, or CHCs.

"CFCs are excellent solvents because they evaporate," said Tashjian. "The problem is they evaporate into the atmosphere and destroy the ozone layer." This thin layer of molecules of a form of oxygen, high in the stratosphere, shields the Earth from the most harmful of the sun's ultraviolet rays.

In the United States the production of CFCs will be phased out by 1996. But since the first day of 1993, two years ahead of its own schedule, AT&T has been quietly manufacturing computer and communications systems components without ozone-depleting chemicals.

"In 1986, I would not have expected that we, or industry in general, could have gotten where we are now," said A. F. Lazzaretti, the engineer in charge of the plant's environmental programs. "A lot of thinking has changed since the 70s and early 80s."

AT&T's work has garnered the applause of environmentalists. "I don't think there's any way to be too quick about getting rid of ozone-depleting chemicals," said Rob Sargent of the Massachusetts Public Interest Research Group.

One new solvent is a natural chemical distilled from discarded orange and grapefruit rinds. Another is a chemical that is found naturally in cantaloupes and grapes but is cheaper to create synthetically, which is also used as a flavoring for soda and gum. Both are shipped to AT&T by the barrel for use in rinsing machinery.

AT&T invested $25 million to rid its operations of ozone-destroying chemicals. The investment is paying off. Because the fruit-derived solvents do not evaporate quickly and can be re-used, less are required: Just 50 gallons a month are needed for one process that used to require 400 gallons a week of ozone-depleting chemicals.

"And most of that would go up the stack into the environment," said Aaron Frank, the engineer who oversaw the conversion that has played a large role in AT&T's dramatic reduction in total chemical emissions.

Since 1987, the North Andover plant has reduced emissions of ozone depleting chemicals from 750 tons to zero. Company-wide, AT&T has reduced the use of such chemicals by 75 percent. Solvents account for 22 percent of the CFCs used nationwide.

Because the solvent is nontoxic and biodegradable, small amounts that escape into rinse water can be treated in the plant's on-site wastewater treatment system.

"I like the company," said state Environmental Affairs Secretary Trudy Coxe, "because they have really been leaders in practing what we preach – pollution prevention."

Coxe, who visited the AT&T plant on Earth Day, also praised AT&T's other environmental programs, which include requiring all suppliers to stop using packaging made using CFCs and spending $2.3 million to replace reflectors above fluorescent lamps, doubling the output of a single light tube.

Recognizing that planning and developing cleaner technologies may be difficult for smaller companies, AT&T has put aside competitive interests in this case. "We're willing to share the technology with anyone," Lazzaretti said.

Coxe said Massachusetts companies can also get help from the state's Office of Technical Assistance, which offers free environmental audits to several hundred companies each year.

"In general, maybe companies are afraid to make [environmental] changes, but when they get on the bandwagon, they find it's not that bad," Coxe said.

US005122279A

United States Patent [19]

Guess

[11] Patent Number: 5,122,279

[45] Date of Patent: Jun. 16, 1992

[54] **FERROUS DITHIONITE PROCESS AND COMPOSITIONS FOR REMOVING DISSOLVED HEAVY METALS FROM WATER**

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[73] Assignee: **Romar Technologies Inc.**, Beverly, Mass.

[21] Appl. No.: **682,129**

[22] Filed: **Apr. 8, 1991**

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[52] **U.S. Cl.** **210/717**; 210/719; 210/724; 210/757; 210/912; 423/515; 75/721; 75/725; 75/726; 75/739; 75/740; 75/741

[58] **Field of Search** 210/717, 719, 722, 724, 210/757, 763, 912; 423/515; 75/714, 719, 721, 725, 726, 739, 740, 741; 252/188.22

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[57] **ABSTRACT**

Heavy metal ions react with ferrous dithionite in acidic aqueous solution. They are reduced to metallic particles that are suitable for recycling and reuse when recovered from the acidic water. When chelating agents are present, they are deactivated by bonding to the ferrous ions. Ferrous dithionite, (FeS_2O_4) is either generated in-situ or ferrous ions and dithionite ions can be provided by other methods.

23 Claims, No Drawings

FERROUS DITHIONITE PROCESS AND COMPOSITIONS FOR REMOVING DISSOLVED HEAVY METALS FROM WATER

BACKGROUND OF THE INVENTION

This invention relates to a process for effectively and completely removing heavy metals from aqueous solutions with hydrosulfite and iron. The present invention is useful for treating metal ion containing waste waters generated by industries such as metal plating, metal surface finishing or printed circuit manufacturing.

Prior to the present invention, methods for producing ferrous dithionite (iron hydrosulfite) have been explored as a possible new way to make sodium hydrosulfite. Sodium hydrosulfite is manufactured by several methods and several hundred million pounds are used worldwide each year. It is mainly used for, 1) bleaching woodpulp for newsprint, 2) reducing textile vat dyes, and 3) reductive leaching of ferric oxide from kaolin clays. All these major uses for hydrosulfite are for whitening or enhancing the color stability of materials to which it is applied. Most iron compounds are black or dark colored, thus discouraging the use of iron hydrosulfite for any of these major applications of sodium hydrosulfite.

U.S. Pat. No. 4,076,791 discloses improvements in making iron hydrosulfite and converting it to sodium hydrosulfite. More than 90% of the iron must be removed and replaced by sodium in order to use the resulting solution for leaching kaolin. A large volume of iron precipitate is produced which absorbs and wastes a large portion of the hydrosulfite, causing this process to be uneconomical. Prior to the present invention, no commercial use for iron hydrosulfite had yet been developed and efforts to develop iron chemistry in connection with hydrosulfite were abandoned.

Ferrous sulfate has been used to stabilize a sodium dithionite solution. In Japanese Patent JP 54029897, a 2% solution of sodium dithionite was used to decolorize dyeing wastewater containing Prussian Brilliant Red H3B [23211-47-4]. Adding some ferrous sulfate to the dithionite solution improves the stability of the decolored wastewater solution. There is no mention of any interaction or involvement by heavy metals existing in this prior work relating ferrous ion to dithionite ion.

Metallic iron has long been known to react directly with certain other metals that are dissolved in acidic aqueous solutions. The iron dissolves into the acidic solution and the other dissolved metal deposits a metallic layer on the surface of the iron. Referred to as metallic replacement or cementation, this characteristic of metals has commonly been used in the commercial extraction of copper from ores and acid leaching of mine tailings. After some time, the surface of the iron is so covered with the other metal that the iron becomes unreactive and the reaction ceases.

U.S. Pat. No. 3,902,896 addresses this limitation and discloses the use of a soluble thiosulfate compound to aid the cementation of such metals as copper, silver, gold, and platinum group metals from aqueous solutions. The patent discloses that the cemented metal flakes off the base metal, exposing fresh surfaces. Two properties of thiosulfate limit its utility for this purpose. In strong acid solutions, thiosulfate decomposes to sulfur dioxide and elemental sulfur, which is colloidal and coats all surfaces it contacts. Also, dilute thiosulfate solutions are very corrosive on ferrous alloys, particularly on stainless steel materials.

U.S. Pat. No. 3,634,071 describes the use of sulfur dioxide for reducing ferric ions contained in recirculated ore leaching acid solutions. Some improvements in the cementation of copper using metallic iron were observed as relating to decreased oxidation of the iron and copper metals by ferric ions. No reference is made to dithionite. At the high sulfuric acid concentrations noted, it is very unlikely that dithionite ion could exist.

U.K. Patent Application GB 125828 A, filed Jun. 16, 1983 discloses a process for removing copper ion from solution by contacting the solution with steel wool under controlled pH conditions. The copper cements over the surface of the fixed bed of steel wool, converting only a small portion of the iron into copper. This process is commercially undesirable due to 1) the uneconomically low conversion of iron to copper, and 2) the high cost of steel wool, and 3) the high labor cost for handling the materials. The recovered copper has a lower recycling value due to the cost of processing required for separating it from the residual steel wool fibers.

Many other methods exist for removing heavy metal ions from aqueous solutions, and which are commonly practiced in the pretreatment of industrial wastewaters containing environmentally toxic metals. When dissolved heavy metal solutions are free of chelating agents, they can be effectively treated by simply admixing an alkaline or caustic compound to precipitate the insoluble metal hydroxide. Sodium hydroxide, soda ash, lime or magnesium hydroxide slurry are all used to do this.

