This report is one in a series of volumes published by the U.S. Environmental Protection Agency (EPA) to provide information of general interest regarding environmental issues associated with specific industrial sectors. The documents were developed under contract by Abt Associates (Cambridge, MA), and Booz-Allen & Hamilton, Inc. (McLean, VA). This publication may be **purchased** from the Superintendent of Documents, U.S. Government Printing Office. A listing of available Sector Notebooks and document numbers is included on the following page.

**All telephone orders should be directed to:**

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
(202) 512-1800
FAX (202) 512-2250
8:00 a.m. to 4:30 p.m., EST, M-F

**Using the form provided at the end of this document, all mail orders should be directed to:**

U.S. Government Printing Office
P.O. Box 371954
Pittsburgh, PA 15250-7954

**Complimentary** volumes are available to certain groups or subscribers, such as public and academic libraries, Federal, State, local, and foreign governments, and the media. For further information, and for answers to questions pertaining to these documents, please refer to the contact names and numbers provided within this volume.

**Electronic** versions of all Sector Notebooks are available free of charge at the following web address: **www.epa.gov/oeca/sector**. Direct technical questions to the "Feedback" button at the bottom of the web page.

*Cover photograph by Steve Delaney, U.S. EPA. Photograph courtesy of Mid-Atlantic Finishing, Capitol Heights, Maryland.*

EPA/310-R-95-007

# EPA Office of Compliance Sector Notebook Project

# Profile of the Fabricated Metal Products Industry

**September 1995**

Office of Compliance
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
401 M St., SW (MC 2221-A)
Washington, DC 20460

## Sector Notebook Contacts

The Sector Notebooks were developed by the EPA's Office of Compliance. Questions relating to the Sector Notebook Project can be directed to:

Seth Heminway, Coordinator, Sector Notebook Project
US EPA Office of Compliance
401 M St., SW (2223-A)
Washington, DC 20460
(202) 564-7017

Questions and comments regarding the individual documents can be directed to the appropriate specialists listed below.

| Document Number | Industry | Contact | Phone (202) |
|---|---|---|---|
| EPA/310-R-95-001. | Dry Cleaning Industry | Joyce Chandler | 564-7073 |
| EPA/310-R-95-002. | Electronics and Computer Industry* | Steve Hoover | 564-7007 |
| EPA/310-R-95-003. | Wood Furniture and Fixtures Industry | Bob Marshall | 564-7021 |
| EPA/310-R-95-004. | Inorganic Chemical Industry* | Walter DeRieux | 564-7067 |
| EPA/310-R-95-005. | Iron and Steel Industry | Maria Malave | 564-7027 |
| EPA/310-R-95-006. | Lumber and Wood Products Industry | Seth Heminway | 564-7017 |
| EPA/310-R-95-007. | Fabricated Metal Products Industry* | Scott Throwe | 564-7013 |
| EPA/310-R-95-008. | Metal Mining Industry | Jane Engert | 564-5021 |
| EPA/310-R-95-009. | Motor Vehicle Assembly Industry | Anthony Raia | 564-6045 |
| EPA/310-R-95-010. | Nonferrous Metals Industry | Jane Engert | 564-5021 |
| EPA/310-R-95-011. | Non-Fuel, Non-Metal Mining Industry | Rob Lischinsky | 564-2628 |
| EPA/310-R-95-012. | Organic Chemical Industry* | Walter DeRieux | 564-7067 |
| EPA/310-R-95-013. | Petroleum Refining Industry | Tom Ripp | 564-7003 |
| EPA/310-R-95-014. | Printing Industry | Ginger Gotliffe | 564-7072 |
| EPA/310-R-95-015. | Pulp and Paper Industry | Seth Heminway | 564-7017 |
| EPA/310-R-95-016. | Rubber and Plastic Industry | Maria Malave | 564-7027 |
| EPA/310-R-95-017. | Stone, Clay, Glass, and Concrete Industry | Scott Throwe | 564-7013 |
| EPA/310-R-95-018. | Transportation Equipment Cleaning Ind. | Virginia Lathrop | 564-7057 |
| EPA/310-R-97-001. | Air Transportation Industry | Virginia Lathrop | 564-7057 |
| EPA/310-R-97-002. | Ground Transportation Industry | Virginia Lathrop | 564-7057 |
| EPA/310-R-97-003. | Water Transportation Industry | Virginia Lathrop | 564-7057 |
| EPA/310-R-97-004. | Metal Casting Industry | Jane Engert | 564-5021 |
| EPA/310-R-97-005. | Pharmaceuticals Industry | Emily Chow | 564-7071 |
| EPA/310-R-97-006. | Plastic Resin and Man-made Fiber Ind. | Sally Sasnett | 564-7074 |
| EPA/310-R-97-007. | Fossil Fuel Electric Power Generation Ind. | Rafael Sanchez | 564-7028 |
| EPA/310-R-97-008. | Shipbuilding and Repair Industry | Anthony Raia | 564-6045 |
| EPA/310-R-97-009. | Textile Industry | Belinda Breidenbach | 564-7022 |
| EPA/310-R-97-010. | Sector Notebook Data Refresh-1997 | Seth Heminway | 564-7017 |
| EPA/310-R-98-001. | Aerospace Industry | Anthony Raia | 564-6045 |
| EPA/310-R-98-002. | Agricultural Chemical, Pesticide, and Fertilizer Industry | Amy Porter | 564-4149 |
| EPA/310-R-98-003. | Agricultural Crop Production Industry | Ginah Mortensen | (913)551-7864 |
| EPA/310-R-98-004. | Agricultural Livestock Production Ind. | Ginah Mortensen | (913)551-7864 |
| EPA/310-R-98-005. | Oil and Gas Exploration and Production Industry | Dan Chadwick | 564-7054 |

EPA/310-R-98-008. Local Government Operations John Dombrowski 564-7036
*Spanish translations available.

# FABRICATED METAL PRODUCTS (SIC 34) TABLE OF CONTENTS

Page

EXHIBIT INDEX ..... VII

LIST OF ACRONYMS ..... IX

I. INTRODUCTION OF THE SECTOR NOTEBOOK PROJECT ..... 1

I.A. Summary of the Sector Notebook Project ..... 1

I.B. Additional Information ..... 2

II. INTRODUCTION TO THE FABRICATED METAL PRODUCTS INDUSTRY ..... 4

II.A. Introduction, Background, and Scope of the Notebook ..... 4

II.B. Characterization of the Fabricated Metal Products Industry ..... 4

II.B.1. Industry Size and Geographic Distribution ..... 4

II.B.2. Product Characterization ..... 9

II.B.3. Economic Trends ..... 9

III. INDUSTRIAL PROCESS DESCRIPTION ..... 12

III.A. Industrial Processes in the Fabricated Metal Products Industry ..... 12

III.A.1. Fabricated Metal Products ..... 13

III.A.2. Surface Preparation ..... 15

III.A.3. Metal Finishing ..... 16

III.B. Raw Material Inputs and Pollution Outputs in the Production Line ..... 21

III.B.1. Metal Fabrication ..... 24

III.B.2. Surface Preparation ..... 25

III.B.3. Metal Finishing ..... 25

III.C. Management of Chemicals in Wastestream ..... 29

**FABRICATED METAL PRODUCTS**
**(SIC 34)**
**TABLE OF CONTENTS (CONT'D)**

Page

IV. CHEMICAL RELEASE AND TRANSFER PROFILE ..... 31

IV.A. EPA Toxic Release Inventory for the Fabricated Metal Products Industry ..... 34

IV.B. Summary of the Selected Chemicals Released ..... 46

IV.C. Other Data Sources ..... 53

IV.D. Comparison of Toxic Release Inventory Between Selected Industries ..... 55

V. POLLUTION PREVENTION OPPORTUNITIES ..... 58

V.A. Identification of Pollution Prevention Activities in Use and Environmental and Economic Benefits of Each Pollution Prevention Activity ..... 58

V.B. Possible Pollution Prevention Future Trends ..... 61

V.C. Pollution Prevention Case Studies ..... 62

V.D. Pollution Prevention Options ..... 65

V.D.1. Metal Shaping Operations ..... 65

V.D.2. Surface Preparation Operations ..... 67

V.D.3. Plating Operations ..... 71

V.D.4. Other Finishing Operations ..... 75

V.E. Pollution Prevention Contacts ..... 78

VI. SUMMARY OF APPLICABLE FEDERAL STATUTES AND REGULATIONS ..... 80

VI.A. General Description of Major Statutes ..... 80

VI.B. Industry Specific Regulations ..... 92

VI.C. Pending and Proposed Regulatory Requirements ..... 97

**FABRICATED METAL PRODUCTS**
**(SIC 34)**
**TABLE OF CONTENTS (CONT'D)**

Page

VII. COMPLIANCE AND ENFORCEMENT PROFILE ..... 100

VII.A. Fabricated Metal Products Industry Compliance History ..... 104

VII.B. Comparison of Enforcement Activity Between Selected Industries ..... 104

VII.C. Review of Major Legal Actions ..... 111

VII.C.1 Review of Major Cases ..... 111

VII.C.2 Supplemental Environmental Projects ..... 112

VIII. COMPLIANCE ACTIVITIES AND INITIATIVES ..... 116

VIII.A. Sector-Related Environmental Programs and Activities ..... 116

VIII.B. EPA Voluntary Programs ..... 122

VIII.C. Trade Association/Industry Sponsored Activity ..... 132

VIII.C.1. Environmental Programs ..... 132

VIII.C.2. Summary of Trade Associations ..... 134

IX. CONTACTS/ACKNOWLEDGMENTS/RESOURCE MATERIALS/ BIBLIOGRAPHY AND OTHER REFERENCES ..... 138

## FABRICATED METAL PRODUCTS (SIC 34)
## EXHIBIT INDEX


| | | Page |
|---|---|---|
| Exhibit 1 | Metal Fabrication Companies | 5 |
| Exhibit 2 | Number of Employees in Metal Finishing Industry | 5 |
| Exhibit 3 | Value of Shipments for Metal Finishing Establishments | 6 |
| Exhibit 4 | Inorganic Coating Job Shops | 6 |
| Exhibit 5 | Organic Coating Job Shops | 6 |
| Exhibit 6 | Metal Finishing Establishments, by Size | 7 |
| Exhibit 7 | Geographic Distribution of Fabricated Metal Products Industry | 7 |
| Exhibit 8 | Markets Served by Metal Finishers | 10 |
| Exhibit 9 | Forming Operations | 14 |
| Exhibit 10 | Rolling | 14 |
| Exhibit 11 | Process for Preparing Metal for Electroplating | 15 |
| Exhibit 12 | Overview of the Metal Finishing Process | 16 |
| Exhibit 13 | Typical Electroplating Equipment | 18 |
| Exhibit 14 | Electroless Plating Process | 19 |
| Exhibit 15 | Process Materials Inputs and Outputs | 22 |
| Exhibit 16 | Fabricated Metal Products Manufacturing Processes | 23 |
| Exhibit 17 | Typical Metal Finishing Process Step | 26 |
| Exhibit 18 | Source Reduction and Recycling Activity for SIC 34 | 30 |
| Exhibit 19 | Top 10 TRI Releasing Fabricated Metal Products Facilities | 35 |
| Exhibit 20 | Top 10 TRI Releasing Metal Fabricating & Finishing Facilities (SIC 34) | 36 |
| Exhibit 21 | Reductions in TRI Releases, 1988-1993 (SIC 34) | 36 |
| Exhibit 22 | Reductions in TRI Transfers, 1988-1993 (SIC 34) | 36 |
| Exhibit 23 | TRI Reporting Metal Fabricating & Finishing Facilities (SIC 34) by State | 37 |
| Exhibit 24 | Releases for Metal Fabricating & Finishing Facilities (SIC 34) in TRI, by Number of Facilities (Releases reported in pounds/year) | 38, 39 |
| Exhibit 25 | Transfers for Metal Fabricating & Finishing Facilities (SIC 34) in TRI, by Number of Facilities (Transfers reported in pounds/year) | 40, 41 |
| Exhibit 26 | Top 10 TRI Releasing Metal Finishing Facilities (SIC 347) | 42 |
| Exhibit 27 | TRI Reporting Metal Finishing Facilities (SIC 347) by State | 43 |
| Exhibit 28 | Releases for Metal Finishing (SIC 347) in TRI, by Number of Facilities (Releases reported in pounds/year) | 43, 44 |

