Pella Corporation

SUMMARY

Pella Corporation, a window and door manufacturer, reduced releases and transfers of 33/50 Program chemicals from 896,300 pounds in 1988 to 151,750 pounds in 1994, an 83 percent decrease. These reductions were achieved primarily by eliminating solvents from adhesives, paints, and cleaning processes. This Success Story focuses on an innovative method to reduce and potentially eliminate chromium releases by using carbon adsorption to recover chromium from industrial wastewater.

PARENT COMPANY BACKGROUND

Pella Corporation, founded in 1925, is a privately held company that manufactures windows and doors (SIC 2431--Millwork). Known for years as the Rolscreen Company, the business grew on the strength of the residential housing market. In 1990, the company changed its name to Pella Corporation.

Pella markets several different lines of windows and doors. Pella Designer Series®, Pella Architect Series™, and Precision Fit® products are manufactured at company headquarters in Pella, Iowa, and sold through a nationwide network of Pella Window Stores®. In addition, Pella ProLine® products are manufactured in Carroll, Iowa, and sold through nationally recognized building supply retail outlets. Pella also serves architectural firms by designing and manufacturing custom windows and doors at its plant in Shenandoah, Iowa. Pella employs approximately 3,500 people.

COMPANY 33/50 PROGRAM GOALS AND ACHIEVEMENTS

Pella's management initiated the efforts to join the 33/50 Program in 1991 and established a goal to significantly exceed EPA's 33/50 targets by reducing 33/50 chemical releases and transfers by 90 percent by 1995, using 1988 as the baseline year. The company reduced 33/50 chemical releases and transfers by 65 percent in 1992 and by 83 percent in 1994. This was accomplished by switching to non-solvent-based adhesives; selecting high-solids paints; eliminating perchloroethylene emissions by replacing one vapor degreaser with an aqueous parts washing system and eliminating the need for a second vapor degreaser by changing the materials used in window manufacturing; and eliminating methylene chloride emissions by simplifying a glazing production process.

FEATURED POLLUTION REDUCTION PROJECT: USING ACTIVATED CARBON FOR CHROMIUM RECOVERY FROM INDUSTRIAL WASTEWATER

Pella paints aluminum extrusions in order to give customers a product with a superior maintenance-free exterior. Aluminum extrusions are processed through a five-stage chromium conversion process prior to adding a durable paint finish. Wastewater from this process contains hexavalent and trivalent chromium. In the past, the wastewater was treated by an in-house wastewater plant using a standard chromium reduction/chemical precipitation process. Consequently, a chrome sludge was produced and disposed of in accordance with the requirements of the Resource Conservation and Recovery Act. Effluent wastewater was regulated under a pretreatment agreement with the local POTW. The total annual cost of operating the wastewater treatment system was approximately $187,000.

Since chrome sludge was the company's largest hazardous waste stream, staff engineers searched for ways to eliminate chromium from the production process. They investigated chromium-free pretreatment methods, but these alternatives did not pass internal product quality standards for paint durability. In 1994, Pella

