



Commonwealth of Massachusetts  
Executive Office of Environmental Affairs  
Department of Environmental Management  
Office of Safe Waste Management

(continued)

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Boston  
Massachusetts  
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**ZINC DISCHARGE REDUCTION  
at  
THE LOWELL CORPORATION**

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Director

**A Case Study prepared by the  
Central Mass. Pollution Prevention Project**

**January 1990**

The Lowell Corporation is a small machine tool shop located in Worcester, Massachusetts, manufacturing specialty ratchets from cast iron blanks. As part of the production process, workpieces are treated with zinc phosphate to prevent tool corrosion.

The phosphating line consists of tanks for cleaning, rinsing and phosphating. (See Diagram 1.) The line discharges into the sewer controlled by the Upper Blackstone Pollution Abatement District (UBWPAD). The sewer authority found that the Lowell Corp. was discharging zinc at 4.77 ppm, out of compliance with the 2.61 ppm zinc limit. The sewer authority told Lowell Corp. to reduce the zinc discharge or eliminate its zinc phosphating operations.

Upon referral from the UBWPAD, DEM engineers visited Lowell Corp. to explore the use of source reduction to come into compliance with the zinc limit. DEM engineers proposed adding a dead rinse tank after the phosphate tank to decrease zinc drag out. Past experience had shown that a single dead rinse tank, installed directly after the plating tank, can reduce drag out by 50%. The installation of the drag out tank took roughly 10 minutes. Zinc discharge dropped from 4.77 ppm to 1.55 ppm, substantially lower than the discharge limit of 2.61 ppm.

The company phosphates the parts at a cost of \$0.05/lb. If the zinc line had been shut down, contracting out the phosphating process would have cost the company \$0.40/lb., about \$26,000 annually. The Lowell Corp. also uses the solution from the drag out tank to replace evaporative losses, saving them money on zinc purchases. In a follow-up interview, Dick Gion, the plant engineer, said, "I never thought something so simple would do it."

committee is composed of ten large and small business owners, representatives from the Worcester Area Chamber of Commerce, the Worcester County Planning Commission, the Central Massachusetts Metalworking Partnership and Shawmut Worcester County Bank.

During Fall 1989, DEM staff developed a 180 firm mailing list used to introduce the project and invite businesses to workshops. On the average, 35 firms attended each of the four workshops held this spring: (1) "Managing Manufacturing to Cut Waste and Save Money," (2) "Solvent Substitution and Use Reduction," (3) "Metalworking Coolants: From Burden to Advantage," and (4) "Source Reduction in Metal Finishing."

DEM has also provided programs and assistance to generators of small quantities of hazardous wastes such as schools, photographers and households. Over 200 dentists and orthodontists attended two meetings where DEM outlined the basics of hazardous waste regulations and explained how silver from photographic processes may be recovered instead of disposed.

## **REGULATORY COORDINATION**

DEM, DEP and the Upper Blackstone Wastewater Pollution Abatement District (UBWPAD) have developed a nationally precedent-setting level of coordination. DEM and DEP developed and signed a Memorandum of Understanding (MOU) that establishes mutually agreeable procedures regarding referrals, training, reporting and assistance on source reduction in enforcement actions. To date, DEM has received 9 UBWPAD and 8 Blackstone (combined UBWPAD and DEP) referrals for technical assistance, including 7 firms in violation of discharge regulations.

During the beginning phases of the Blackstone project, DEM engineers met periodically with the DEP and UBWPAD personnel to train inspectors on multimedia (air, water, hazardous waste and right-to-know) approaches to minimize emissions. The training focused on source reduction and recycling rather than end-of-pipe approaches.

## **CONSULTANT AND VENDOR NETWORK**

DEM has developed a network of source reduction biased vendors who act as experts for DEM engineers, consultants for businesses and a pool of qualified speakers on source reduction technologies. DEM periodically invites vendors, consultants and industrial representatives to DEM Technical Review Sessions to present information on the new innovations in source reduction technology.

## **INTERGOVERNMENT COORDINATION**

DEM acts as a source reduction technical and policy clearinghouse of information by performing literature searches and providing case studies and reference documents. DEM staff sit on committees for the Northeast Pollution Prevention Program and EPA's Northeast Hazardous Substance Research Center. Staff engineers work with national and regional environmental agencies, including EPA officials from the Washington headquarters, the Office of Research and Development (ORD) in Cincinnati, EPA Region I in Boston, DEM Fisheries and Wildlife, DEM Division of Water Resources (DWR), DEP and the MWRA.

include solvents, heavy metals, oils and cyanide. Reduction efforts focus first on eliminating the need to use the hazardous substances, then on reducing the volume and toxicity of waste generated.

## TECHNICAL ASSISTANCE

Since July 1989, DEM engineers have made twenty seven plant visits and provided telephone and mail information to five others. In each plant visited, DEM engineers have been able to identify opportunities for firms to reduce toxics use and hazardous waste generation, several of which are outlined below in Table 1. In addition to reductions from the on-site program, the workshop series has provided firms with the tools to implement use reduction changes on their own.