## FABRICATED METAL PRODUCTS (SIC 34)
## EXHIBIT INDEX (CONT'D)


Page

Exhibit 29 Transfers for Metal Finishing (SIC 347) in TRI, by Number of Facilities (Transfers reported in pounds/year) ..... 45, 46

Exhibit 30 Pollutant Releases (Short Tons/Year) ..... 54

Exhibit 31 Summary of 1993 TRI Data ..... 56

Exhibit 32 Toxic Releases Inventory for Selected Industries ..... 57

Exhibit 33 Hazardous Wastes Relevant to the Metal Finishing Industry ..... 96, 97

Exhibit 34 Five Year Enforcement and Compliance Summary for Fabricated Metal Products Industry ..... 106

Exhibit 35 Five Year Enforcement and Compliance Summary for Selected Industries ..... 107

Exhibit 36 One Year Enforcement and Compliance Summary for Selected Industries ..... 108

Exhibit 37 Five Year Inspection and Enforcement Summary by Statute for Selected Industries ..... 109

Exhibit 38 One Year Inspection and Enforcement Summary by Statute for Selected Industries ..... 110

Exhibit 39 Supplemental Environmental Projects ..... 113, 114, 115

Exhibit 40 Fabricated Metal Producers Participating in the 33/50 Program ..... 123 - 129

## FABRICATED METAL PRODUCTS
## (SIC 34)
## LIST OF ACRONYMS

AFS - AIRS Facility Subsystem (CAA database)
AIRS - Aerometric Information Retrieval System (CAA database)
BIFs - Boilers and Industrial Furnaces (RCRA)
BOD - Biochemical Oxygen Demand
CAA - Clean Air Act
CAAA - Clean Air Act Amendments of 1990
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS - CERCLA Information System
CFCs - Chlorofluorocarbons
CO - Carbon Monoxide
COD - Chemical Oxygen Demand
CSI - Common Sense Initiative
CWA - Clean Water Act
D&B - Dun and Bradstreet Marketing Index
ELP - Environmental Leadership Program
EPA - United States Environmental Protection Agency
EPCRA - Emergency Planning and Community Right-to-Know Act
FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act
FINDS - Facility Indexing System
HAPs - Hazardous Air Pollutants (CAA)
HSDB - Hazardous Substances Data Bank
IDEA - Integrated Data for Enforcement Analysis
LDR - Land Disposal Restrictions (RCRA)
LEPCs - Local Emergency Planning Committees
MACT - Maximum Achievable Control Technology (CAA)
MCLGs - Maximum Contaminant Level Goals
MCLs - Maximum Contaminant Levels
MEK - Methyl Ethyl Ketone
MSDSs - Material Safety Data Sheets
NAAQS - National Ambient Air Quality Standards (CAA)
NAFTA - North American Free Trade Agreement
NCDB - National Compliance Database (for TSCA, FIFRA, EPCRA)
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NEIC - National Enforcement Investigation Center
NESHAP - National Emission Standards for Hazardous Air Pollutants
$NO_2$ - Nitrogen Dioxide
NOV - Notice of Violation
$NO_X$ - Nitrogen Oxide
NPDES - National Pollution Discharge Elimination System (CWA)

## FABRICATED METAL PRODUCTS (SIC 34) LIST OF ACRONYMS (CONT'D)

NPL - National Priorities List
NRC - National Response Center
NSPS - New Source Performance Standards (CAA)
OAR - Office of Air and Radiation
OECA - Office of Enforcement and Compliance Assurance
OPA - Oil Pollution Act
OPPTS - Office of Prevention, Pesticides, and Toxic Substances
OSHA - Occupational Safety and Health Administration
OSW - Office of Solid Waste
OSWER - Office of Solid Waste and Emergency Response
OW - Office of Water
P2 - Pollution Prevention
PCS - Permit Compliance System (CWA Database)
POTW - Publicly Owned Treatments Works
RCRA - Resource Conservation and Recovery Act
RCRIS - RCRA Information System
SARA - Superfund Amendments and Reauthorization Act
SDWA - Safe Drinking Water Act
SEPs - Supplementary Environmental Projects
SERCs - State Emergency Response Commissions
SIC - Standard Industrial Classification
$SO_2$ - Sulfur Dioxide
TOC - Total Organic Carbon
TRI - Toxic Release Inventory
TRIS - Toxic Release Inventory System
TCRIS - Toxic Chemical Release Inventory System
TSCA - Toxic Substances Control Act
TSS - Total Suspended Solids
UIC - Underground Injection Control (SDWA)
UST - Underground Storage Tanks (RCRA)
VOCs - Volatile Organic Compounds

# FABRICATED METAL PRODUCTS (SIC 34)

## I. INTRODUCTION OF THE SECTOR NOTEBOOK PROJECT

### I.A. Summary of the Sector Notebook Project

Environmental policies based upon comprehensive analysis of air, water, and land pollution are an inevitable and logical supplement to traditional single-media approaches to environmental protection. Environmental regulatory agencies are beginning to embrace comprehensive, multi-statute solutions to facility permitting, enforcement and compliance assurance, education/outreach, research, and regulatory development issues. The central concepts driving the new policy direction are that pollutant releases to each environmental medium (air, water, and land) affect each other, and that environmental strategies must actively identify and address these inter-relationships by designing policies for the "whole" facility. One way to achieve a whole facility focus is to design environmental policies for similar industrial facilities. By doing so, environmental concerns that are common to the manufacturing of similar products can be addressed in a comprehensive manner. Recognition of the need to develop the industrial "sector-based" approach within the EPA Office of Compliance led to the creation of this document.

The Sector Notebook Project was initiated by the Office of Compliance within the Office of Enforcement and Compliance Assurance (OECA) to provide its staff and managers with summary information for eighteen specific industrial sectors. As other EPA offices, States, the regulated community, environmental groups, and the public became interested in this project, the scope of the original project was expanded. The ability to design comprehensive, common sense environmental protection measures for specific industries is dependent on knowledge of several inter-related topics. For the purposes of this project, the key elements chosen for inclusion are: general industry information (economic and geographic); a description of industrial processes; pollution outputs; pollution prevention opportunities; Federal statutory and regulatory framework; compliance history; and a description of partnerships that have been formed between regulatory agencies, the regulated community, and the public.

For any given industry, each topic listed above could alone be the subject of a lengthy volume. However, in order to produce a manageable document, this project focuses on providing summary information for each topic. This format provides the reader with a synopsis of each issue, and references where more in-depth information is available. Text within each profile was researched from a variety of sources, and was usually condensed from more detailed sources pertaining to specific topics. This approach allows for a wide coverage of activities that can be further explored based upon the citations and references listed at the end of this profile. As a check on the information included, each notebook went through an external review process. The Office of Compliance appreciates the efforts of all those that participated in this process and enabled us to develop more complete, accurate, and up-to-date summaries. Many of those who reviewed this notebook are listed as contacts in Section IX and may be sources of additional information. The individuals and groups on this list do not necessarily concur with all statements within this notebook.

## I.B. Additional Information

### Providing Comments

OECA's Office of Compliance plans to periodically review and update the notebooks and will make these updates available both in hard copy and electronically. If you have any comments on the existing notebook, or if you would like to provide additional information, please send a hard copy and computer disk to the EPA Office of Compliance, Sector Notebook Project, 401 M St., SW (2223-A), Washington, DC 20460. Comments can also be uploaded to the Enviro$en$e Bulletin Board or the Enviro$en$e World Wide Web for general access to all users of the system. Follow instructions in Appendix A for accessing these data systems. Once you have logged in, procedures for uploading text are available from the on-line Enviro$en$e Help System.

### Adapting Notebooks to Particular Needs

The scope of the existing notebooks reflect an approximation of the relative national occurrence of facility types that occur within each sector. In many instances, industries within specific geographic regions or States may have unique characteristics that are not fully captured in these profiles. For this reason, the Office of Compliance encourages State and local environmental agencies and other groups

to supplement or re-package the information included in this notebook to include more specific industrial and regulatory information that may be available. Additionally, interested States may want to supplement the "Summary of Applicable Federal Statutes and Regulations" section with State and local requirements. Compliance or technical assistance providers may also want to develop the "Pollution Prevention" section in more detail. Please contact the appropriate specialist listed on the opening page of this notebook if your office is interested in assisting us in the further development of the information or policies addressed within this volume.

If you are interested in assisting in the development of new notebooks for sectors not covered in the original eighteen, please contact the Office of Compliance at 202-564-2395.

# II. INTRODUCTION TO THE FABRICATED METAL PRODUCTS INDUSTRY

This section provides background information on the size, geographic distribution, employment, production, sales, and economic condition of the Fabricated Metal Products industry. The types of facilities described within the document are also described in terms of their Standard Industrial Classification (SIC) codes. Additionally, this section contains a list of the largest companies in terms of sales.

## II.A. Introduction, Background, and Scope of the Notebook

The fabricated metal products industry comprises facilities that generally perform two functions: forming metal shapes and performing metal finishing operations, including surface preparation. The Standard Industrial Classification (SIC) code 34 is composed of establishments that fabricate ferrous and nonferrous metal products and those that perform electroplating, plating, polishing, anodizing, coloring, and coating operations on metals. Since the main processes associated with this industry can be divided into three types of operations (i.e., metal fabrication, metal preparation, and metal finishing), this profile is organized by the techniques that fall within these three groups.

## II.B. Characterization of the Fabricated Metal Products Industry

To provide a general understanding of this industry, information pertaining to the industry size and distribution, product characterization, and economic health and outlook is presented below. This information should provide a basic understanding of the facilities developing the products, the products themselves, and the economic condition of the industry.

### II.B.1. Industry Size and Geographic Distribution

Variation in facility counts occur across data sources due to many factors, including reporting and definitional differences. This document does not attempt to reconcile these differences, but rather reports the data as they are maintained by each source.

The U.S. fabricated metal products industry comprises approximately 34,000 companies. Exhibit 1 lists the largest companies in selected metal fabricating industries. Companies are ranked by sales figures.

**Exhibit 1**
**Metal Fabrication Companies**

| Company | Sales ($ Millions) | Number of Employees |
|---|---|---|
| *SIC 3444 -- Sheet Metal Work* | | |
| Stolle Corp., Sidney, OH | 480 | 4,600 |
| Alcan Alum. Corp., Warren, OH | 120 | 1,200 |
| Nytronics, Inc., Pitman, NJ | 110 | 2,000 |
| Hart and Cooley Inc., Holland, MI | 100 | 1,200 |
| Syro Steel Co., Girard, OH | 100 | 400 |
| Consolidated Systems, Inc., Columbia, SC | 100 | 300 |
| *SIC 3465 -- Automotive Stampings* | | |
| Budd Co., Troy, MI | 1,000 | 9,000 |
| Douglas and Lomason Co., Farmington Hts., MI | 391 | 5,800 |
| Northern Engraving Corp., Sparta, WI | 280 | 3,000 |
| Randall Textron Inc., Cincinnati, OH | 210 | 2,000 |
| *SIC 3469 -- Metal Stampings* | | |
| Hexcel Corp., Pleasanton, CA | 386 | 2,900 |
| JSJ Corp., Grand Haven, MI | 260 | 2,500 |
| Mirro-Foley Co., Manitowoc, WI | 210 | 2,000 |
| Tempel Steel Co., Niles, IL | 210 | 1,100 |
| *SIC 3499 -- Fabricated Metal Products* | | |
| Steel Technologies, Louisville, KY | 155 | 500 |
| R.D. Werner Company, Inc., Greenville, PA | 150 | 1,600 |
| BW/IP Int., Inc., Seal Div., Long Beach, CA | 104 | 400 |
| LeFebure Corp., Cedar Rapids, IA | 100 | 1,100 |
| Dura Mech. Components, Inc., Troy, MI | 100 | 1,000 |

*Source: Fabricators & Manufacturers Association, Intl.*

Exhibits 2 and 3 show the distribution of employees and the total shipments for the metal finishing industry. A typical "job shop" (i.e., small, independently owned metal finishing company) employs 15 to 20 people and generates $800,000 to $1 million in annual gross revenues.