Frequently however, complexing ammonium ions or chelating compounds such as the sodium salts of etheylenediaminetetra-acetic acid (E.D.T.A.) and others having similar properties are present. They occur as ingredients in the used plating baths, cleaners and brighteners drained into the wastewater. In such cases, it is necessary either; 1) to use a strong chemical that breaks the chelant- to-heavy metal bond and forms a stable, insoluble compound or complex of the toxic metals, or 2) to add a substance that exerts a stronger attraction for the chelant than does the toxic metal ion, to free the heavy metal to precipitate as an insoluble hydroxide. Processes of both types are currently practiced.

Sodium sulfide is used to effectively precipitate heavy metals. Its sole advantage is the extremely low solubility of most heavy metal sulfides. Most are capable of existing in the presence of even the strongest chelating agents. Undesirable aspects of using a sulfide process include the extreme toxicity of hydrogen sulfide gas, which can be generated by contacting the sulfides with strong acids. Also, metal sulfide precipitates are slimy and difficult to filter. Large quantities of flocculants and filter aids are used, generating large volumes of sludge and corresponding high disposal costs.

Sodium borohydride is a strong, water soluble reducing agent that has an advantage of producing a compact semi-metallic sludge. There are several reasons for its not having broad acceptance for heavy metal removal in waste-water treatment: 1) it is very expensive, 2) precipitated metals easily reoxidize and redissolve in the presence of dissolved ammonia, 3) dangerous concentrations of potentially explosive hydrogen gas can accumulate in the space above a reaction using sodium borohydride, and 4) at times when pH is not controlled

perfectly, reactions occurring at an elevated pH of 8 or higher give off toxic fumes of hydrogen sulfide gas, dangerous to workers and sensitive equipment.

Hydrazine is another strong reducing chemical capable of breaking a metal ion bond to chelants. It is used to a limited extent for heavy metal removal, but like borohydride, lacks widespread acceptance. Partly because it too is very expensive to use, and it too can generate dangerous volumes of hydrogen gas when acidified, hydrazine has also been placed on a list of chemicals suspected of being carcinogenic. This has been a major impediment to its industrial use.

Several compounds have been used that form insoluble metal complexes with heavy metal ions. All exert a stronger attraction to the metal ion than the chelants normally occurring with the metals in the wastewaters. Insoluble starch xanthate is one such material, reportedly effective at complete removal of dissolved metal from the water. Its drawback is its generation of huge volumes of sludge, which retains a high water content and costs the user a severe penalty for disposing of same as a hazardous waste.

Another such complexing agent has gained widespread use. Known in the water treatment trade as D.T.C., or as dimethyldithiocarbamate, it is fairly effective at completely removing the heavy metal ions from solution. However, D.T.C. is quite expensive and generates quite high volumes of sludges which are unusable for current recycling methods. The precipitate is light in density and difficult to gravity settle, and it also gives off a foul smelling odor.

The conventional wastewater treatment process, perhaps most frequently used by the largest number of industries, uses ferrous sulfate heptahydrate powder. Ferrous ion is substituted at a controlled acidic pH of about 2 to 3, to replace toxic heavy metal ions that are bonded by chelating agents. This allows the heavy metal ions to be rendered insoluble as hydroxides which are precipitated from an alkaline solution.

In the presence of strong chelants or free ammonia dissolved in alkaline solutions, a large excess of this source of ferrous ion is required. Normally, 5 to 10 ferrous ions are added for each copper ion being removed from chelated wastewaters. In heavily chelated streams, as many as 25 to 30 ferrous ions per heavy metal ion may be required in order to prevent the chelants from dissolving the heavy metal hydroxide. The commercial ferrous sulfate has seven waters of hydration and is only about 20% iron by weight. In some cases, over 100 pounds of ferrous sulfate powder is added to the wastewater for each pound of chelated or ammoniated copper removed generating 60 to 80 pounds of sludge.

In typical treatment systems, each additional pound of iron used adds about 4 pounds to the weight of sludge made. This can be reduced to about 3 pounds of dry sludge per pound of iron if a sludge dryer is used. When ferrous sulfate is dissolved into wastewater, it causes acidity in the water. Each mole of iron introduced this way requires using two moles of sodium hydroxide to neutralize the iron and form ferrous hydroxide. Therefore, when large excess amounts of ferrous sulfate heptahydrate powder are used, the total chemical cost for treatment is compounded. Higher hazardous waste sludge disposal costs are also incurred.

Sodium hydrosulfite is a strong, water soluble reducing agent. It can reduce heavy metal ions to zero valance and produce a metallic precipitate that is resistant to reoxidation. Commercial products are available as either a 13-14% buffered solution or as 85-95% powder. However, sodium hydrosulfite solutions are quite unstable and have a very short shelf life. Storage tanks need to be refrigerated and inert gas blanketed. The powdered products have an acrid odor and a dust that is extremely irritating to a worker's eyes and nose. Damp or wet powder can spontaneously ignite into flames, creating a toxic smoke of sulfur dioxide. These objectionable properties have prevented sodium hydrosulfite products from gaining any major share of usage for heavy metal removal or for wastewaters treatment in general.

It would be highly desirable to provide a simple, non-hazardous process for removing heavy metals from aqueous solutions that would;

1) use non-hazardous materials in a safe and simple method that does not give off foul odors or toxic or explosive gases or irritating dust, and,
2) achieve very low levels of residual toxic heavy metal ions resulting in environmentally compliant wastewater for discharge to the sewer, and,
3) minimize hazardous waste sludges requiring regulated transport and expensive disposal, and,
4) produce dense, fast settling or easily filterable solids with high metal concentrations suitable for recycling and reuse of the metals.

SUMMARY OF THE INVENTION

In accordance with the present invention, ferrous dithionite is reacted with heavy metal ions in acidic water in a novel process which requires and uses both ferrous and dithionite ions. The dithionite ions reduce the heavy metal ions to zero valence in the presence of ferrous ions. When a chelating agent is present in the acidic water, the ferrous ions bind to the chelant compound replacing the heavy metal ions previously bonded, in the presence of dithionite ions. The reducible heavy metals form metallic particles that are suitable for economical recycling and reuse. The heavy metallic particles are recovered by gravity settling or filtering from the acidic solution.

In one embodiment of this invention, the pH of the resulting solution can be raised to between 9 and 9.5 to precipitate the remaining quantity of unbound ferrous ions and other unreducible heavy metals as insoluble hydroxides.

Ferrous dithionite is preferably generated in-situ by a reaction between metallic iron particles and bisulfite ions in the acidic heavy metal solution. The same resulting composition and beneficial effects can be obtained by several routes or alternative materials. Adding both a soluble dithionite compound and a soluble ferrous compound, either separately or in a combined form, into the acidic solution of heavy metals can achieve the desirable result and comprise the process of this invention.

Such other sources of dithionite and ferrous ions can include, for example, sodium hydrosulfite and ferrous sulfate. When combined together in the presence of dissolved heavy metal ions in an acidic aqueous solution, dithionite and ferrous ions are equally useful in precipitating heavy metals, whether generated in-situ or each is added to the reaction from separate origins.

In one aspect of this invention, a novel reactant composition is provided by this invention which is reactive to produce ferrous dithionite under acidic conditions. The composition comprises a dense slurry of iron parti-

cles, hydrated crystals of an alkali metal sulfite and a saturated alkaline aqueous solution of the alkali metal sulfite having a pH in the range of about 9 to 12. The proportions of the iron particles, alkali metal sulfite and alkaline water used to make up this composition are such that 0.1 or more moles of sulfite are present with each mole of iron, and enough water is added to produce a pumpable fluid slurry. If less than sufficient water is added, the mixture becomes solid. If too much water is added, then too much of the alkali metal sulfite is dissolved in the liquid phase and the iron particles will separate and settle on the bottom of the container. The preferred volume of saturated solution of dissolved alkali metal sulfite is having the liquid phase just sufficient in volume to submerge the solids contained in the slurry.