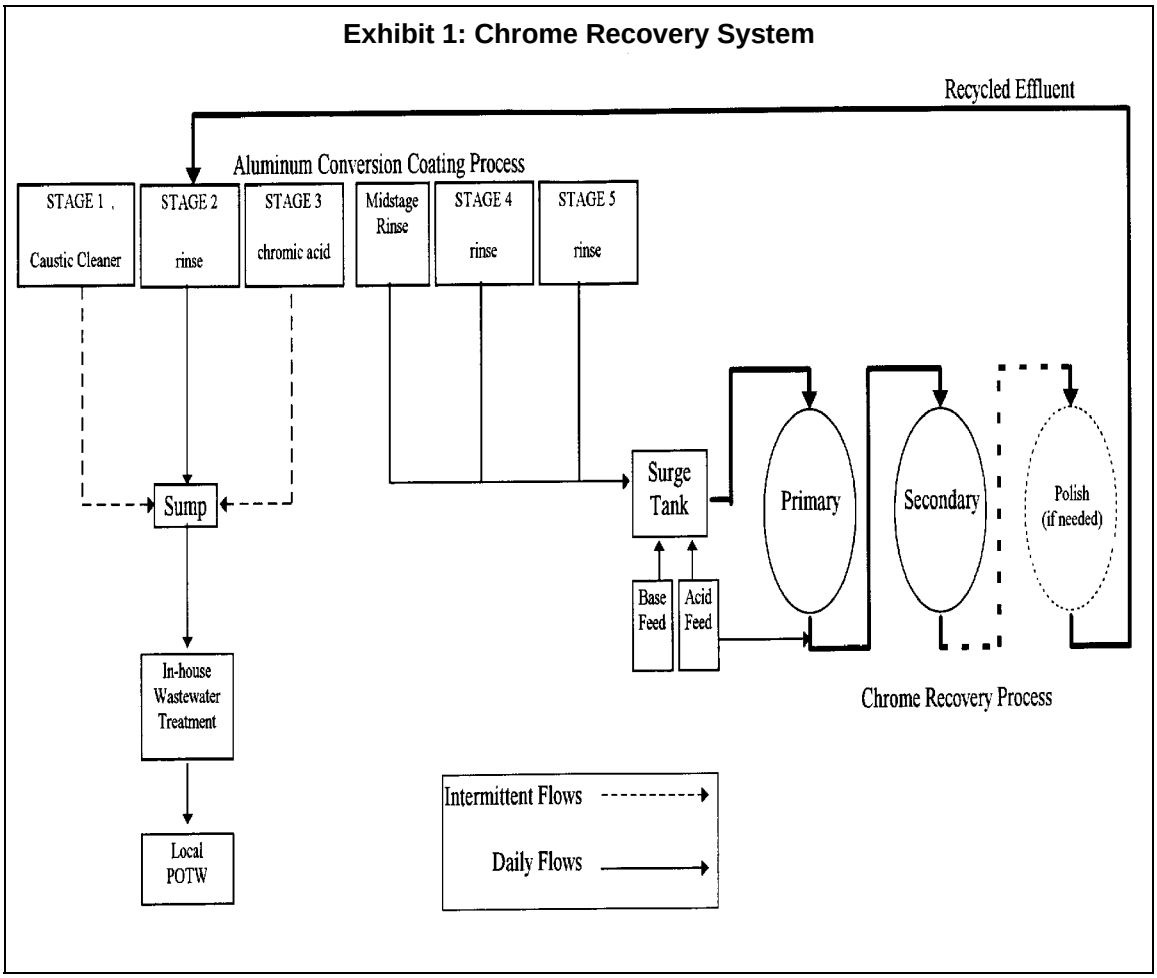
learned about a metals recovery and recycling process developed by Lewis Environmental Services, Inc. (LES) of Pittsburgh, Pennsylvania. The recovery system utilizes granular activated carbon with a proprietary conditioning pretreatment to enhance heavy metal adsorption, combined with electrolytic metal recovery to produce a valuable metallic product. LES has a patent pending for this system, which is called the Enviro-Clean process. Pella requested LES to demonstrate the applicability of the process to chromium. Additional sampling was done to characterize the wastewater and a treatability study was conducted. It became apparent that a properly designed system would meet the following goals: (1) reduce or eliminate chrome sludge; (2) recycle wastewater back into conversion coating rinses; (3) achieve cost savings by reducing chemical purchases and hazardous waste disposal.

LES designed and built a system consisting of two adsorbers operating in series. A schematic of the system is shown in Exhibit 1. Influent wastewater flows into a 500-gallon surge tank equipped with chemical feed mechanisms used to adjust the pH to approximately 4.5. Wastewater is pumped through the primary adsorber, where more than 90 percent of the chromium is removed. Since the pH tends to rise slightly as the wastewater flows through the primary adsorber, a midstage pH meter and chemical feed maintains an optimum pH as wastewater moves into the secondary adsorber. Operators monitor the chromium concentrations of the influent, midstage, and the effluent twice per 10-hour shift to determine system effectiveness and performance. Once breakthrough occurs in the primary adsorber, it is sent offsite for regeneration and replaced by the secondary adsorber, which in turn is replaced by a recently regenerated adsorber.