**Exhibit 2**
**Number of Employees in Metal Finishing Industry**

| | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|
| SIC 3471 | 76,300 | 76,600 | 73,200 | 66,600 | 65,400 |
| SIC 3479 | 47,000 | 44,600 | 44,300 | 43,400 | 43,700 |
| Total | 123,300 | 121,200 | 117,500 | 110,000 | 109,100 |

*Source: U.S. Department of Commerce, 1992 Census of Manufacturers.*

**Exhibit 3**
**Value of Shipments for Metal Finishing Establishments ($ Millions)**

| | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|
| SIC 3471 | 4,324 | 4,452 | 4,513 | 4,124 | 4,726 |
| SIC 3479 | 4,867 | 4,756 | 4,929 | 4,634 | 5,161 |
| Total | 9,191 | 9,208 | 9,442 | 8,758 | 9,887 |

*Source: U.S. Department of Commerce, 1992 Census of Manufacturers.*

Exhibits 4 and 5 list the largest companies in selected metal finishing industries. Companies are ranked by sales figures.

**Exhibit 4**
**Inorganic Coating Job Shops**

| Company | Sales ($ Millions) | Number of Employees |
|---|---|---|
| Windsor Plastics, Evansville, IN | 50 | 600 |
| Crown City Plating, El Monte, CA | 25 | 425 |
| Pioneer Metal Finishing, Minneapolis, MN | 20-30 | 380 |
| Metal Surfaces, Bell Gardens, CA | 15-25 | 310 |
| Victory Finishing Technologies, Inc., Providence, RI | 15-25 | 245 |
| State Plating, Inc., Elwood, IN | 15-20 | 400 |

*Source: "Large Plating Job Shops," Beverly A. Greaves, Products Finishing, April 1994.*

**Exhibit 5**
**Organic Coating Job Shops**

| Company | Sales ($ Millions) | Number of Employees |
|---|---|---|
| Metokote Corp., Lima, OH | 25+ | 800 |
| The Crown Group, Warren, MI | 25+ | 659 |
| Industrial Powder Coatings, Inc., Norwalk, OH | 25+ | 620 |
| PreFinish Metals, Chicago, IL | 25+ | 600 |
| E/M Corp., West Lafayette, IN | 15-25 | 300 |
| Chicago Finished Metals, Bridgeview, IL | 25+ | 250 |
| Linetec Co., Wausau, WI | 10-15 | 200 |
| B.L. Downey Co., Inc., Broadview, IL | 10-15 | 175 |

*Source: "Large Coating Job Shops," Beverly A. Greaves, Products Finishing, December 1994.*

Between 1982 and 1987, the total number of independent metal finishers employing less than 20 employees declined slightly, while those employing more than 20 employees increased by a corresponding amount. Exhibit 6 shows the number and percent of metal finishers of various sizes.

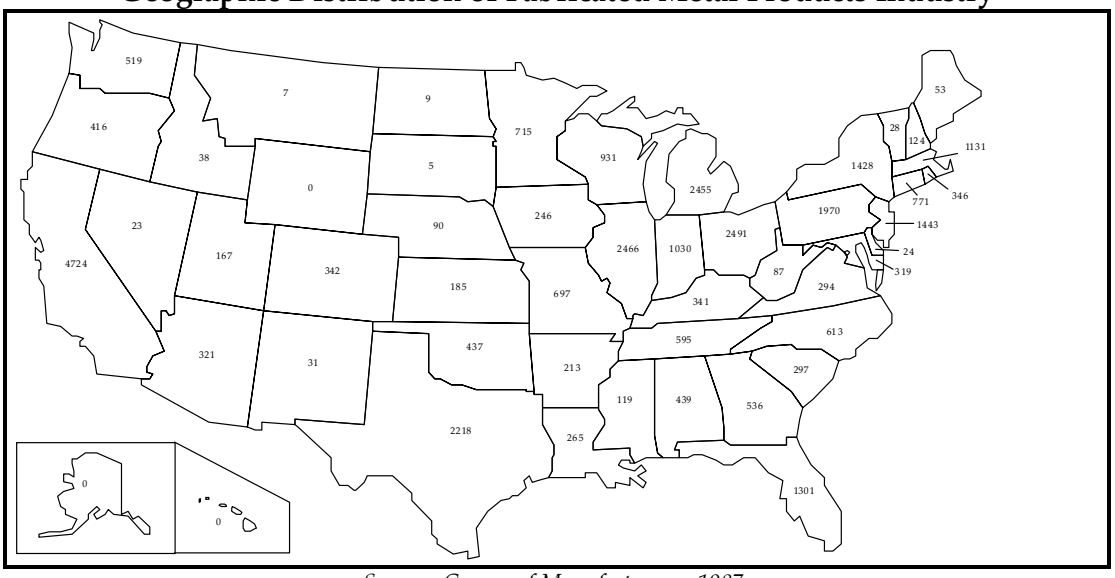
**Exhibit 6**
**Metal Finishing Establishments, by Size**

| 1987 | | | 1992 | |
|---|---|---|---|---|
| **Establishments With and Average of :** | **Number of Companies** | **Percent Total** | **Number of Companies** | **Percent Total** |
| 1 to 9 Employees | 2481 | 47.1 | 2553 | 48.7 |
| 10 to 49 Employees | 2262 | 43.0 | 2186 | 41.7 |
| 50 to 99 Employees | 365+ | 6.9 | 381 | 6.8 |
| 100 to 249 Employees | 137 | 2.6 | 356 | 2.4 |
| 250 or more Employees | 20 | 0.4 | 127 | 0.4 |
| **Total** | **5265** | **100.0** | **5603** | **100.0** |

*Source: Census of Manufacturers: 1992, U. S. Department of Commerce, Bureau of the Census.*

Although the metal finishing industry is geographically diverse, the industry is concentrated in what are usually considered the most heavily industrialized regions in the United States (See Exhibit 7). This geographic concentration occurs in part because it is cost-effective for small metal finishing facilities to be located near their customer base.

**Exhibit 7**
**Geographic Distribution of Fabricated Metal Products Industry**




*Source: Census of Manufacturers: 1987.*

California has more establishments that produce metal-related products than any other State. California's establishments constitute 10.2 percent of the total establishments that produce fabricated structural metal (SIC 3441). In addition, California leads in the

number of establishments of other related industries: 15.6 percent of the sheet metal work establishments (SIC 3444); 13 percent of the metal doors, sash, and trim establishments (SIC 3442); and 13.7 percent of the architectural metal work establishments (SIC 3446). California also has the majority of plating and polishing (SIC 3471) and metal coating and allied services (SIC 3479) establishments at 17.3 and 16.1 percent, respectively.

Michigan, Illinois, and Ohio have large numbers of various metal-related industries. Michigan has the largest number of companies in the screw machine products (SIC 3451) and automotive stampings (SIC 3465) industries, at 14 and 46.7 percent of the total companies in the United States, respectively. Illinois is home to 14.1 percent of companies that produce bolts, nuts, rivets, and washers (SIC 3452) and Ohio contains 12.6 percent of companies that produce iron and steel forgings (SIC 3462).

Establishments engaged primarily in metal finishing tend to be small, independently owned job shops, also are referred to as independent metal finishers. Establishments that conduct metal finishing operations as part of a larger manufacturing operation are referred to as "captive" metal finishers. Captive metal finishing facilities are approximately three times more numerous than independent metal finishers. Numerous similarities exist between the independent and captive facilities; for the purposes of this profile, they are considered part of one industry. In addition, the two segments have parallel ties with suppliers and customers. Captive operations may be more specialized in their operations, however, because they often work on a limited number of products and/or employ a limited number of processes. Independent metal finishers, on the other hand, tend to be less specialized in their operations because they may have many customers, often with different requirements.

## II.B.2. Product Characterization

The Department of Commerce classification codes divide this industry by product and services. SIC code 34 is further divided as follows:

- SIC 341 - Metal Cans and Shipping Containers
- SIC 342 - Cutlery, Handtools, and General Hardware
- SIC 343 - Heating Equipment, Except Electric and Warm Air, and Plumbing Fixtures
- SIC 344 - Fabricated Structural Metal Products
- SIC 345 - Screw Machine Products, and Bolts, Nuts, Screws, Rivets, and Washers
- SIC 346 - Metal Forgings and Stampings
- SIC 347 - Coating, Engraving, and Allied Services
- SIC 348 - Ordnance and Accessories, Except Vehicles and Guided Missiles
- SIC 349 - Miscellaneous Fabricated Metal Products.

## II.B.3. Economic Trends

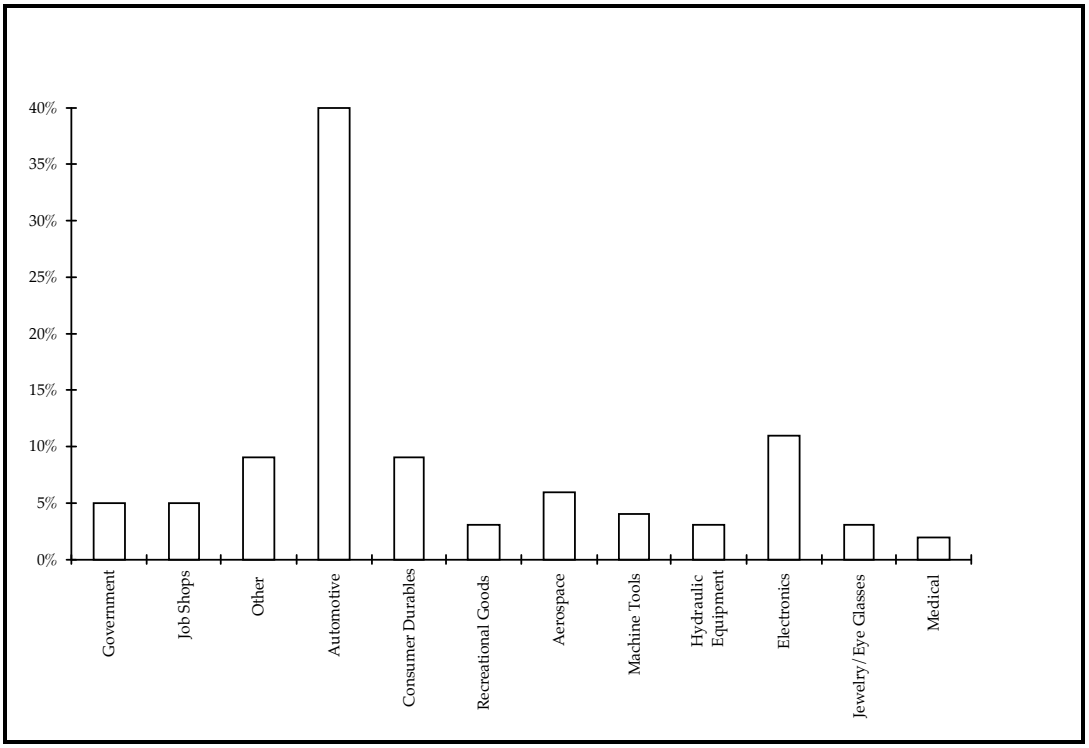
Most industries in SIC 34 are largely dependent upon the demands of other industries. For example, the success of the commercial construction industry is fundamental to the success of the fabricated structural metal industry; 95 percent of the output from the latter is consumed by the former. The general component-producing industries (e.g., screw machine products, industrial fasteners, etc.) display the same demand structure; the demand for such products is directly related to the demand for automobiles and public works construction.