DESCRIPTION OF SPECIFIC EMBODIMENTS

In accordance with the method of this invention, ferrous dithionite is utilized to precipitate heavy metals from aqueous solutions. In a preferred method, iron particles and a bisulfite compound or suitable bisulfite precurser are admixed with a slightly acidic aqueous solution containing dissolved heavy metal ions. The metallic iron reacts with the bisulfite ions, producing ferrous dithionite in the presence of the heavy metal ions and in accordance with Equation I.

$$Fe^{\circ} + 2(HSO_3)^- + 2H^- \rightarrow (Fe)^{++} + (S_2O_4)^= + 2H_2O \quad \text{(Equation 1)}$$

Under the slightly acidic condition provided, the dithionite ions react instantly with and reduce the heavy metal ions present to zero valence metallic particles. The dithionite ions are thus oxidized and become regenerated as reactive bisulfite ions, as shown by Equation 2.

$$(S_2O_4)^= + (HM)^{++} + 2H_2O \rightarrow (HM)^{\circ} + 2H^+ + 2(HSO_3)^- \quad \text{(Equation 2)}$$

Therefore as shown by Equations 1 and 2 wherein HM is a heavy metal, this reaction is self regenerating in the bisulfite ion when the reactions are performed simultaneously and in-situ. This method provides a very efficient utilization of the bisulfite ion or its suitable precursor. The bisulfite-dithionite redox cycle promotes the indirect reducing reaction between the metallic iron and the heavy metal ions.

When chelating agents are present in the aqueous solutions being treated the ferrous ions produced in Equation 1 also are beneficially utilized by bonding to chelating agents [CA=] which were previously bound to heavy metal ions. This reaction is defined by Equation 3 as follows.

$$(Fe)^{++} + [CA=]^{\circ}(HM)^{++} \rightarrow (HM)^{++} + [CA=]^{\circ}(Fe^{++}) \quad \text{(Equation 3)}$$

The reaction defined by Equations 1, 2, and 3 are effected at a pH between about 1 and 7, preferably between about 3 and 6. A practical trade off between faster reactions at lower pH values versus more efficient use of reactants at higher pH values is required which may result in varying choices from solution to solution being treated. The upper pH limit may also be governed by the tendency to form insoluble metal hydroxides at pH values approaching neutral between 5 and 7. The higher the concentration of dissolved metals, the lower the pH at which the insoluble hydroxides begin appearing. It is desirable to avoid hydroxide formation prior to heavy metal recovery since it is difficult to separate the hydroxide from the precipitated heavy metal.

Metal ions generally have a more positive oxidation potential when bonded to a chelate complex. Upon being dissociated from the chelant complexes by the ferrous ion, the heavy metal ions have a more negative oxidation potential and are therefore more reactive with and more readily reduced by the dithionite ion. This mutual and beneficial interaction between the ferrous ion, the chelated heavy metal ion, and the dithionite ion is important and useful in the present invention when chelating agents are present.

The present invention permits the use of a reactor vessel of suitable design which allows unreacted iron particles to settle from the outflowing liquid and to be returned to the agitating zone. The finely divided heavy metal particles produced in the reaction are carried along with the outflowing liquid. By gravity settling this stream, a thick slurry of the heavy metals can be recovered. Filtering this slurry and drying the recovered solids produces a concentrated, highly metallic form of material, suitable for recycling and reuse of the metals.

The slightly acidic liquid obtained after removal of iron and heavy metal particles can be neutralized using a caustic compound to a pH in the range of 9 to 12. This precipitates the insoluble hydroxides of all remaining dissolved and unreduced heavy metals. The excess dissolved iron that is not bonded to chelants co-precipitates with the other metals as ferrous hydroxide. While this recovery step can be advantageous, it is not essential to the process of this invention.

These reactions are shown by Equation 4 and Equation 5, respectively.

$$(HM)^{++} + 2(OH)^- \rightarrow HM(OH)_2 \quad \text{(Equation 4)}$$

$$(Fe)^{++} + 2(OH)^- \rightarrow Fe(OH)_2 \quad \text{(Equation 5)}$$

In accordance with the process of this invention, ferrous dithionite is utilized to reduce heavy metal ions to metallic particles of said heavy metals. By the term "heavy metal" as used herein, is meant a metal having:

1) an atomic weight heavier than calcium, that is, greater than 40.08, and

2) its compounds exhibit biological toxicity when released into the environment.

Representative heavy metals include copper, nickel, tin, lead, cadmium, mercury, chromium, zinc, manganese, silver, gold, platinum, palladium, and mixtures thereof.

As set forth herein, one precursor raw material source of ferrous dithionite hereunder comprises the novel composition of this invention reacting at an acidic pH. However, it is to be understood that the process of this invention using ferrous dithionite for removing heavy metals from water can be utilized regardless of the source or form of the ferrous dithionite, or bisulfite used to react with the metallic iron particles, and regardless of the source or form of the metallic iron particles used.

For example, a solution of acidic sodium or potassium bisulfite can be made up by dissolving in water to a desired concentration, sodium or potassium metabisulfite. Likewise, sodium hydroxide or potassium hydroxide solutions could be treated with liquid or gaseous sulfur dioxide to produce a usable solution of alkali metal bisulfite. Any or all of these ingredients can be

added separately or in combination directly into the heavy metal containing aqueous solution into which the metallic iron is directly added.

In another method, a ferrous dithionite solution consists of ferrous ions and dithionite ions, each provided by separate means. The dithionite ions can be provided from sodium hydrosulfite and the ferrous ions can be provided from ferrous sulfate. When both such materials are added, either combined or separately, to an acidic heavy metal solution, the desired results of the process of this invention occurs.

Similarly, when bisulfite ions are exposed to the reducing influence of sodium borohydride under certain conditions, dithionite ions are produced. When such dithionite ions are admixed with ferrous ions from any source and then such materials as result are admixed with heavy metal ions in acidic aqueous solution, the process of this invention is obtained.

Alternately, when metallic zinc is contacted with an aqueous solution containing dissolved bisulfite ions, such as occurs when sulfur dioxide is dissolved in water, dithionite ions are produced. When such dithionite ions are produced in the presence of heavy metal ions and ferrous ions in aqueous solution or added into such a solution containing both heavy metal and ferrous ions, the process of this invention is obtained.

A novel reactant composition is provided by this invention which is reactive to produce ferrous dithionite under acidic conditions. The composition comprises a dense slurry of iron particles, hydrated crystals of an alkali metal sulfite and a saturated alkaline aqueous solution of the alkali metal sulfite having a pH in the range of about 9 to 12 as controlled by added alkali metal hydroxides.

The proportions of the iron particles, alkali metal sulfite and alkaline water used to make up this composition are such that more than about 0.1 moles of sulfite are present with each mole of iron, and enough water is added to produce a pumpable fluid slurry. If less than sufficient water is added, the mixture forms a hard solid. If too much water is added, then more of the alkali metal sulfite is dissolved in the liquid phase and the iron particles will settle and pack in a layer on the bottom of the container. The preferred volume of saturated solution of dissolved alkali metal sulfite is having the liquid phase just sufficient in volume to cover the solids.

While the size of the iron particles is not critical to the present invention, it is desirable to use particles of a size between about −50 mesh and +300 mesh, preferably between about −100 mesh and +200 mesh. Generally, the molar ratio of sulfite to iron is between about 0.1 and 10.0, and preferably between about 0.5 and 4.0 for each mole of iron.

When this composition is added to an adequate volume of sufficiently acidic water, bisulfite ion is formed from the sulfite ion by Equation 6;

$$(SO_3)^{=} + H^{+} \rightarrow (HSO_3)^{-} \qquad \text{(Equation 6)}$$

and ferrous dithionite is made therefrom to substantially or completely react the iron particles in accordance with Equation 1.

When the alkali metal in the sulfite is either sodium or potassium, a nominal excess of sulfite can be desirable to achieve optimum results. The optimum pH of a final reaction mixture will depend upon the intended use for the ferrous dithionite so generated. When dissolved heavy metals are present to be reduced by the dithionite, the reaction pH should be controlled within a range of about 1 to 7, preferably between about 3 and 6.