**TABLE 1: TECHNICAL ASSISTANCE CASE STUDIES**

Small Plating Company	After attending a DEM workshop, the company installed four counter-current rinse stations, reducing water use in half, and installed four electrolytic recovery units to remove lead, tin, nickel and copper from wastewaters.
Medium Plating Company	While in compliance with federal, state and local regulations, the company dumps a 550 gallon hexavalent chrome tank for treatment every 2 days. The chrome is reduced, precipitated and pressed in filter cake sludge. This hazardous waste sludge is sent to Canada for ground disposal. DEM engineers estimate that with a few minor process modifications to reduce the drag-in of contaminants into the chrome tank, the firm should be able to extend the life of the chrome solution one-hundred fold.
Large Machining Company	DEM engineers recommended a process change on a hexavalent chrome plating line that eliminates the use of three chrome tanks and substitutes them with a small, hand applying process using a less toxic metal (hard nickel). The metal substitution eliminated two chrome waste streams: air exhaust off the process tank and sewer wastewater.
Small Machining Company	Working with DEM engineers to eliminate use of 1,1,1-trichloroethane, a chlorinated solvent, in workpiece cleaning and machine maintenance.
Small Metalworking Company	By following an DEM recommendation, reduced zinc discharge below sewer limit and avoided an estimated \$25,000 annual cost. DEM developed a case study on zinc discharge reduction at the Lowell Corporation.
Small Metal Stripping Company	Working with DEM engineers to (1) switch from a cyanide to a less toxic, non-cyanide metal stripping process and (2) substitute an aqueous cleaner for a chlorinated solvent.
Newspaper Printing Company	Planning to implement a DEM-designed, zero wastewater discharge system that will reduce hazardous waste generation by 90%.

## WORKSHOP SERIES

Since July 1989, DEM has conducted an extensive campaign to involve Central Massachusetts government, university and trade associations in the project. DEM established a representative advisory committee to identify appropriate activities and methods of increasing participation. The



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**CENTRAL MASSACHUSETTS POLLUTION PREVENTION PROJECT**

**FY '90 PROJECT UPDATE**

**June 1990**

**INTRODUCTION**

In March 1989, EPA awarded the Office of Safe Waste Management a competitive three-year, \$300,000, source reduction and recycling technical assistance project matching grant. Under the grant, DEM is providing technical assistance in the electroplating and metalworking industries in Central Massachusetts to reduce their use of toxic chemicals and generation of hazardous pollutants. In the first year of the grant, DEM engineers have provided technical assistance for 33 companies and conducted four source reduction workshops. DEM identified toxics use reduction and/or cost reduction opportunities at all 33 firms. Preliminary data indicates that eleven of the firms have implemented some type of cost or waste reducing process substitution or change, an equal number of firms are in the planning and design stages. In addition to technical assistance, DEM has provided training, support and coordination for DEP's multimedia inspection program.

**BACKGROUND**

DEM began actively promoting source reduction in 1983, organizing conferences and workshops, publishing fact sheets and researching technical solutions to toxic use and emission problems. From 1986-1989, DEM ran a multimedia technical assistance program targeted at the jewelry industry in Southeastern Massachusetts.

DEM chose the Central Massachusetts for technical assistance because industries in the area have (1) economic importance to the Commonwealth, (2) significant hazardous waste, air pollution and wastewater discharges, (3) potential hazards to workers and (4) limited availability of source reduction and recycling opportunities. The target area also includes an environmentally sensitive area, the upper Blackstone River basin, that drains into Narragansett Bay.

DEM gains access to toxics users by sponsoring a workshop series, coordinating with the Worcester Area Chamber of Commerce and the Central Massachusetts Metalworking Partnership (a metalworking trade association) and receiving referrals from two regulatory agencies: the Department of Environmental Protection (DEP) and the Upper Blackstone Water Pollution Abatement District (UBWPAD, the local sewer authority). Hazardous materials used by the industries



*Office of Technical Assistance*  
Executive Office of Environmental Affairs  
Commonwealth of Massachusetts

# Toxics Use Reduction Case Study

## ZINC DISCHARGE REDUCTION AT THE LOWELL CORPORATION

### SUMMARY

The Lowell Corporation added a dead-water rinse tank, drip boards and a drain rack to its zinc phosphating line in order to minimize its losses of zinc while permitting some reuse of phosphating solution. The production line change -- which was carried out at a nominal cost in time and labor -- cut zinc discharges by two thirds, bringing the firm into line with local sewer authority discharge limits. This environmentally beneficial change effectively saved the Lowell Corporation approximately \$26,000 per year.