Fabricated structural metal output declined two percent in 1993 due to a decrease in construction of office buildings, commercial structures, manufacturing facilities, and multi-family housing. Ninety-five percent of structural metal output is consumed by the construction industry. Low demand for structural metal is expected to continue, attributable to the recent overbuilding of commercial space and high levels of vacant office space. A slight increase in demand from the public sector (e.g., highway construction) is expected, however, which will positively influence demand for structural metal products. An increased demand for plumbing products is also likely, as the residential construction industry continues to grow.

Total shipments of general components (e.g., screw machine products, industrial fasteners, valves, and pipe fittings) increased by about 3.1 percent in 1993. Strong demand from the automotive sector, combined with increased demand from equipment and machinery manufacturers, were the major factors causing the increased shipments.

The two primary markets for metal finishing services are the automotive and electronics industries. As illustrated in Exhibit 8, consumer durables, aerospace, and the government also are large segments served by metal finishers.

**Exhibit 8**
**Markets Served by Metal Finishers**
**Percent of 1992 Market**




*Source: Surface Finishing Market Research Board, Metal Finishing Industry Market Survey 1992-1993.*
*NOTE: Data includes both job and captive shops.*

The sale of metal finishing services is also essentially a derived demand (i.e., sales depend entirely upon the production of other industries). However, sales by the metal finishing industry have not kept up with sales of the industries served.

In the last several years, many U.S. fastener (nuts, screws, bolts, rivets) companies have become more competitive in the global market by incorporating new technology into production lines to improve efficiency and quality. In 1993, U.S. exports of industrial fasteners edged up about 0.6 percent; Canada and Mexico were the largest importers. U.S. imports of industrial fasteners also increased 11 percent over the last several years. This is because demand in the U.S. out-paced production. The expansion of the U.S. automotive and residential construction sectors was a major factor in the increase in fastener imports.

Exports of U.S. valve and pipe fittings are also expected to grow. 1993 industry exports increased six percent compared with 1992 figures. Although Canada remains the principal foreign market, exports to Chile and the Philippines almost tripled, and exports to developing countries increased dramatically.

## III. INDUSTRIAL PROCESS DESCRIPTION

This section describes the major industrial processes within the Fabricated Metal Products industry, including the materials and equipment used and the processes employed. The section is designed for those interested in gaining a general understanding of the industry, and for those interested in the inter-relationship between the industrial process and the topics described in subsequent sections of this profile: pollutant outputs, pollution prevention opportunities, and Federal regulations. This section does not attempt to replicate published engineering information that is available for this industry. Refer to Section IX for a list of reference documents that are available.

Specifically, this section contains a description of commonly used production processes, the associated raw materials, the byproducts produced or released, and the materials either recycled or transferred off-site. This discussion, coupled with schematic drawings of the identified processes, provides a concise description of where wastes may be produced in the process. This section also describes the potential fate (air, water, land) of these waste products.

### III.A. Industrial Processes in the Fabricated Metal Products Industry

In view of the high cost of most new equipment and the relatively long lead time necessary to bring new equipment into operation, changes in production methods and products are made only gradually; even new process technologies that fundamentally change the industry are only adopted over long periods of time. In addition, the recent financial performance of the Fabricated Metal Products industry combined with the difficulty of raising funds in the bond market, have left many establishments with a limited ability to raise the capital necessary to purchase new equipment.

For the purposes of this profile, the industrial processes associated with the Fabricated Metal Products industry will be grouped into three categories: fabricated metal products; surface preparation; and metal finishing. Each category is discussed in greater depth in the following subsections.

## III.A.1. Fabricated Metal Products

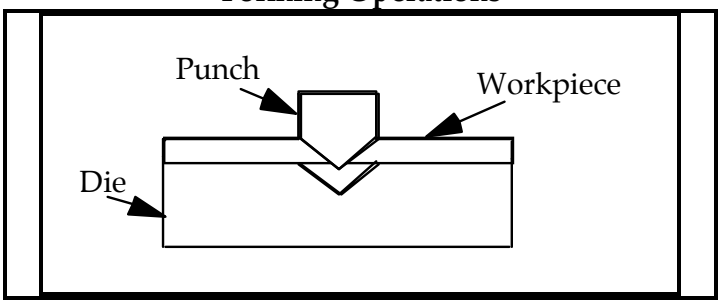
Once molten metal (ferrous or nonferrous) containing the correct metallurgical properties has been produced (see SIC 33, which comprises activities associated with the nonferrous metals industry), it is cast into a form that can enter various shaping processes. Recently, manufacturers have been using continuous casting techniques that allow the molten metal to be formed directly into sheets, eliminating interim forming stages. This section identifies some of the many forming and shaping methods used by the metal fabrication industry. In general, the metal may be heat treated or remain cold. Heat treating is the modification of the physical properties of a workpiece through the application of controlled heating and cooling cycles. Cold metal is formed by applying direct physical pressure to the metal.

Regardless of the forming method used, the metal fabricating process usually employs the use of cutting oils (e.g., ethylene glycol), degreasing and cleaning solvents, acids, alkalis, and heavy metals. The oils are typically used when forming and cutting the metal. The solvents (e.g., trichloroethane, methyl ethyl ketone), alkalines, and acids (e.g., hydrochloric, sulfuric) are used to clean the surface of the metals. The current trend in the industry is to use aqueous non-VOCs to clean the metals, whenever possible. The use of 1,1,1-trichloroethane and methyl ethyl ketone is declining.

Once molten metal is formed into a workable shape, shearing and forming operations are usually performed. Shearing operations cut materials into a desired shape and size, while forming operations bend or conform materials into specific shapes. Cutting or shearing operations include punching, piercing, blanking, cutoff, parting, shearing, and trimming. Basically, these operations produce holes or openings, or produce blanks or parts. The most common hole-making operation is punching. Cutoff, parting, and shearing are similar operations with different applications. The rate of production is highest in hot forging operations and lowest in simple bending and spinning operations.

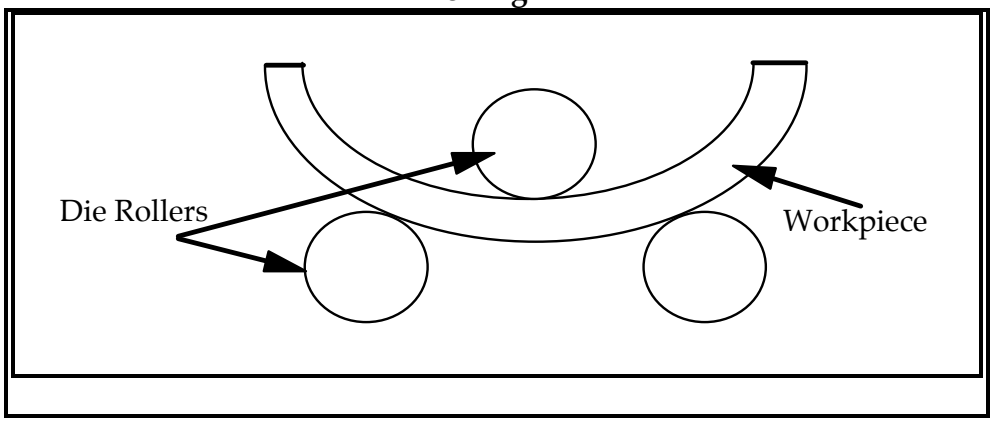
Forming operations, as illustrated in Exhibit 9, shape parts by bending, forming, extruding, drawing, rolling, spinning, coining, and forging the metal into a specific configuration. Bending is the simplest forming operation; the part is simply bent to a specific angle or shape. Other types of forming operations produces both two- and three-dimensional shapes.

**Exhibit 9**
**Forming Operations**




Extruding is the process of forming a specific shape from a solid blank by forcing the blank through a die of the desired shape. Extruding can produce complicated and intricate cross-sectional shapes. In rolling the metal passes through a set or series of rollers that bend and form the part into the desired shape (See Exhibit 10). Coining is a process that alters the form of the part by changing its thickness to produce a three-dimensional relief on one or both sides of the part, like a coin.

**Exhibit 10**
**Rolling**



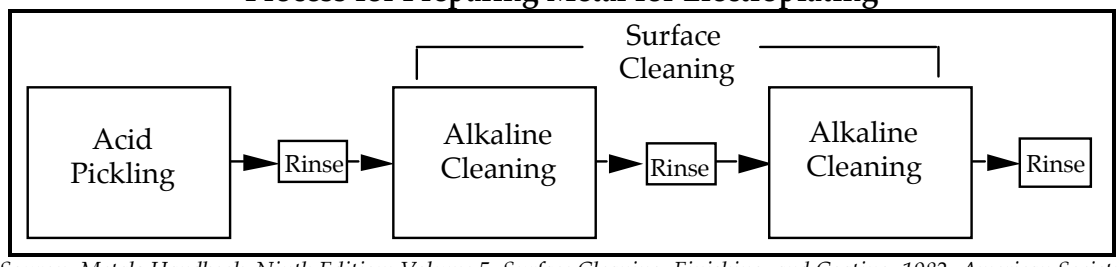

In drawing, a punch forces sheet stock into a die, where the desired shape is formed in the space between the punch and die. In spinning, pressure is applied to the sheet while it spins on a rotating form, forcing the sheet to acquire the shape of the form. Forging operations produce a specific shape by applying external pressure that either strikes or squeezes a heated blank into a die of the desired shape. Forging operations may be conducted on hot or cold metal using either single- or multi-stage dies.

Once shearing and forming activities are complete, the material is machined. Machining refines the shape of a workpiece by removing material from pieces of raw stock with machine tools. The principal processes involved in machining are drilling, milling, turning, shaping/planing, broaching, sawing, and grinding.

### III.A.2. Surface Preparation

The surface of the metal may require preparation prior to applying a finish. Surface preparation, cleanliness, and proper chemical conditions are essential to ensuring that finishes perform properly. Without a properly cleaned surface, even the most expensive coatings will fail to adhere or prevent corrosion. Surface preparation techniques range from simple abrasive blasting to acid washes to complex, multi-stage chemical cleaning processes. Exhibit 11 provides a flow chart of a representative process used when preparing metal for electroplating. Various surface preparation methods are discussed below.

**Exhibit 11**
**Process for Preparing Metal for Electroplating**




*Source: Metals Handbook, Ninth Edition; Volume 5, Surface Cleaning, Finishing, and Coating, 1982, American Society for Metals.*

Some cleaning techniques involve the application of organic solvents to degrease the surface of the metal. Other techniques, emulsion cleaning, for example, use common organic solvents (e.g., kerosene, mineral oil, and glycols) dispersed in an aqueous medium with the aid of an emulsifying agent. Emulsion cleaning uses less chemical than solvent degreasing because the concentration of solvent is lower.