One particularly preferable method of this invention comprises feeding an excess of iron particles into a vigorously agitated reactor. A slurry density of suspended metallic iron as high as 100 grams per liter or higher can be produced to provide expansive reactive surface area to the solution, and increasing the rates at which the iron dissolving reactions occur. The bisulfite reagent or suitable precursor is fed at a fixed ratio to the quantity of dissolved heavy metal contained in the feeding aqueous solution. As either the flow or the concentration of dissolved heavy metals may increase or decrease, the feed rate of bisulfite component is varied proportionately.

The process of this invention produces only a small fraction of the amount of metal hydroxide, hazardous waste sludge as compared to existing wastewater treatment technologies, particularly when compared against the conventional method for using ferrous sulfate, which requires dissolving up to 25 times as much iron as does this process. Conventional prior art methods of either settling or filtering or both are usable for removing the metal hydroxide sludge from the final wastewater effluent produced by the process of this invention.

The following examples illustrate the present invention and are not intended to limit the same.

Four experiments were performed with spent electroless copper bath having an initial pH of 9.2 (Examples 1 through 4), but then acidified to a pH of 4.0 with concentrated sulfuric acid and diluted with water to a final copper concentration of 100 Mg/L. In each test, 1.00 gram of grade 0 steel wool was inserted into a 4.0 cm length section of glass tubing with an inside diameter of 1.0 cm, creating a fixed bed with a volume of 3.1416 cc. An adjustable flow micro-metering pump was used to feed exactly 10 liters of the prepared copper solution through the bed of steel wool at a flow of 200 mls per hour over a 50 hour period.

Five other experiments were performed using atomized iron powder having particle sizes in the nominal range between −100 mesh and +300 mesh, and having a purity of greater than 99 percent iron,(Examples 5 through 9). A copper solution was made up from several source solutions obtained from printed circuit processes. This test solution contained portions of ammoniacal etchant bath, cupric chloride etchant bath, electroless copper plating bath, sulfuric acid-hydrogen peroxide etching bath, sodium persulfate etching bath, and copper sulfate electroplating bath in the approximate proportions to approximate typical waste and disposed of into a plant wastewater system. The final mixed solution was diluted to 200 Mg/L copper and adjusted to pH 3.

The final example given comprises a test using the composition of this invention in a demonstration of one method of this invention.

EXAMPLE I

In the first test, the feed solution was pumped through the steel wool with no further changes made (without bisulfite). The outflowing liquid was collected and accumulated in a 5 gallon container. Over the period of the test, some removal of copper was visually evident, as the appearance of the entire steel wool mass gradually turned from shiny steel color to copper colored fibers. At the end of the test, the copper content of the 10 liters of collected effluent liquid was tested by

atomic absorption (AA) spectrophotometry and contained 72.0 Mg/L copper, indicating that 28% of the copper in the feed was collected on the steel wool.

EXAMPLE II

In another test, 3.00 grams of sodium metabisulfite ($Na_2S_2O_5$) were added and dissolved into 10 liters of the prepared copper feed solution of Example I. This modified feed solution was then fed at 200 mls per hour through a new steel wool bed made the same way as in Example I.

Within a few minutes after starting the feed, a difference was observed on the appearance of the steel wool compared to the first experiment. Only the feed end portion of the steel wool bed, approximately the first ½ cm, showed any color effect of copper. As the run proceeded, it was evident that rather than copper covered fibers of steel wool as obtained in the first test, a compact layer of copper particles was forming and being held together by the tightly packed steel wool fibers behaving as a filter. The short length of the coloration zone revealed that an extremely fast reaction rate was being observed.

After about 2 hours of operating this test, the effluent from the bed was spot sampled and AA tested for copper, finding only 0.02 Mg/L Cu in the effluent. This same result was repeated after 10 hours, 20 hours, and 30 hours of run time. At 40 hours, the effluent spot sample contained 13 Mg/L of copper and only about ½ cm of steel wool remained.

The copper solids were packed up against this plug of steel wool in a mass occupying only about 0.4 cm of length. The bottom cm of the tube was void of solids and contained entering feed solution only. The run was continued to the end of the 10 liters of feed, at which time there was no evidence of fibrous material left from the steel wool. There also was no magnetically responsive material in the solids remaining in the tube. A compact slug of copper solids about 0.5 cm long was left, held in position by the cotton plug used to hold the steel wool in the end of the tube.

After the run was completed, the 10 liters of effluent solution was stirred and sampled and AA analyzed, indicating 11.1 Mg/L of dissolved copper. A rise of about 1 unit was detected in the pH of this solution, measured at 4.9 versus 4.0 for the feed.

EXAMPLE III

Another test was performed by feeding a bisulfite solution in the absence of copper, prepared by dissolving 3 grams of sodium metabisulfite in water and diluting to 100 mls volume and adjusting its pH to 4. This solution was fed in about 30 minutes at 200 mls per hour through a new steel wool column made the same as in the prior tests. The effluent of the bed was directed into a 10 liter quantity of the prepared copper containing solution of Example I, with gentle stirring applied. About fifteen minutes after starting, a change in the copper solution was noted, changing to a greener color. The darkening continued until about near the end of the run, at which point the solution had turned almost black and showed evidence of particulate solids being formed in suspension.

By the end of the 30 minute feeding cycle, discrete copper colored solid particles had formed in the 10 liters of liquid being treated. A further 100 ml of flushing water was passed through the remaining bed materials and into the mixing solution. By the end of that time, about another half hour, dense particles of copper were visible in the stirring 10 liters of liquid. After settling for one hour, a sample of supernatant liquid put through a p5 Fisher filter paper was tested and found to contain 38 Mg/L of dissolved copper.

The remaining steel wool fibers occupied only about ⅓ of the tubular space and had nearly lost the fibrous shape, becoming a more a mass of fine black particles. Upon removing the remaining iron solids from the glass tube, rapid air oxidation took place, generating exothermic heat and rapidly forming rust-like material. This example shows that by contacting the bisulfite with iron prior to contacting copper produced a product capable of precipitating copper.

EXAMPLE IV

The procedure followed in making up the bisulfite containing copper solution fed to the test of Example II above was conducted except in the absence of iron. An equal amount of bisulfite as used in the Example III test above was added into a 10 liter sample of the prepared copper containing solution. Other than a slight darkening of color toward a blue greenish tint, no visible reaction or other change occurred. No solids were formed and no removal of copper was effected by combining the bisulfite and dissolved copper in the same solution in the absence of metallic iron particles.

EXAMPLE V

This test was conducted to determine the influence exerted by chelating agents and ammonium ions in the feed solution. One liter of the new 200 Mg/L mixed copper solution was pH adjusted to 9.0 by adding sodium hydroxide with vigorous mixing. Copper hydroxide solids were precipitated and after 15 minutes of mixing, a drop of commercial anionic polymer was added to flocculate the precipitated solids. After settling 15 minutes, a liquid sample was withdrawn and put through a Fisher P5 filter paper and analyzed for dissolved copper. A concentration of 136 Mg/L dissolved copper indicated that 68% of the copper in the feed was effectively chelated or complexed.

EXAMPLE VI

This test was designed to measure the efficiency of removing copper from the solution using the simple cementation reaction with iron particles in the absence of bisulfite or dithionite. One liter of solution of Example V was placed in a beaker and provided with an overhead mixer. An equimolar quantity of iron particles weighing 0.176 grams was added to the solution and mixed for 1 hour. During that time, a coating of deposited metallic copper could be observed forming on the surface of the iron particles. After mixing for the 1 hour period, a sample was withdrawn and filtered and analyzed, indicating that 174 Mg/L or 87% of copper was still dissolved. After mixing for a second hour, another filtered sample indicated 170 Mg/L of copper still in the solution, thus completing this experiment. This result indicated an uneconomically low efficiency of about 15 percent for the conversion of surface iron to copper by cementation in what is also an impractically slow reaction.

EXAMPLE VII

This experiment was carried out using another one liter sample of the subject feed solution of Example V. 1.0 gram of sodium metabisulfite was added with vigor-

ous mixing until dissolving was complete. then 0.176 grams of iron powder was added. After about 2-3 minutes, a visually different result was observed happening from that of the second test. The suspended iron particles more nearly retained their grey-to-black color and tiny particles of copper/reddish material turned the solution to a copper-like color. After 15 minutes of mixing, a sample was withdrawn and filtered and analyzed. A dissolved copper content of 22 Mg/L was measured on the 15 minute sample, indicating 89% removal of copper from the solution.