The modular design of the system allows for operational flexibility in meeting the wastewater treatment requirements. Quick-disconnect hoses allow for rapid changes of the adsorbers. In addition, it is possible to run additional adsorbers in a series of two or three units, thereby increasing the capacity of the system. Consequently, Pella purchased a system with five adsorbers and the capacity to run 40 gallons per minute (gpm). The total cost of purchasing, installing, and modifying the system in two phases was approximately $115,000.

The first phase of the project, which began in November 1995, involved equipment installation and startup. Initially, wastewater from all five stages of the aluminum conversion coating process was treated with two adsorbers operated in series. However, because the rate of aluminum carryover was higher than expected, an aluminum hydroxide precipitate formed in the surge tank and subsequently accumulated in a layer that restricted flow to 8 gpm in the first adsorber. Therefore, plumbing modifications were made so that in the first project phase, only rinses from the fourth and fifth stages were sent to carbon adsorbers while wastewater from the other three stages was treated by conventional chromium reduction/precipitation. The rinsewater flows from the fourth and fifth stages had chromium concentrations ranging from 60-80 mg/L and flowed at 15 gpm for one 10-hour shift per day. In addition, the influent pH was lowered to 4.0 in order to minimize aluminum hydroxide precipitation, maintain normal flow rates, and still achieve a chromium removal rate of 99 percent. Under this configuration, the system removed more than 99 percent of the chromium. Chrome sludge disposal was reduced by 32 percent during the first phase of the project.

Exhibit 1: Chrome Recovery System



The second phase, which began in May 1996, involved plant modifications to incorporate additional wastewater flows from a second chromium conversion line and to capture the midstage rinse following the third stage. After completing the modifications, the influent concentration of chromium increased significantly to 200-500 mg/L, the flow rate increased to approximately 27 gpm, and the effluent was recycled back into the production process. Due to the higher chromium loadings, three adsorbers were run in series in order to achieve the desired chromium removal rates.

The advantages offered by the chromium recovery process include:

- **Significantly reducing and potentially eliminating chrome sludge disposal**. The recovered chromium material is sold to industrial users and completely spent carbon is sold as feedstock to steel manufacturers.
- **Lowering operating costs**. Implementing the carbon adsorption system generated an annual cost savings of approximately $77,000, due primarily to reduced purchases of the chemicals used in the traditional reduction/precipitation process. The company estimates that the payback period for the initial investment in the carbon adsorption system will be less than two years.
- **Recycling effluent**. The company consumes less water by recycling the effluent for use in a rinse stage earlier in the aluminum conversion process.
- **Increasing operational flexibility through a modular design**. The company can continue to adapt the system to accommodate changes in their production needs.
- **Occupying less floor space than the traditional wastewater treatment system**.

Pella perceives the potential to adapt the carbon adsorption system in the future so that it can be used to treat all of the wastewater from the aluminum conversion process and virtually eliminate chrome sludge production. Due to the high concentration of dissolved aluminum in wastewater from the first two stages and the resulting precipitation of aluminum hydroxide in the surge tank, this adaptation presents some technical challenges that are currently being investigated by Pella.

CONTACTS

For additional information on this Success Story, please contact:

- Mr. Gene DeBoef
  Vice President of Engineering
  Pella Corporation
  102 Main Street
  Pella, IA 50219
  Tel: (515) 628-1000
  Fax: (515) 628-6189
  E-mail: grdboef@pella.com

KEY WORDS

- **Parent Company**: Pella Corporation
- **Company Size**: large
- **Location**: Iowa
- **Industry Type**: millwork
- **33/50 Program Chemicals**: chromium & compounds
- **Process in which Chemicals are used**: Plating/anodizing
- **Release Media**: transfers off-site, transfers to POTW
- **Total Company 33/50 Releases and Transfers, 1988**: 500,001 – 1,000,000 lbs.
- **Pollution Prevention Hierarchy Ranking**: recycling
- **Pollution Reduction Method**: process/equipment change, waste recovery/recycling
- **SIC Code**: 2431

United States
Environmental Protection
Agency

Office of Pollution
Prevention and Toxics
7408

EPA 745-K-96-058
December 1996

EPA's 33/50 Program Success Story

Pella Corporation

Using Activated Carbon for Chromium Recovery from Industrial Wastewater

THE 33/50 PROGRAM

33/50 Program Success Stories are being developed and distributed by EPA, based upon submissions from Program participants, to provide technical information describing efforts to reduce pollution associated with toxic chemicals.