Alkaline cleaning may also be utilized for the removal of organic soils. Most alkaline cleaning solutions are comprised of three major types of components: (1) builders, such as alkali hydroxides and carbonates, which make up the largest portion of the cleaner; (2) organic or

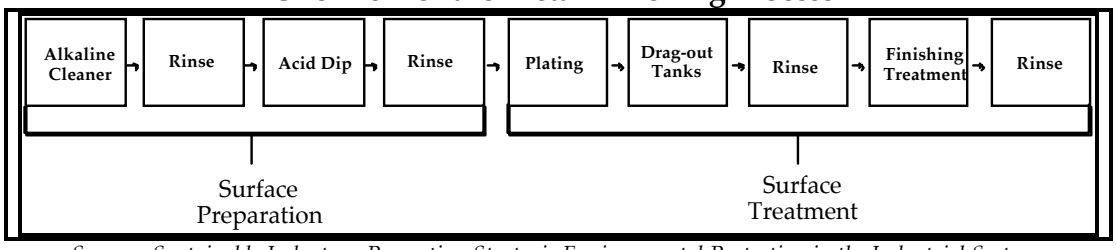
inorganic additives, which promote better cleaning or act to affect the metal surface in some way; and (3) surfactants. Alkaline cleaning is often assisted by mechanical action, ultrasonics, or by electrical potential (e.g., electrolytic cleaning).

Acid cleaning, or pickling, can also be used to prepare the surface of metal products by chemically removing oxides and scale from the surface of the metal. For instance, most carbon steel is pickled with sulfuric or hydrochloric acid, while stainless steel is pickled with hydrochloric or hydrofluoric acids, although hydrochloric acid may embrittle certain types of steel and is rarely used. The metal generally passes from the pickling bath through a series of rinses. Acid pickling is similar to acid cleaning, but is usually used to remove the scale from semi-finished mill products, whereas acid cleaning is usually used for near-final preparation of metal surfaces before electroplating, painting, and other finishing processes.

### III.A.3. Metal Finishing

Surface finishing usually involves a combination of metal deposition operations and numerous finishing operations. A diagram depicting the general metal finishing process, including surface preparation, is provided in Exhibit 12. Wastes typically generated during these operations are associated with the solvents and cleansers applied to the surface and the metal-ion-bearing aqueous solutions used in the plating tanks. Metal-ion-bearing solutions are commonly based on hexavalent chrome, trivalent chrome, copper, gold, silver, cadmium, zinc, and nickel. Many other metals and alloys are also used, although less frequently. The cleaners (e.g., acids) may appear in process wastewater; the solvents may be emitted into the air, released in wastewater, or disposed of in solid form; and other wastes, including paints, metal-bearing sludges, and still bottom wastes, may be generated in solid form. Several of the many metal finishing operations are described below.

## Exhibit 12
## Overview of the Metal Finishing Process




*Source: Sustainable Industry: Promoting Strategic Environmental Protection in the Industrial Sector, Phase 1 Report, U.S. EPA, OERR, June 1994.*

*Anodizing*

Anodizing is an electrolytic process which converts the metal surface to an insoluble oxide coating. Anodized coatings provide corrosion protection, decorative surfaces, a base for painting and other coating processes, and special electrical and mechanical properties. Aluminum is the most frequently anodized material. Common aluminum anodizing processes include: chromic acid anodizing, sulfuric acid anodizing, and boric-sulfuric anodizing. The sulfuric acid process is the most common method.

Following anodizing, parts are typically rinsed, then proceed through a sealing operation that improves the corrosion resistance of the coating. Common sealants include chromic acid, nickel acetate, nickel-cobalt acetate, and hot water.

*Chemical Conversion Coating*

Chemical conversion coating includes chromating, phosphating, metal coloring, and passivating operations. Chromate conversion coatings are produced on various metals by chemical or electrochemical treatment. Solutions, usually containing hexavalent chromium and other compounds, react with the metal surface to form a layer containing a complex mixture of compounds consisting of chromium, other constituents, and base metal. Phosphate coatings may be formed by the immersion of steel, iron, or zinc-plated steel in a dilute solution of phosphate salts, phosphoric acid, and other reagents to condition the surfaces for further processing. They are used to provide a good base for paints and other organic coatings, to condition the surfaces for cold forming operations by providing a base for drawing compounds and lubricants, and to impart corrosion resistance to the metal surface.

Metal coloring involves chemically converting the metal surface into an oxide or similar metallic compound to produce a decorative finish such as a green or blue patina on copper or steel, respectively. Passivating is the process of forming a protective film on metals by immersion into an acid solution, usually nitric acid or nitric acid with sodium dichromate. Stainless steel products are often passivated to prevent corrosion and extend the life of the product.

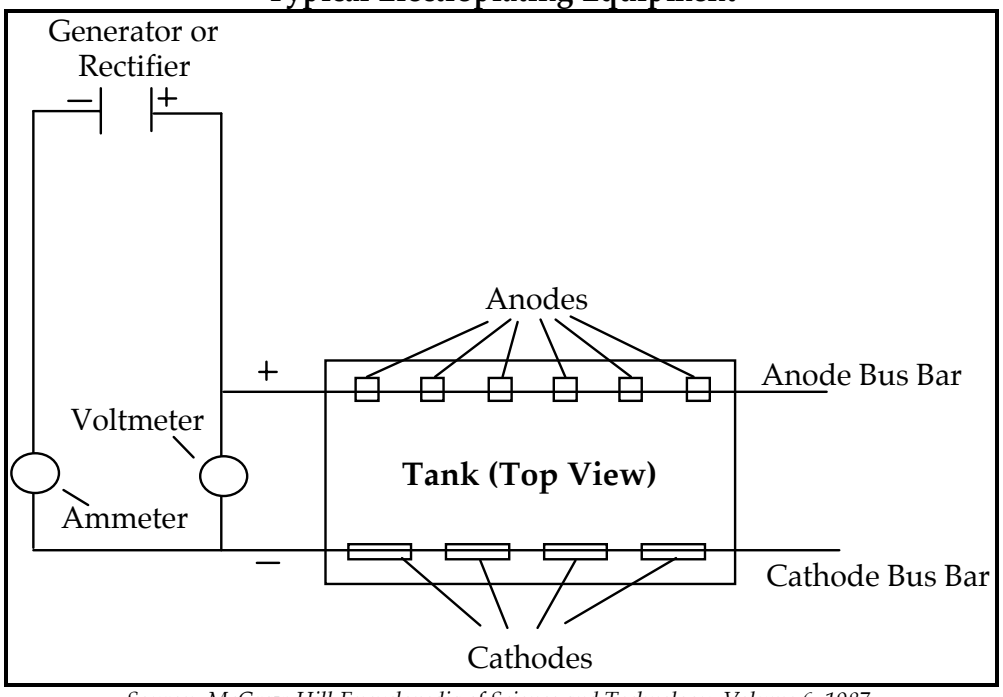
*Electroplating*

Electroplating is the production of a surface coating of one metal upon another by electrodeposition. Electroplating activities involve

applying predominantly *inorganic* coatings onto surfaces to provide corrosion resistance, hardness, wear resistance, anti-frictional characteristics, electrical or thermal conductivity, or decoration. Exhibit 13 illustrates the important parts of typical electroplating equipment. The most commonly electroplated metals and alloys include: brass (copper-zinc), cadmium, chromium, copper, gold, nickel, silver, tin, and zinc.

In electroplating, metal ions in either acid, alkaline, or neutral solutions are reduced on the workpieces being plated. The metal ions in the solution are usually replenished by the dissolution of metal from solid metal anodes fabricated of the same metal being plated, or by direct replenishment of the solution with metal salts or oxides. Cyanide, usually in the form of sodium or potassium cyanide, is usually used as a complexing agent for cadmium and precious metals electroplating, and to a lesser degree, for other solutions such as copper and zinc baths.

**Exhibit 13**
**Typical Electroplating Equipment**




*Source: McGraw Hill Encyclopedia of Science and Technology, Volume 6, 1987.*

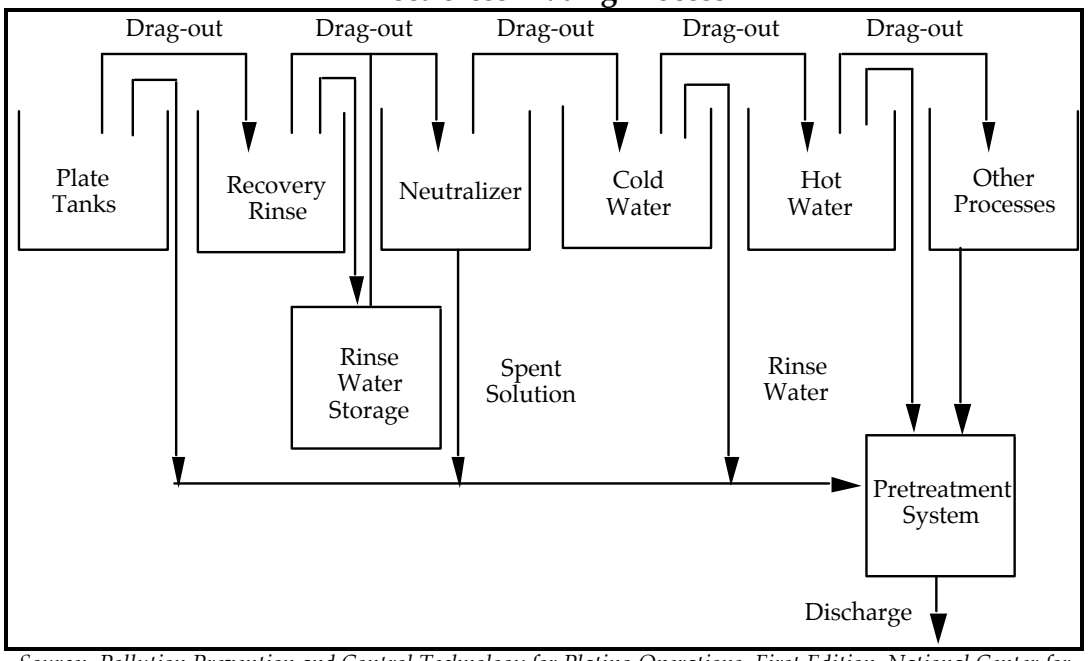
The sequence of steps in an electroplating includes: cleaning, often using alkaline and acid solutions; stripping of old plating or paint; electroplating; and rinsing between and after each of these operations.

Sealing and conversion coating may be employed on the metals after electroplating operations.

*Electroless Plating*

Electroless plating is the chemical deposition of a metal coating onto a plastic object, by immersion of the object in a plating solution. Copper and nickel electroless plating is commonly used for printed circuit boards. The basic ingredients in an electroless plating solution are: a source of metal (usually a salt); a reducer; a complexing agent to hold the metal in solution; and various buffers and other chemicals designed to maintain bath stability and increase bath life. Immersion plating produces a thin metal deposit, commonly zinc or silver, by chemical displacement. Immersion plating baths are usually formulations of metal salts, alkalis, and complexing agents (e.g., lactic, glycolic, malic acid salts). Electroless plating and immersion plating commonly generate more waste than other plating techniques, but individual facilities vary significantly in efficiency. Exhibit 13 illustrates a typical plating process.

**Exhibit 14**
**Electroless Plating Process**




*Source: Pollution Prevention and Control Technology for Plating Operations, First Edition, National Center for Manufacturing Sciences and National Association of Metal Finishers, 1994.*

*Painting*

Painting involves the application of predominantly *organic* coatings to a workpiece for protective and/or decorative purposes. It is applied in various forms, including dry powder, solvent-diluted formulations, and water-borne formulations. Various methods of application are used, the most common being spray painting and electrodeposition. Spray painting is a process by which paint is placed into a pressurized cup or pot and is atomized into a spray pattern when it is released from the vessel and forced through an orifice. Electrodeposition is the process of coating a workpiece by either making it anodic or cathodic in a bath that is generally an aqueous emulsion of the coating material. When applying the paint as a dry powder, some form of heating or baking is necessary to ensure that the powder adheres to the metal. These processes may result in solvent waste (and associated still bottom wastes generated during solvent distillation), paint sludge wastes, paint-bearing wastewaters, and paint solvent emissions.