### BACKGROUND

The Lowell Corporation is a 28-employee machine tool shop which manufactures specialty ratchets from cast iron blanks. The firm was based in Worcester until June of 1991, but has since relocated to West Boylston. As part of the production process, pieces of iron are treated with zinc phosphate to improve corrosion resistance. Before it began to explore Toxics Use Reduction (TUR) opportunities, the Lowell Corporation used a zinc phosphating line with two phosphating tanks, each followed by a running-water rinse tank. (See Figure 1)

The regional sewer authority, known as the Upper Blackstone Pollution Abatement District (UBWPAD), measured zinc concentrations in Lowell's wastewaters at 4.47 ppm -- considerably above the 2.61 ppm zinc limit specified in the company's discharge permit. UBWPAD instructed Lowell to bring its zinc discharges into line or eliminate its zinc phosphating processes and contract out the phosphating work. After determining that out-of-house phosphating would add \$26,000 per year to its operating costs, Lowell officials decided to investigate process modifications that would remove zinc from its wastewater.

### OTA CONSULTATION

The UBWPAD referred Lowell Plant Manager Richard Gion to the Massachusetts Office of Technical Assistance (OTA) for help in reducing zinc discharges. OTA proposed the installation of a dead-water rinse tank after the second phosphating tank in Lowell's phosphating line. (See Figure 1) OTA's past experience with similar changes indicated that this technique would decrease zinc drag-out by approximately 50%. Additionally, OTA suggested drip boards and drain racks on all rinse tanks to further reduce zinc drag-out. (See Figure 2).

### TOXICS USE REDUCTION MODIFICATIONS

The Lowell Corporation chose to install the dead-water drag-out tank. The change was hardly complex - the new tank carried a modest price tag and took only ten minutes to install.

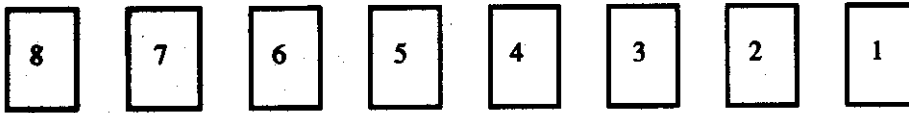
## RESULTS

**Reductions Achieved:** Zinc concentrations in Lowell's wastewater dropped from 4.61 ppm to 1.55 ppm -- well below the permitted limit. In a follow-up interview, Gion said, "I never thought something so simple would do it."

**Economics:** The company phosphates parts at a cost of \$0.05 per pound. If the zinc line had been shut down, contracting out the phosphating process would have cost the firm approximately \$0.40 per pound, spelling an additional cost of \$26,000 per year. The Lowell Corp. also uses the concentrated zinc-phosphate solution which accumulates in its new dead-water rinse tank to replace evaporative losses from its phosphating tank, thus realizing an additional savings on zinc purchases.

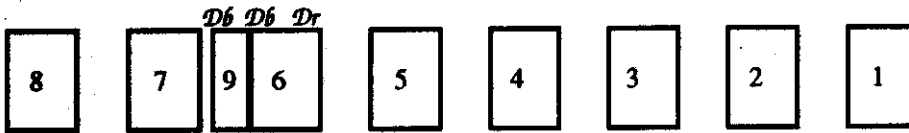
*Figure 1: Dead-water Rinse Tank*

### Pre-TUR Plating Line:



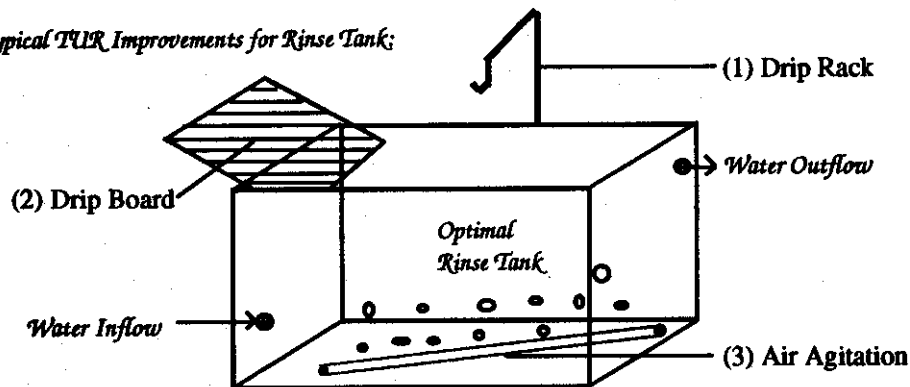
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|--------------------|----------------------|
| 1. Cleaner         | 5. Rinse Tank        |
| 2. Rinse Tank      | 6. Phosphate         |
| 3. Activating Etch | 7. Rinse Tank        |
| 4. Phosphate       | 8. Water-Soluble Oil |

### Post-TUR Plating Line:



9. Dead Rinse Tank      Db. Drain Boards (tanks 6 and 9)  
 Dr. Drip Rack (tank 6)

*Figure 2: Typical TUR Improvements for Rinse Tank;*



*This Case Study is one of a series of such documents prepared by the Office of Technical Assistance (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 toxics. 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, 100 Cambridge Street, Boston, Massachusetts 02202, or phone OTA at (617) 727-3260.*