The 33/50 Program is an EPA voluntary pollution reduction initiative that targets 17 high-priority TRI chemicals (see Box) for reductions in direct environmental releases and offsite transfers. The Program derives its name from its national goals—an interim reduction of 33% in 1992 and an ultimate reduction of 50% in 1995, using 1988 TRI reporting as a baseline. These goals translate to a targeted reduction of nearly 750 million pounds of pollution from the nearly 1.5 billion pounds reported to TRI for 1988 (the program excludes transfers to recycling and energy recovery, which were not reported to TRI until 1991). The 33/50 Program is one of a broad group of EPA activities designed to encourage source reduction, or prevention, as the best means of reducing pollution.

17 PRIORITY CHEMICALS TARGETED BY THE 33/50 PROGRAM

BENZENE
CADMIUM & COMPOUNDS
CARBON TETRACHLORIDE
CHLOROFORM
CHROMIUM & COMPOUNDS
CYANIDE COMPOUNDS
DICHLOROMETHANE*
LEAD & COMPOUNDS
MERCURY & COMPOUNDS
METHYL ETHYL KETONE
METHYL ISOBUTYL KETONE
NICKEL & COMPOUNDS
TETRACHLOROETHYLENE
TOLUENE
1,1,1-TRICHLOROETHANE
TRICHLOROETHYLENE
XYLENES

* Also referred to as methylene chloride

The 33/50 Program has proven to be remarkably successful. Spearheaded by the efforts of its 1,300 corporate participants (which own more than 6,000 TRI facilities), **33/50 surpassed its ultimate 50% reduction goal in 1994, a year ahead of schedule.** Releases and transfers of 33/50's 17 target chemicals were reduced by an additional 62 million pounds (7.8%) in 1994, bringing total reductions since 1988 to 757 million pounds and exceeding the Program's 50% national pollution reduction goal by more than 10 million pounds. 33/50's interim 1992 33% reduction goal was also achieved a year early and ultimately exceeded by more than 100 million pounds.

EPA is committed to recognizing companies for their participation in the 33/50 Program and for the emissions reductions they achieve. The Program has issued several Progress Reports in which participating companies are listed and highlighted. Approximately 30 Company Profiles have been prepared to provide more detailed information about how companies have achieved their emissions reductions, drawing upon extensive interviews with company representatives, the annual TRI reports submitted by the company's facilities and, in many cases, site visits to one or more of the company's facilities.

To provide a more robust compendium of project-specific descriptions, the Program issued invitations for all participants to submit their own Success Stories describing actions taken to reduce emissions of 33/50 Program chemicals. Submissions were reviewed to ensure consistency with official TRI data and converted into a common format. Together, 33/50 Program Success Stories and Company Profiles provide a wealth of information that can be drawn upon by others seeking to reduce toxic chemical pollution in their own operations. However, mention of trade names, products, or services in these documents does not convey, and should not be interpreted to convey, official EPA approval, endorsement, or recommendation.

Copies of other 33/50 Program Success Stories and Company Profiles, as well as Reductions Highlights documents summarizing all of these Profiles, may be obtained by contacting the Program as specified in the box below. In addition, all written company communications to EPA regarding the 33/50 Program are available to the public upon request.

For information on the 33/50 Program, contact the TSCA Hotline at (202) 554-1404 or contact 33/50 Program staff directly by phone at (202) 260-6907 or by mail at Mail Code 7408, Office of Pollution Prevention and Toxics, U.S. EPA, 401 M Street, SW, Washington, D.C. 20460.