*Other Metal Finishing Techniques*

Polishing, hot dip coating, and etching are processes that are also used to finish metal. Polishing is an abrading operation used to remove or smooth out surface defects (scratches, pits, or tool marks) that adversely affect the appearance or function of a part. Following polishing operations, area cleaning and washdown can produce metal-bearing wastewaters. Hot dip coating is the coating of a metallic workpiece with another metal to provide a protective film by immersion into a molten bath. Galvanizing (hot dip zinc) is a common form of hot dip coating. Water is used for rinses following precleaning and sometimes for quenching after coating. Wastewaters generated by these operations often contain metals. Etching produces specific designs or surface appearances on parts by controlled dissolution with chemical reagents or etchants. Etching solutions commonly comprise strong acids or bases with spent etchants containing high concentrations of spent metal. The solutions include ferric chloride, nitric acid, ammonium persulfate, chromic acid, cupric chloride, and hydrochloric acid.

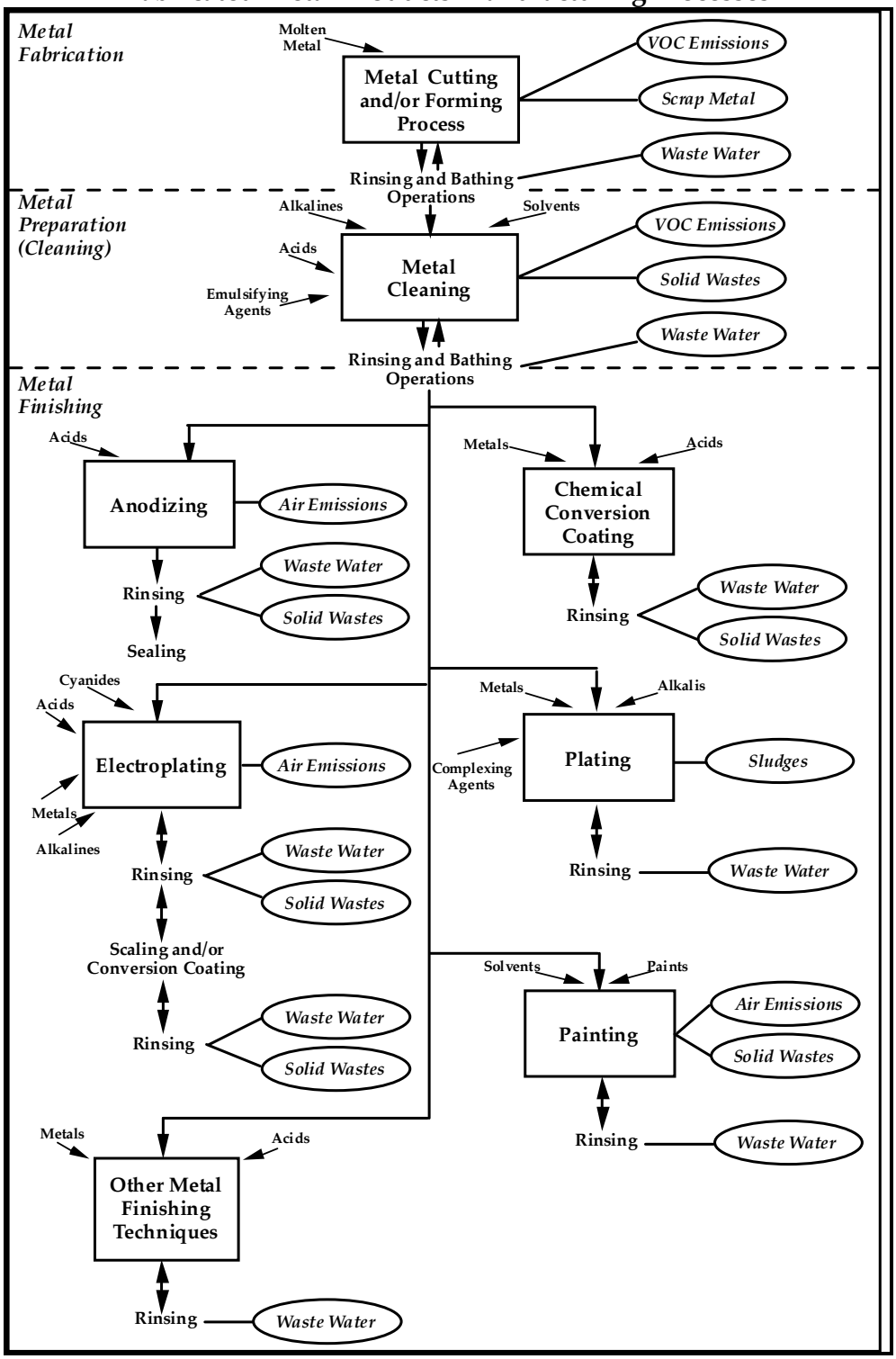
## III.B. Raw Material Inputs and Pollution Outputs in the Production Line

The material inputs and pollution outputs resulting from metal fabrication, surface preparation, and metal finishing processes are presented by media in Exhibit 15. Exhibit 16 illustrates the general processes associated with this industry, the pollutants generated, and the point in the process at which the pollutants are produced.

## Exhibit 15
## Process Materials Inputs and Outputs

| Process | Material Input | Air Emission | Process Wastewater | Solid Waste |
|---|---|---|---|---|
| ***Metal Shaping*** | | | | |
| Metal Cutting and/or Forming | Cutting oils, degreasing and cleaning solvents, acids, alkalis, and heavy metals | Solvent wastes (e.g., 1,1,1-trichloroethane, acetone, xylene, toluene, etc. ) | Waste oils (e.g., ethylene glycol) and acid (e.g., hydrochloric, sulfuric, nitric), alkaline, and solvent wastes | Metal chips (e.g., scrap steel and aluminum), metal-bearing cutting fluid sludges, and solvent still-bottom wastes |
| ***Surface Preparation*** | | | | |
| Solvent Degreasing and Emulsion, Alkaline, and Acid Cleaning | Solvents, emulsifying agents, alkalis, and acids | Solvents (associated with solvent degreasing and emulsion cleaning only) | Solvent, alkaline, and acid wastes | Ignitable wastes, solvent wastes, and still bottoms |
| ***Surface Finishing*** | | | | |
| Anodizing | Acids | Metal-ion-bearing mists and acid mists | Acid wastes | Spent solutions, wastewater treatment sludges, and base metals |
| Chemical Conversion Coating | Metals and acids | Metal-ion-bearing mists and acid mists | Metal salts, acid, and base wastes | Spent solutions, wastewater treatment sludges, and base metals |
| Electroplating | Acid/alkaline solutions, heavy metal bearing solutions, and cyanide bearing solutions | Metal-ion-bearing mists and acid mists | Acid/alkaline, cyanide, and metal wastes | Metal and reactive wastes |
| Plating | Metals (e.g., salts), complexing agents, and alkalis | Metal-ion-bearing mists | Cyanide and metal wastes | Cyanide and metal wastes |
| Painting | Solvents and paints | Solvents | Solvent wastes | Still bottoms, sludges, paint solvents, and metals |
| Other Metal Finishing Techniques (Including Polishing, Hot Dip Coating, and Etching) | Metals and acids | Metal fumes and acid fumes | Metal and acid wastes | Polishing sludges, hot dip tank dross, and etching sludges |

## Exhibit 16
## Fabricated Metal Products Manufacturing Processes



III.B.1. Metal Fabrication

Each of the metal shaping processes can result in wastes containing chemicals of concern. For example, the application of solvents to metal and machinery results in air emissions. Additionally, wastewater containing acidic or alkaline wastes and waste oils, and solid wastes, such as metals and solvents, are usually generated during this process.

Metal fabrication facilities are major users of solvents for degreasing. In cases where solvents are used solely in degreasing (not used in any other plant operations), records of the amount and frequency of purchases provide enough information to estimate emission rates, based on the assumption that all solvent purchased is eventually emitted. Section V.D., Pollution Prevention Options, illustrates techniques that may be used to reduce the loss of solvents to the atmosphere.

Metalworking fluids are applied to either the tool or the metal being tooled to facilitate the shaping operation. Metalworking fluid is used to:

- Control and reduce the temperature of tools and aid lubrication,
- Control and reduce the temperature of workpieces and aid lubrication,
- Provide a good finish,
- Wash away chips and metal debris, and
- Inhibit corrosion or surface oxidation.

Fluids resulting from this process typically become spoiled or contaminated with extended use and reuse. In general, metal working fluids can be petroleum-based, oil-water emulsions, and synthetic emulsions. When disposed, these fluids may contain high levels of metals (e.g., iron, aluminum, and copper). Additional contaminants present in fluids resulting from these processes include acids and alkalis (e.g., hydrochloric, sulfuric, nitric), waste oils, and solvent wastes.

Scrap metal may consist of metal removed from the original piece (e.g., steel), and may be combined with small amounts of

metalworking fluids (e.g., solvents) used prior to and during the metal shaping operation that generates the scrap. Quite often, this scrap is reintroduced into the process as a feedstock. The scrap and metalworking fluids, however, should be tracked since they may be regulated as solid wastes.

III.B.2. Surface Preparation

Surface preparation activities usually result in air emissions, contaminated wastewater, and solid wastes. The primary air emissions from cleaning are due to the evaporation of chemicals from solvent degreasing and emulsion cleaning processes. These emissions may result through volatilization of solvents during storage, fugitive losses during use, and direct ventilation of fumes.

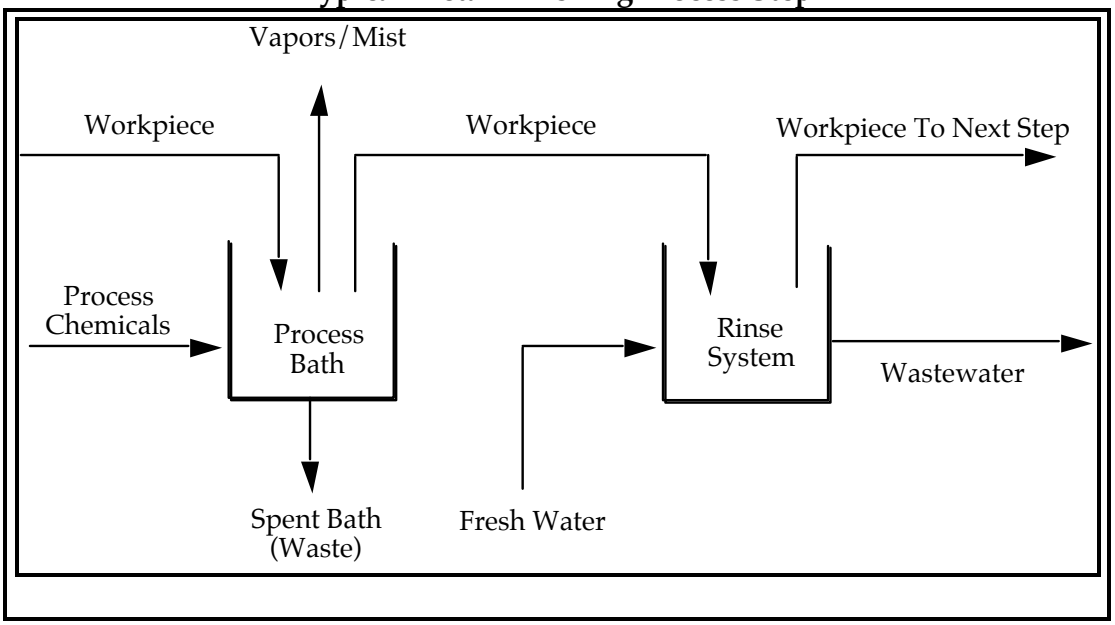
Wastewaters generated from cleaning are primarily rinse waters, which are usually combined with other metal finishing wastewaters (e.g., electroplating) and treated on-site by conventional hydroxide precipitation. Solid wastes (e.g., wastewater treatment sludges, still bottoms, cleaning tank residues, machining fluid residues, etc.) may also be generated by the cleaning operations. For example, solid wastes are generated when cleaning solutions become ineffective and are replaced. Solvent-bearing wastes are typically pre-treated to comply with any applicable National Pollutant Discharge System (NPDES) permits and then sent off-site, while aqueous wastes from alkaline and acid cleaning , which do not contain solvents, are often treated on-site.