EXAMPLE VIII

In a further experiment of the method of Example VII, all conditions were kept the same except that twice as much iron powder was added. After 15 minutes of mixing, a 10 ml sample was withdrawn and filtered and analyzed, obtaining a result of 0.05 Mg/liter of dissolved copper. A pH of 4.8 was measured on the reacted solution. A strong permanent magnet was placed against the bottom of the beaker and then moved up the side of the glass attracting the unreacted iron particles which were observed to be black and not coated with a layer of deposited copper.

EXAMPLE IX

In this experiment, the resulting beaker of the experiment of Example VIII was settled for 15 minutes and the liquid portion was decanted off, leaving the solids in the bottom covered with a few milliliters of liquid. A new one liter portion of the subject feed solution was added to these contents and instantly, a new portion of 1 gram of sodium metabisulfite was added and dissolved with vigorous mixing. After mixing 15 minutes, a sample was filtered and analyzed, finding 39.2 Mg/L dissolved copper remaining in solution. No magnetic iron was found remaining in the copper colored metallic solids. The total copper removed in the two reactions by the one charge of 0.352 grams of iron is 360.65 milligrams, which calculates as an efficiency in the use of the iron at 90.16 percent.

EXAMPLE X

This example illustrates the formulation and use of the reactant composition of this invention. As a pumpable slurry, hydrated sodium sulfite crystals and iron particles are suspended in a saturated alkaline aqueous sodium sulfite solution. A preferable choice of starting materials includes technical grade anhydrous sodium sulfite crystals, atomized iron powder, sodium hydroxide, and water.

Since sodium sulfite is known to form a heptahydrate crystal in the presence of sufficient moisture, the procedures used herein must take into account the propensity for the anhydrous sulfite to absorb and bond this water into its crystalline matrix. The consequence of not properly allowing for this property is the potential for creating a rock, hard, concrete-like mass of the materials.

One successful mixture employing the above precautions was composed of 126 grams of anhydrous sodium sulfite which is added into 200 mls of water with continuous agitation. About 1 ml of 50% sodium hydroxide is added to increase the pH to about 12. Approximately 1 hour of steady mixing is required to hydrate the sulfite. Seven moles of water or 126 grams are taken in the liquid, which can be expected to dissolve enough sodium sulfite heptahydrate to become a saturated solution. At 20% solubility of sodium sulfite, this results in a mixture containing about 202.7 grams of sodium sulfite heptahydrate, 24.7 grams of dissolved sodium sulfite and about 98.7 grams of free water in the liquid solution phase. About 28 grams of atomized iron powder is admixed into the sulfite slurry, creating a more or less homogeneous dispersion of the iron throughout the sulfite crystal mass.

This mixture is found to remain pliable and pumpable if kept in a sealed container that prevents evaporation of the solution. The molar ratio of this example is to provide two moles of sulfur for each mole of iron. More or less iron can be added in variations upon the example without materially affecting the physical characteristics of the composition. The intended purpose for this composition is to provide in one feasible substance the necessary ingredients for implementing the process of this invention, by adding said composition into an acidic solution of dissolved heavy metals.

An experiment wherein such a composition was used for this purpose was carried out on a batch of 10 liters of the feed solution of Example V, which contained a total of 2000 milligrams of dissolved copper. A 45 gram portion of a well mixed slurry composition prepared in accordance with the above procedure (calculated to contain 3,54 grams of iron) was added directly to the 10 liter batch of feed having a preadjusted pH of 2.5. Vigorous agitation was provided for a 15 minute reaction time.

Copper solids were produced and black, magnetic iron particles were observed in the final mixture. A sample was filtered and analyzed and found to contain 0.45 Mg/L of dissolved copper. After the solids settled for 10 minutes, a one liter sample of clear liquid was poured into a beaker. Caustic soda was added to pH 9.0, precipitating ferrous hydroxide and any other insoluble heavy metals. A filtered sample of the final alkaline liquid tested non-detectable for copper, indicating the dissolved copper concentration was below 0.02 Mg/1.

I claim:

1. The process for removing dissolved heavy metal from an aqueous solution containing said heavy metal which comprises admixing said solution with a source of ferrous and dithionite ion in solution at a pH between about 1 and 7 to effect precipitation of said heavy metal and recovering said precipitated heavy metal.

2. The process of claim 1 wherein the pH is between about 3 and 6.

3. The process of claim 1 wherein said ferrous ion is produced in situ from iron particles.

4. The process of claim 1 wherein said ferrous ion source is ferrous dithionite.

5. The process of claim 1 wherein said ferrous ion source is ferrous sulfate.

6. The process of claim 1 wherein said ferrous ion source is ferrous bisulfite.

7. The process of claim 1 wherein said ferrous ion source is ferrous sulfite.

8. The process of claim 1 wherein said ferrous ion and dithionite ion are produced in-situ with a pumpable composition for adding to an acidic medium for producing ferrous dithionite in said acidic medium, which composition comprises an alkaline slurry of iron particles, hydrated crystals of an alkali metal sulfite, and an alkaline aqueous saturated solution of said alkali metal sulfite and an alkali metal hydroxide, having a pH between about 9 and 12, wherein the molar ratio of said sulfite to iron contained is between about 0.1 and 10.

9. The process of claim 1 wherein said dithionite ion is produced in-situ by reacting bisulfite ion and iron particles.

10. The process of claim 1 wherein said dithionite ion produced in-situ by reacting bisulfite ion and zinc particles.

11. The process of claim 1 wherein said dithionite ion is produced in-situ by reacting bisulfite ion and aluminum particles.

12. The process of claim 1 wherein said dithionite ion is produced in-situ by reacting bisulfite ion and sodium borohydride.

13. The process of claim 1 wherein said dithionite ion source is sodium hydrosulfite.

14. The process of claim 1 wherein said dithionite ion source is zinc hydrosulfite.

15. The process of claim 1 wherein said dithionite ion source is aluminum hydrosulfite.

16. The process of claim 1 wherein said heavy metal is copper.

17. The process of claim 1 wherein said heavy metal is at least one metal selected from the group consisting of copper, tin, lead, nickel, chromium, cadmium, mercury, silver, gold, platinum, and palladium.

18. The process of claim 3 wherein said iron particles are of a size between about −10 mesh and +300 mesh.

19. The process of claim 9 wherein said source of bisulfite ion is an alkali metal meta-bisulfite.

20. The process of claim 9 wherein said source of bisulfite ion is an alkali metal sulfite.

21. The process of claim 9 wherein said source of bisulfite ion is sulfur dioxide in water.

22. The process of claim 9 wherein said source of bisulfite ion is sulfur dioxide with an alkali metal hydroxide.

23. The process of claim 1 wherein a ferrous containing solution is obtained after recovering said precipitated heavy metal and raising the pH of said ferrous containing solution to precipitate ferrous hydroxide and recovering said ferrous hydroxide.