III.B.3. Metal Finishing

Many metal finishing operations are typically performed in baths (tanks) and are then followed by rinsing cycles. Exhibit 17 illustrates a typical chemical or electrochemical process step in which a workpiece enters the process bath containing process chemicals that are carried to the rinse water (drag-out). Metal plating and related waste account for the largest volumes of metal- (e.g., cadmium, chromium, copper, lead, and nickel) and cyanide-bearing wastes. Painting operations account for the generation of solvent-bearing wastes and the direct release of solvents (including benzene, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene). Paint cleanup operations may contribute to the release of chlorinated solvents (including carbon tetrachloride, methylene chloride, 1,1,1-trichloroethane, and perchloroethylene). Compliance with one law through emission or effluent controls may generate waste regulated under another statute

(e.g., effluent controls required by the Clean Water Act may generate sludges which are regulated by the Resource Conservation and Recovery Act). The nature of the wastes produced by these processes is discussed further below.

**Exhibit 17**
**Typical Metal Finishing Process Step**




*Source: Guides to Pollution Prevention: The Metal Finishing Industry, U.S. EPA, ORD, October 1992.*

*Anodizing*

Anodizing operations produce air emissions, contaminated wastewaters, and solid wastes. Mists and gas bubbles arising from heated fluids are a source of air emissions, which may contain metals or other substances present in the bath. When dyeing of anodized coatings occurs, wastewaters produced may contain nickel acetate, non-nickel sealers, or substitutes from the dye. Other potential pollutants include complexers and metals from dyes and sealers. Wastewaters generated from anodizing are usually combined with other metal finishing wastewaters and treated on-site by conventional hydroxide precipitation. Wastewaters containing chromium must be pretreated to reduce hexavalent chromium to its trivalent state. The conventional treatment process generates a sludge that is usually sent off-site for metals reclamation and/or disposal.

Solid wastes generated from anodizing include spent solutions and wastewater treatment sludges. Anodizing solutions may be contaminated with the base metal being processed due to the anodic nature of the process. These solutions eventually reach an intolerable concentration of dissolved metal and require processing to remove the dissolved metal to a tolerable level or treatment/disposal.

*Chemical Conversion Coating*

Chemical conversion coating generally produces contaminated wastewaters and solid waste. Pollutants associated with these processes enter the wastestream through rinsing and batch dumping of process baths. The process baths usually contain metal salts, acids, bases, and dissolved basis materials. Wastewaters containing chromium are usually pretreated to reduce hexavalent chromium to its trivalent state. The conventional treatment process generates a sludge that is sent off-site for metals reclamation and/or disposal. Solid wastes generated from these processes include spent solutions and wastewater treatment sludges. Conversion coating solutions may also be contaminated with the base metal being processed. These solutions will eventually reach an intolerable concentration of dissolved metal and require processing to remove the dissolved metal to a tolerable level.

*Electroplating*

Electroplating operations produce air emissions, contaminated wastewaters and solid wastes. Mists arising from electroplating fluids and process gases can be a source of air emissions, which may contain metals or other substances present in the bath. The industry has recently begun adding fume suppressants to electroplating baths to reduce air emissions of chromium, one of the most frequently electroplated metals. The fume suppressants lower the surface tension of the bath, which prevents hydrogen bubbles in the bath from bursting and producing a chromium-laden mist. The fume suppressants are highly effective when used in decorative plating, but less effective when used in hard-chromium plating. Contaminated wastewaters result from workpiece rinsing and process cleanup waters. Rinse waters from electroplating are usually combined with other metal finishing wastewaters and treated on-site by conventional hydroxide precipitation. Wastewaters containing chromium must be pretreated to reduce hexavalent chromium to its trivalent state. These wastewater treatment techniques can result in solid-phase wastewater treatment sludges. Other wastes generated from electroplating

include spent solutions which become contaminated during use, and therefore, diminish performance of the process. In addition to these wastes, spent process solutions and quench bathes may be discarded periodically when the concentrations of contaminants inhibit proper function of the solution or bath.

*Electroless Plating*

Electroless plating produces contaminated wastewater and solid wastes. The spent plating solution and rinse water are usually treated chemically to precipitate out the toxic metals and to destroy the cyanide. Electroless plating solutions can be difficult to treat; settling and simple chemical precipitation are not effective at removing the chelated metals used in the plating bath. The extent to which plating solution carry-over adds to the wastewater and enters the sludge depends on the type of article being plated and the specific plating method employed. However, most sludges may contain significant concentrations of toxic metals, and may also contain complex cyanides in high concentrations if cyanides are not properly isolated during the treatment process.

*Painting*

Painting operations result in emissions, contaminated wastewaters, and the generation of liquid and solid wastes. Atmospheric emissions consist primarily of the organic solvents used as carriers for the paint. Emissions also result from paint storage, mixing, application, and drying. In addition, cleanup processes can result in the release of organic solvents used to clean equipment and painting areas. Wastewaters are often generated from painting processes due primarily to the discharge of water from water curtain booths. On-site treatment processes to treat contaminated wastewater generate a sludge that is sent off-site for disposal. Sources of solid- and liquid-phase wastes include:

- Paint application emissions control devices (e.g., paint booth collection systems, ventilation filters, etc.)
- Equipment washing
- Disposal materials used to contain paint and overspray
- Excess paints discarded upon completion of a painting operation or after expiration of the paint shelf-life.

These solid and liquid wastes may contain metals from paint pigments and organic solvents, such as paint solvents and cleaning solvents. Still bottoms also contain solvent wastes. The cleaning solvents used on painting equipment and spray booths may also contribute organic solid waste to the wastes removed from the painting areas.

*Other Metal Finishing Techniques*

Wastewaters are often generated during other metal finishing processes. For example, following polishing operations, area cleaning and washdown can produce metal-bearing wastewaters. Hot dip coating techniques, such as galvanizing, use water for rinses following pre-cleaning and sometimes for quenching after coating. Hot dip coatings also generate solid waste, anoxide dross, that is periodically skimmed off the heated tank. These operations generate metal-bearing wastewaters. Etching solutions are comprised of strong acids (e.g., ferric chloride, nitric acid, ammonium persulfate) or bases. Resulting spent etchant solutions may contain metals and acids.

## III.C. Management of Chemicals in Wastestream

The Pollution Prevention Act of 1990 (EPA) requires facilities to report information about the management of TRI chemicals in waste and efforts made to eliminate or reduce those quantities. These data have been collected annually in Section 8 of the TRI reporting Form R beginning with the 1991 reporting year. The data summarized below cover the years 1992-1995 and is meant to provide a basic understanding of the quantities of waste handled by the industry, the methods typically used to manage this waste, and recent trends in these methods. TRI waste management data can be used to assess trends in source reduction within individual industries and facilities, and for specific TRI chemicals. This information could then be used as a tool in identifying opportunities for pollution prevention compliance assistance activities.

While the quantities reported for 1992 and 1993 are estimates of quantities already managed, the quantities reported for 1994 and 1995 are projections only. The EPA requires these projections to encourage facilities to consider future waste generation and source reduction of those quantities as well as movement up the waste management hierarchy. Future-year estimates are not commitments that facilities reporting under TRI are required to meet.

Exhibit 18 shows that the fabricated metals industry managed about 798 million pounds of production-related waste (total quantity of TRI chemicals in the waste from routine production operations) in 1993 (column B). Column C reveals that of this production-related waste, 34 percent was either transferred off-site or released to the environment. Column C is calculated by dividing the total TRI transfers and releases by the total quantity of production-related waste. In other words, about 62 percent of the industry's TRI wastes were managed on-site through recycling, energy recovery, or treatment as shown in columns D, E and F, respectively. The majority of waste that is released or transferred off-site can be divided into portions that are recycled off-site, recovered for energy off-site, or treated off-site as shown in columns G, H, and I, respectively. The remaining portion of the production-related wastes (13.2 percent), shown in column J, is either released to the environment through direct discharges to air, land, water, and underground injection, or it is disposed off-site.

From the yearly data presented below it is apparent that the portion of TRI wastes reported as recycled on-site is projected to decrease and the portions treated or managed through energy recovery on-site have increased between 1992 and 1995 (projected).

**Exhibit 18**
**Source Reduction and Recycling Activity for SIC 34**

| A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| | | | On-Site | | | Off-Site | | | |
| Year | Production Related Waste Volume ($10^6$lbs.)* | % Reported as Released and Transferred | % Recycled | % Energy Recovery | % Treated | % Recycled | % Energy Recovery | % Treated | Remaining Releases and Disposal |
| 1992 | 750 | 38% | 23.22% | 12.24% | 23.11% | 26.03% | 1.57% | 2.02% | 12.05% |
| 1993 | 798 | 34% | 26.48% | 11.04% | 24.24% | 21.31% | 1.54% | 2.10% | 13.28% |
| 1994 | 735 | — | 27.91% | 8.90% | 26.33% | 22.18% | 1.53% | 2.32% | 10.84% |
| 1995 | 697 | — | 19.20% | 13.86% | 27.78% | 23.94% | 1.63% | 2.46% | 11.13% |

## IV. CHEMICAL RELEASE AND TRANSFER PROFILE

This section is designed to provide background information on the pollutant releases that are reported by this industry. The best source of comparative pollutant release information is the Toxic Release Inventory System (TRI). Pursuant to the Emergency Planning and Community Right-to-Know Act, TRI includes self-reported facility release and transfer data for over 600 toxic chemicals. Facilities within SIC Codes 20-39 (manufacturing industries) that have more than 10 employees, and that are above weight-based reporting thresholds are required to report TRI on-site releases and off-site transfers. The information presented within the sector notebooks is derived from the most recently available (1993) TRI reporting year (which then included 316 chemicals), and focuses primarily on the on-site releases reported by each sector. Because TRI requires consistent reporting regardless of sector, it is an excellent tool for drawing comparisons across industries.

Although this sector notebook does not present historical information regarding TRI chemical releases over time, please note that in general, toxic chemical releases have been declining. In fact, according to the 1993 Toxic Release Inventory Data Book, reported releases dropped by 42.7 percent between 1988 and 1993. Although on-site releases have decreased, the total amount of reported toxic waste has not declined because the amount of toxic chemicals transferred off-site has increased. Transfers have increased from 3.7 billion pounds in 1991 to 4.7 billion pounds in 1993. Better management practices have led to increases in off-site transfers of toxic chemicals for recycling. More detailed information can be obtained from EPA's annual Toxics Release Inventory Public Data Release book (which is available through the EPCRA Hotline at 1-800-535-0202), or directly from the Toxic Release Inventory System database (for user support call 202-260-1531).

Wherever possible, the sector notebooks present TRI data as the primary indicator of chemical release within each industrial category. TRI data provide the type, amount, and media receptor of each chemical released or transferred. When other sources of pollutant release data have been obtained, these data have been included to augment the TRI information.

TRI Data Limitations

The reader should keep in mind the following limitations regarding TRI data. Within some sectors, the majority of facilities are not subject to TRI reporting because they are not considered manufacturing industries, or because they are below TRI reporting thresholds. Examples are the mining, dry cleaning, printing, and transportation equipment cleaning sectors. For these sectors, release information from other sources has been included.

The reader should also be aware that TRI "pounds released" data presented within the notebooks is not equivalent to a "risk" ranking for each industry. Weighting each pound of release equally does not factor in the relative toxicity of each chemical that is released. The Agency is in the process of developing an approach to assign toxicological weightings to each chemical released so that one can differentiate between pollutants with significant differences in toxicity. As a preliminary indicator of the environmental impact of the industry's most commonly released chemicals, the notebook briefly summarizes the toxicological properties of the top five chemicals (by weight) reported by each industry.