* * * * *

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[54] LAUNDRY WASTE WATER TREATMENT AND WASH PROCESS

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[58] Field of Search ..... 8/158; 68/13 R, 18 R, 68/18 F, 183, 207

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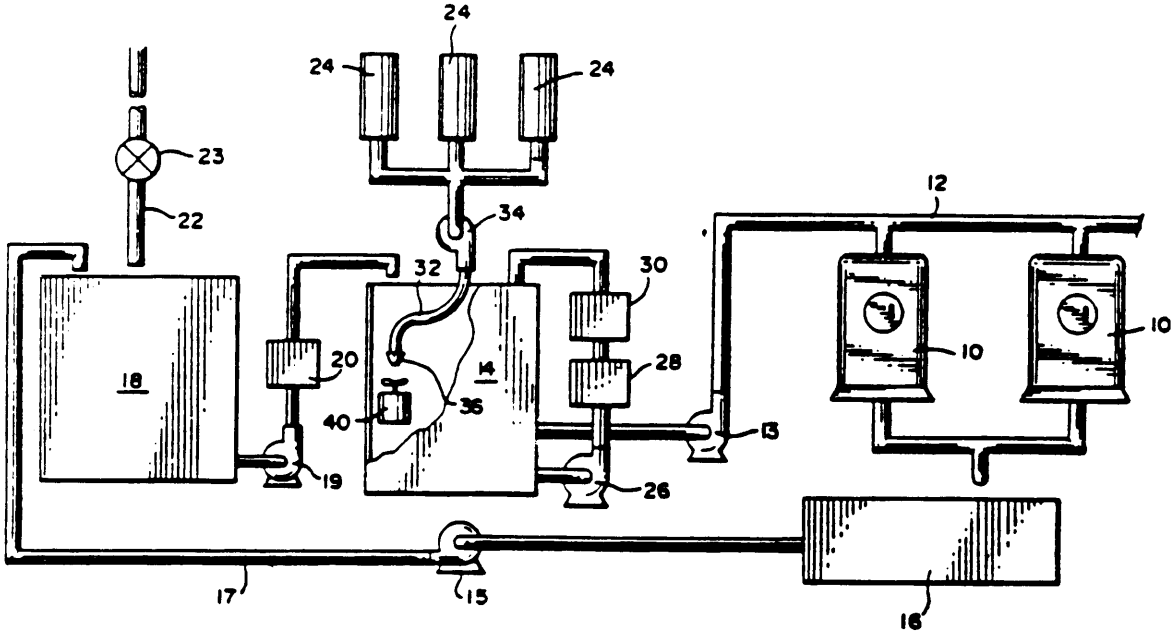
[57] ABSTRACT

A method and apparatus for washing laundry without hot water and detergent using a closed loop ozonated wash water system wherein wash water maintained in a storage tank is ozonated by an ozone generator prior to use in a washing machine. The spent wash water is collected, filtered and reused thereby eliminating waste water disposal problems and resulting in considerable water and energy savings. The ozone generator includes a unique air flow configuration to maximize ozone generation resulting in a high efficiency washing system.

19 Claims, 2 Drawing Sheets



LAUNDRY WASTE WATER TREATMENT AND WASH PROCESS

BACKGROUND OF THE INVENTION

The present invention relates to a laundry waste water treatment and wash process and in particular to such a process using only ozone as the cleaning and disinfecting product.

Typically ozone is generated when oxygen, O_2, is exposed to ultraviolet light or an electrical charge which breaks it down to individual oxygen molecules. Some of these recombine into ozone, O_3. Ozone is the triatomic, allotropic form of oxygen O_2. It is an unstable gas with a pungent odor and it is normally produced in low concentrations. The chemically active O_3 then acts as an oxidant to break down compounds it comes in contact with.

When ozone is created by an ozonator, air is subjected to an electric discharge commonly known as a corona which is produced by an electric charge between parallel or concentric electrodes separated by a dielectric to prevent a spark discharge. Normally a blower forces air between the electrodes and when an alternating potential from 6,000–30,000 volts, depending upon the thickness of the air space and the dielectric material, is applied to the electrodes, the part of the oxygen in the air is transformed into charged oxygen atoms, ions, which conduct the electric current. Some of these ions recombine to form pre-atom molecules O_3 or ozone. Because the ozone is unstable, it is important to remove the ozone as quickly as possible after it is produced and normal ozonators provide a minimum air velocity for sufficient operation to remove the ozone from the electrodes. Increasing the frequency of the power supply to the ozonator increases both the current and the yield of ozone; however, very high frequencies often require water cooling of the electrodes. Because of its instability, the ozone must be generated at the point of application and prior art systems often do not produce enough ozone for a particular application.

Since ozone is a powerful oxidant, it is well-known as a sterilizing and preserving agent as well as a chemical oxidizing agent. Among the uses for ozone are the sterilization and preservation of foods such as cheese, eggs, meat, poultry, fruit and so forth. Using ozone as a food preservation agent was known in the Republic of Germany in the early 20th century. It is also well-known in Australia to preserve meat using ozone in the mid-1930's. Ozone is well-known in the purifying and cleaning of water for a variety of purposes including drinking, bathing, cleaning and so forth.

Ozone also is used to control airborne organics, bacteria and viruses by chemically reacting with them. This makes ozone useful in health care applications as a disinfectant such as patient and operating rooms, physical therapy rooms, laundry and disposal rooms, food service industries, hotels, restaurants, livestock industries among others.

The prior art has recognized the usefulness of ozone with laundry washing processes. For example, Japanese Patent No. 2,149,293 relates to a wet clothes washing unit comprising a washing tank, a foaming device with a nozzle for dispersion of bubble generation and an ozone generator for feeding ozone containing air into the nozzle. The ozone is ejected in the form of bubbles through a porous plate which is transmitted to the wash water and laundry which helps clean the laundry without mechanical stirring to remove stains by a bleaching action. Spanish Patent No. 2,006,978 relates to an ozone generator for washing machines having an internal electrode encapsulated in the glass tube and a coaxial metal tube as an external electrode. Air is drawn by a pump over the generator electrode and passed into the wash bath. Japanese Patent No. 86-218,645 describes an electric washing machine with a built in bleaching function which incorporates an ozone generator and air diffuser pipe for blowing ozone into the washing machine to bleach clothes without using a bleaching agent. Belgian Patent No. 899,577 discloses a washing machine which agitates clothes with compressed air and ozone blown into the washing chamber. German Patent No. 3,232,057 discloses a washing machine with an ozone generator to kill bacteria using an ozone atomizer spray and feed channel which lead into the cleaning fluid vessel and acts during the rinsing phase. Another German Patent No. DE 3,007,670 describes a detergent free laundering process of textiles using an aqueous solution of bromide or bromic acid and ozone.

The present invention relates to a laundry waste water and wash treatment process wherein water is continually recycled and filtered in a washing machine system using ozone as the primary disinfecting, cleaning and bleaching agent. With this system, it is not necessary to use conventional detergents and soaps which make the water unusable except for an initial cleaning process. The process contemplates recycling the water, both during the cleaning cycle and the rinse cycle, without adverse effects to the washing process. Rather, ozone washed laundry exhibits a high quality of cleanliness and freedom from bacteria as well as providing an aesthetically clean looking and smelling laundry product.

In a preferred embodiment, water is recycled from a collection sump and is pumped to a storage tank where it is stored until it is needed for a wash cycle. When a wash cycle begins, the water is pumped from the storage tank, through a filtered line into a holding tank. The water is the holding tank is treated with ozone which is entrained into the holding tank water as it is being stored. The water in the holding tank is kept in a continual state of flow by being pumped from the tank bottom through a filter and returned to the top of the tank. When a wash cycle is activated, water is pumped directly to a washing machine or machines for use in a conventional wash cycle. After the wash cycle is complete, the water is drained into the sump and a rinse cycle is initiated by pumping additional water from the holding tank into the machines. With the present system there is no need for the water to be heated thereby enabling the fluid to be kept in a closed cycle system. Additional water is periodically added to either the storage tank or holding tank to compensate for the loss of water in the system due to evaporation, spillage and to replace the water removed by the wet laundry.

With the present system, using recycled water, water savings is considerable. When used in commercial and institutional locations, millions of gallons of water per year can be saved. The problem of eliminating waste water and the treatment of this water which in previous systems would eventually find its way back into the ecological water supply is eliminated. The ozonated wash water eliminates the use of soap and other sour and toxic chemicals and the resulting environmental degradation caused thereby. Not least of all, the present

system increases the capacity of the washing machines in use, eliminates the use for hot water and generally greatly reduces the cost of laundry operations.

Among the objects of the present invention are the provision of an ozone laundry waste water treatment and wash system which saves water, eliminates the need for hot water, soap and chemicals and greatly reduces the costs of operation of the various systems.

These and other objects will become apparent with reference to the following drawings and specification.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a closed loop laundry waste water treatment and wash system in accordance with the present invention.

FIG. 2 illustrates a corona discharge unit used in the system of FIG. 1.

FIG. 3 illustrates a detail of the unit of FIG. 2.

FIG. 4 is a top plan view of an ozonator used with the system of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, the laundry waste water treatment and wash process includes a series of washing machines 10 such as are found in a commercial laundry institution, laundromat or similar establishment. Each machine is capable of being operated independently of the other and is supplied with water through a water supply line 12 connected to a water holding tank 14 which pumps the wash water into the machines 10 using a supply pump 13. The washing machines 10 are drained into a sump 16 which collects the waste water for recycling. After a wash cycle is completed, the water from the sump 16 is pumped by a sump pump 15 or gravity fed through a resupply line 17 to a storage tank 18 where it is collected. Prior to the initiation of a wash cycle, the water from the storage tank 18 is fed by a pump 19 through a filter 20 into the holding tank 14. A supply of fresh water may also be added through line 22 from a source (not shown) through a suitable valve 23 to replace the water which is lost during the wash cycle due to spillage, evaporation and the wetting of the laundry being washed. The holding tank 14 is provided with at least one and preferably a series of ozonators 24 which inject ozone into the water in the holding tank 14 at a controlled rate.

The ozone is entrained from the ozonators 24 through an ozone supply line 32 by an ozone pump 34 into the holding tank 14 using a nozzle 36 which directs the ozone against a rotating impeller 38 attached to and driven by a motor 40. The impeller 38 aids in thoroughly mixing the ozone within the water held in the holding tank 14. It will be appreciated that the motor 40 may be a submersible type or may be located outside the holding tank 14 with a suitable mechanical connection to the impeller 38.

The water in the holding tank 14 is continuously circulated using a recirculation pump 26 which pumps water from the bottom of the holding tank 14, through filters 28 and 30, and back into the top of the tank 14. This recirculation of the water, continuously cleans the water using the filters 28 and 30 and also creates a continuous agitation of the water in the holding tank which further aids in mixing the ozone in the water being stored in the holding tank 14.

Referring to FIGS. 2 and 3, the ozonators 24 are formed of a plurality of corona discharge units 50. Each unit includes an evacuated glass envelope 51 which is generally cylindrical in shape having closed ends 52 and 54. The interior of the glass envelope 51 includes a permanently fixed electrode 56 having conductive leads 58 which are connected to a high voltage transformer (not shown) having a high voltage output, for example 10,000 volts. The interior of the envelope 51 is filled with an inert gas such as argon or the like or a combination of such gases. The outside surface of the glass envelope 51 is formed with a helical rib 55 extending the length of the envelope. The rib 55 ma be glass integrally formed with the outside of the envelope or may be a teflon wrap or other similar material adhered to the outside of the envelope after it is made. The outer portion of the corona discharge unit 50 is formed with a metallic sleeve 57 closely fit to the helical rib 55 on the outside of the glass envelope 51 forming an air tight seal between the glass envelope 51 along the rib 55 and the metallic sleeve 56. This creates a helical air flow path from the top of the corona discharge unit 50 to the bottom. When the high voltage is impressed across the electrode 56, an electric field is produced which interacts with the inert gas creating a corona charge on the outside of the glass envelope 51. The corona charge interacts with the oxygen in the air, breaking it down into individual oxygen molecules O. Some of these molecules recombine into the unstable O_3 form which is ozone. Air flows across the outside of the envelope 51 in the helical path formed between the envelope 51 and the outer metallic sleeve 56. This aids in breaking down the oxygen to ozone due to the increased time the air remains across the surface of the charged envelope 51. Preferably the air is either drawn by suction or pumped from one end of the tube to the other to facilitate continuous air flow and collection of the ozone.

FIG. 4 illustrates a typical ozonator 24 as seen in plan. The ozonator 24 is formed with a series of corona discharge units 51 placed lengthwise in an outer housing 60 to create multiple sources of ozone. Typically 6 to 10 corona discharge units 51 are used with each ozonator, however, it will be appreciated that any number may be provided depending upon the requirements of the system. The housing 60 is provided with water cooled tubes 62 which circulate water or other cooling fluid within the ozonator to cool the corona discharge units.

Whereas FIG. 4 illustrates only a partially filled outer housing, it will be appreciated that the housing is sized to accommodate the number of corona discharge units and water cooled tubes.

As can be seen from the schematic of the wash system, a continuous, closed fluid flow loop is provided. In a typical closed loop washing system, such as might be found in an institution, commercial laundry or the like, a series of washing machines 10, each capable of washing a 125 pound load, are connected to a source of ozonated water washing fluid held in the water holding tank 14, capable of holding from 500 to 1,000 gallons of ozonated water. The machines 10 typically are designed to hold between 30 and 90 gallons of water for a given wash cycle. The washing fluid in the holding tank 14 is continuously circulated from the bottom of the tank to the top of the tank using the recirculating pump 26 which pumps the washing fluid from the bottom of the holding tank 14 through a series of filters 28 and 30 back into the top of the tank 14. This recirculation of the water aids in cleaning the water with the filters and also in mixing the ozone in the ozonated water washing fluid. The pump may be continuously or intermittently

operated in order to keep the ozone evenly circulated within the water.

In a typical system using the present invention, the water is kept at room temperature and requires no soap or detergent during the washing process. Water from the storage tank 18 is pumped through the filter 20 to the holding tank 14. When a wash cycle is initiated, the ozonated water is pumped to the machines for the wash cycle. When the wash cycle is terminated, the used wash water is drained into the sump 16 and is eventually pumped back to the storage tank 18. Additional ozonated water is pumped to the machines for the rinse cycle and discharged to the sump when the rinse cycle is complete. Automatic level controls (not shown) such as float switches or level sensors control the transfer of water between the various storage and collecting areas. The recycled water is properly filtered using state of the art filter units so the water used in subsequent wash cycles is clean.

As indicated above, the system loses water by evaporation, spillage and splashing and through being carried away by the laundry at the completion of a cycle. This loss is replaced from a standard supply source of cold water. The replacement water represent only a small fraction of the amount of water used in similar systems where the use of soap, detergent and bleaches requires the wash water be disposed of and replaced after each use. It will be appreciated that modifications may be made in the system and apparatus described hereinabove in keeping within the scope of the present invention as defined in the following claims.

We claim:

1. A method of washing laundry using a closed loop wash water system comprising the steps of:

maintaining a supply of wash water in a first storage means;

ozonating said wash water supply;

delivering said ozonated wash water supply to a washing means upon commencement of a wash cycle;

washing said laundry in said washing means;

collecting said wash water supply in a collecting means at the end of the wash cycle; and

recirculating said wash water supply from said collecting means to said storage means.

2. The method of claim 1 further comprising the step of storing said wash water in a second storage means prior to delivery to said first storage means.

3. The method of claim 2 further including the step of transferring the wash water from said second storage means to said first storage means prior to the initiation of a wash cycle.

4. The method of claim 3 wherein said transferring step includes pumping the wash water from said second storage means to said first storage means and further including the step of filtering the wash water between the second and first storage means.

5. The method of claim 1 further including the step of removing waste wash materials from said wash water supply at the end of the wash cycle.

6. The method of claim 5 wherein said removing step is further defined as filtering said wash water supply.

7. The method of claim 1 further including the step of recirculating and mixing said supply of wash water in said first storage means.

8. The method of claim 7 wherein said step of recirculating and mixing includes pumping said wash water out of said storage tank through a recirculating line and back into said first storage means.

9. The method of claim 8 wherein said step of recirculating and mixing removes the wash water from the bottom and returns the wash water to the top of said first storage means.

10. The method of claim 7 further including the step of filtering said supply of wash water to remove contaminants therefrom as it is being recirculated.

11. The method of claim 1 further including the steps of rinsing said laundry with a fresh supply of wash water at the end of the wash cycle and collecting the rinse water at the end of the rinse cycle in said collecting means.

12. The method of claim 1 further including the step of replenishing the wash water lost during the washing process.

13. The method of claim 1 wherein the ozonating step is further defined by generating a source of ozone and entraining the ozone into the wash water within said first storage means.

14. The method of claim 13 further including the step of mixing said entrained ozone at the point it enters into said wash water within said first storage means.

15. The method of claim 13 wherein the step of generating the ozone further includes the steps passing air over a high voltage corona created by said generator in a non-linear path.

16. The method of claim 15 wherein the non-linear path is defined as helical.

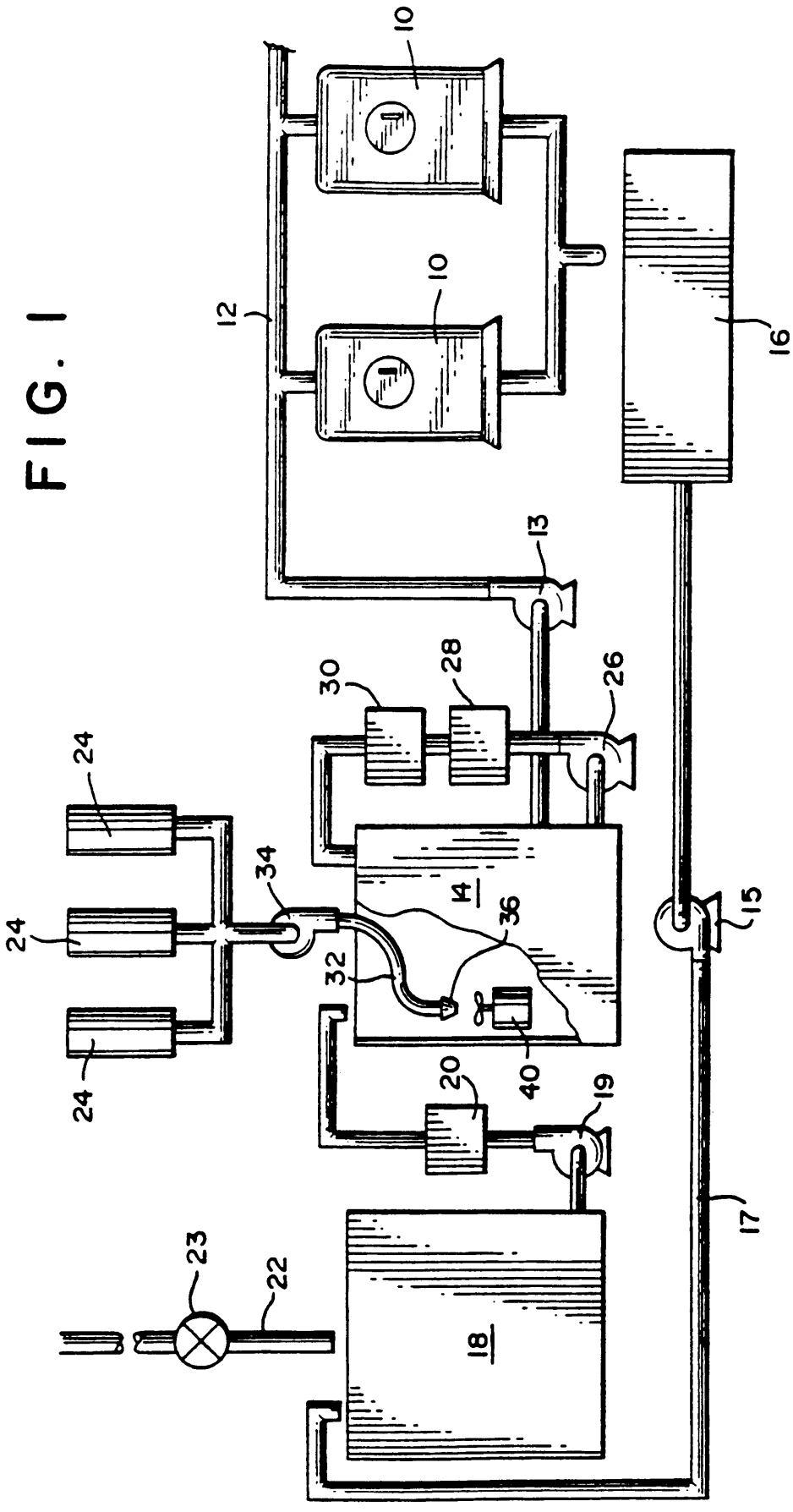
17. The method of claim 16 wherein said air is passed over said high voltage corona by drawing the air with a pump in said helical, non-linear path whereby the increased air path permits a larger amount of oxygen to break down and recombine into ozone

18. The method of claim 1 wherein said wash water is maintained at ambient temperature.

19. The method of claim 18 wherein said wash water is free from additives defined by the group of soaps, detergents and bleaches.

* * * * *

FIG. 1



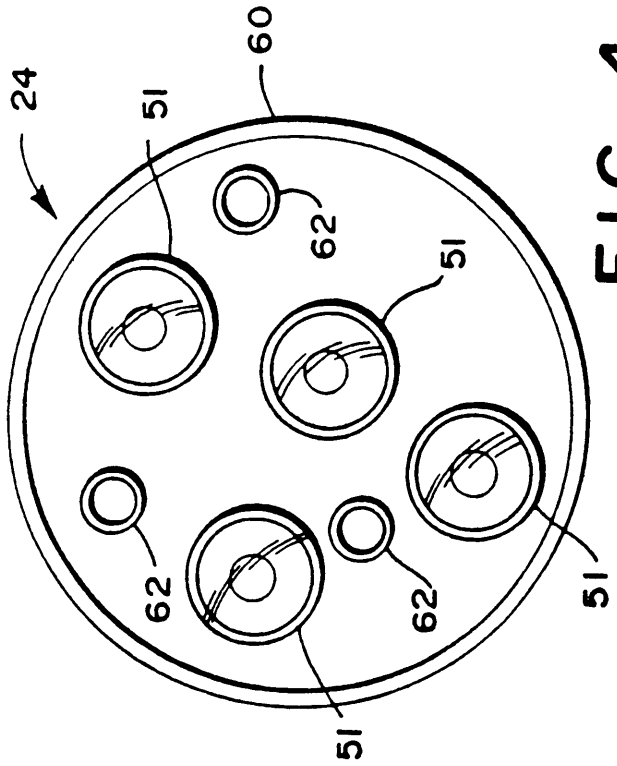


FIG. 4

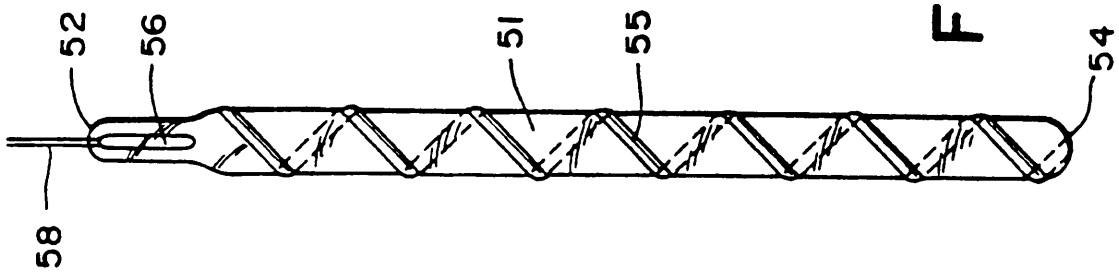


FIG. 3

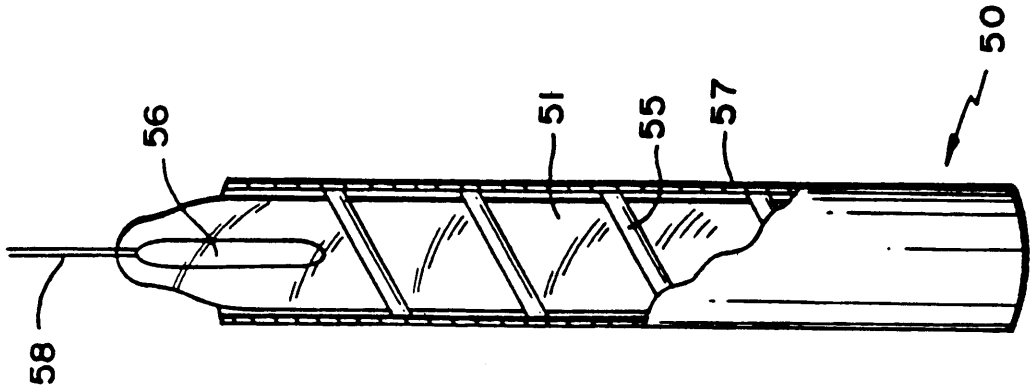


FIG. 2