**Definitions Associated With Section IV Data Tables**

General Definitions

**SIC Code** -- the Standard Industrial Classification (SIC) is a statistical classification standard used for all establishment-based Federal economic statistics. The SIC codes facilitate comparisons between facility and industry data.

**TRI Facilities** -- are manufacturing facilities that have 10 or more full-time employees and are above established chemical throughput thresholds. Manufacturing facilities are defined as facilities in Standard Industrial Classification primary codes 20-39. Facilities must submit estimates for all chemicals that are on the EPA's defined list and are above throughput thresholds.

Data Table Column Heading Definitions

The following definitions are based upon standard definitions developed by EPA's Toxic Release Inventory Program. The categories below represent the possible pollutant destinations that can be reported.

**RELEASES** -- are an on-site discharge of a toxic chemical to the environment. This includes emissions to the air, discharges to bodies of water, releases at the facility to land, as well as contained disposal into underground injection wells.

**Releases to Air (Point and Fugitive Air Emissions)** -- Include all air emissions from industry activity. Point emissions occur through confined air streams as found in stacks, ducts, or pipes. Fugitive emissions include losses from equipment leaks, or evaporative losses from impoundments, spills, or leaks.

**Releases to Water (Surface Water Discharges)** - encompass any releases going directly to streams, rivers, lakes, oceans, or other bodies of water. Any estimates for stormwater runoff and non-point losses must also be included.

**Releases to Land** -- includes disposal of waste to on-site landfills, waste that is land treated or incorporated into soil, surface impoundments, spills, leaks, or waste piles. These activities must occur within the facility's boundaries for inclusion in this category.

**Underground Injection** -- is a contained release of a fluid into a subsurface well for the purpose of waste disposal.

**TRANSFERS** -- is a transfer of toxic chemicals in wastes to a facility that is geographically or physically separate from the facility reporting under TRI. The quantities reported represent a movement of the chemical away from the reporting facility. Except for off-site transfers for disposal, these quantities do not necessarily represent entry of the chemical into the environment.

**Transfers to POTWs** -- are wastewaters transferred through pipes or sewers to a publicly owned treatments works (POTW). Treatment and chemical removal depend on the chemical's nature and treatment methods used. Chemicals not treated or destroyed by the POTW are generally released to surface waters or landfilled within the sludge.

**Transfers to Recycling** -- are sent off-site for the purposes of regenerating or recovering still valuable materials. Once these chemicals have been recycled, they may be returned to the originating facility or sold commercially.

**Transfers to Energy Recovery** -- are wastes combusted off-site in industrial furnaces for energy recovery. Treatment of a chemical by incineration is not considered to be energy recovery.

**Transfers to Treatment** -- are wastes moved off-site for either neutralization, incineration, biological destruction, or physical separation. In some cases, the chemicals are not destroyed but prepared for further waste management.

**Transfers to Disposal** -- are wastes taken to another facility for disposal generally as a release to land or as an injection underground.

## IV.A. EPA Toxic Release Inventory for the Fabricated Metal Products Industry

TRI release amounts listed below are not associated with non-compliance with environmental laws. These facilities appear based on self-reported data submitted to the Toxic Release Inventory program.

The TRI database contains a detailed compilation of self-reported, facility-specific chemical releases. The top reporting facilities for this sector are listed below. Facilities that have reported only the SIC codes covered under this notebook appear in Exhibit 19. Exhibit 20 contains additional facilities that have reported the SIC code covered within this report, and one or more SIC codes that are not within the scope of this notebook. Therefore, Exhibit 20 includes facilities that conduct multiple operations — some that are under the scope of this notebook, and some that are not. Currently, the facility-level data do not allow pollutant releases to be broken apart by industrial process.

Exhibits 21 - 24 illustrate the TRI releases and transfers for the Fabricated Metal Products industry (SIC 34). For the industry as a whole, solvents comprise the largest number of TRI releases. This reflects the fact that solvents are used during numerous metal shaping, surface preparation, and surface finishing operations. For example, during metal shaping and surface preparation operations, solvents are used primarily to degrease metal. Solvents are also used during painting operations. All of the processes which use solvents generally result in air emissions, contaminated wastewater, and solid wastes.

Between 1988 and 1993, the Fabricated Metals Products industry substantially reduced its TRI transfers and releases (see section V. Pollution Prevention Opportunities). Exhibits 21 and 22 show the

differences in transfers and releases over time, categorized by type of transfer or release.

Exhibit 19 lists the ten facilities with the highest total TRI releases, most of which are continuous coil manufacturers (e.g., facilities that manufacture aluminum cans from long strips of metal). The wastes generated by these manufacturers are not necessarily representative of the wastes generated by the metal fabricating and finishing industries as a whole.

**Exhibit 19**
**Top 10 TRI Releasing Fabricated Metal Products Facilities**

| SIC Codes | Total TRI Releases in Pounds | Facility Name | City | State |
|---|---|---|---|---|
| 3411 | 946,923 | U.S. Can Co., Plant 20 Weirton | Weirton | WV |
| 3411 | 880,500 | Metal Container Corp., NWB | New Windsor | NY |
| 3710, 3714, 3465 | 822,902 | GMC NAO Flint OPS., BOC Flint Automotive Div. | Flint | MI |
| 3471 | 708,285 | Plastene Supply Co. | Portageville | MO |
| 3731, 3441, 3443 | 688,540 | Ingalls Shipbuilding, Inc. | Pascagoula | MS |
| 3411 | 636,126 | American National Can Co., Winston Salem Plant | Winston-Salem | NC |
| 3411 | 624,250 | Metal Container Corp. FTA | Fort Atkinson | WI |
| 3479 | 619,436 | Ken-Koat, Inc. | Huntington | IN |
| 3714, 3471 | 618,359 | Keeler Brass Automotive, Kentwood Plant | Grand Rapids | MI |
| 3341, 3479, 3355 | 570,622 | Commonwealth Aluminum Corp. | Lewisport | KY |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

*Note: Being included on this list does not mean that the release is associated with non-compliance with environmental laws.*

## Exhibit 20
## Top 10 TRI Releasing Metal Fabricating & Finishing Facilities (SIC 34)

| Rank | Total TRI Releases in Pounds | Facility Name | City | State |
|---|---|---|---|---|
| 1 | 946,923 | U.S. Can Co., Plant 20, Weirton | Weirton | WV |
| 2 | 880,500 | Metal Container Corp., NWB | New Windsor | NY |
| 3 | 708,285 | Plastene Supply Co. | Portageville | MO |
| 4 | 636,126 | American National Can Co., Winston Salem Plant | Winston-Salem | NC |
| 5 | 624,250 | Metal Container Corp. | Fort Atkinson | WI |
| 6 | 619,436 | Ken-Koat, Inc. | Huntington | IN |
| 7 | 545,505 | Metal Container Corp. | Columbus | OH |
| 8 | 541,654 | Reynolds Metals Co. | Houston | TX |
| 9 | 524,346 | Hickory Springs Mfg. Co. | Fort Smith | AR |
| 10 | 492,872 | Tennessee Electroplating, Inc. | Ripley | TN |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

*Note: Being included on this list does not mean that the release is associated with non-compliance with environmental laws.*

## Exhibit 21
## Reductions in TRI Releases, 1988-1993 (SIC 34)

| Releases | 1988 | 1993 | Percent Reduction |
|---|---|---|---|
| Total Air Emissions | 131,296,827 | 90,380,667 | 31.2 |
| Surface Water Discharges | 1,516,905 | 101,928 | 93.3 |
| Underground Injection | 386,120 | 1,490 | 99.6 |
| Releases to Land | 4,202,919 | 660,072 | 84.4 |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

## Exhibit 22
## Reductions in TRI Transfers, 1988-1993 (SIC 34)

| Transfers | 1988 | 1993 | Percent Reduction |
|---|---|---|---|
| Recycling | 213,214,641 | 244,278,696 | -14.6 |
| Energy | 12,331,653 | 13,812,271 | -12.0 |
| Treatment | 34,313,199 | 18,561,504 | 45.9 |
| POTWs | 17,149,495 | 3,809,715 | 77.8 |
| Disposal | 43,529,628 | 19,736,496 | 54.7 |
| Other Off-Site Transfers | 8,303,148 | 369,491 | 95.5 |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

## Exhibit 23
## TRI Reporting Metal Fabricating & Finishing Facilities (SIC 34) by State

| State | Number of Facilities | State | Number of Facilities |
|---|---|---|---|
| AL | 54 | MS | 29 |
| AR | 25 | NC | 35 |
| AS | 1 | NE | 9 |
| AZ | 17 | NH | 5 |
| CA | 208 | NJ | 60 |
| CO | 19 | NV | 3 |
| CT | 83 | NY | 101 |
| DE | 2 | OH | 225 |
| FL | 36 | OK | 29 |
| GA | 42 | OR | 20 |
| HI | 2 | PA | 123 |
| IA | 30 | PR | 10 |
| ID | 1 | RI | 30 |
| IL | 230 | SC | 37 |
| IN | 111 | SD | 3 |
| KS | 16 | TN | 47 |
| KY | 41 | TX | 107 |
| LA | 12 | UT | 15 |
| MA | 76 | VA | 30 |
| MD | 17 | WA | 24 |
| ME | 5 | WI | 103 |
| MI | 159 | WV | 16 |
| MN | 59 | WY | 2 |
| MO | 54 | | |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

## Exhibit 24
## Releases for Metal Fabricating & Finishing Facilities (SIC 34) in TRI, by Number of Facilities (Releases reported in pounds/year)

| Chemical Name | # Facilities Reporting Chemical | Fugitive Air | Point Air | Water Discharges | Under-ground Injection | Land Disposal | Total Releases | Average Releases per Facility |
|---|---|---|---|---|---|---|---|---|
| Sulfuric Acid | 861 | 186135 | 149329 | 41032 | 547 | 54700 | 431743 | 501 |
| Hydrochloric Acid | 652 | 264628 | 265452 | 505 | 250 | 255 | 531090 | 815 |
| Nitric Acid | 390 | 81650 | 216384 | 1510 | 76 | 0 | 299620 | 768 |
| Xylene (Mixed Isomers) | 336 | 2982600 | 5985667 | 25 | 0 | 553 | 8968845 | 26693 |
| Nickel | 311 | 23285 | 8126 | 3558 | 0 | 6121 | 41090 | 132 |
| Chromium | 287 | 25150 | 6072 | 2162 | 0 | 30345 | 63729 | 222 |
| Manganese | 271 | 29884 | 9536 | 834 | 250 | 30994 | 71498 | 264 |
| Glycol Ethers | 269 | 4990228 | 13281181 | 5 | 0 | 5 | 18271419 | 67923 |
| Copper | 267 | 19231 | 20632 | 2795 | 0 | 763 | 43421 | 163 |
| Methyl Ethyl Ketone | 254 | 2134002 | 4511723 | 555 | 0 | 71335 | 6717615 | 26447 |
| Zinc Compounds | 228 | 87045 | 55641 | 13561 | 0 | 95457 | 251704 | 1104 |
| N-Butyl Alcohol | 215 | 3209678 | 7372875 | 0 | 0 | 5 | 10582558 | 49221 |
| Toluene | 205 | 1366663 | 3325311 | 7 | 0 | 300 | 4692281 | 22889 |
| 1-Trichloroethane | 189 | 2046210 | 2727842 | 10 | 0 | 133 | 4774195 | 25260 |
| Trichloroethylene | 185 | 2410195 | 2903856 | 51 | 0 | 6600 | 5320702 | 28761 |
| Chromium Compounds | 176 | 7039 | 13687 | 1035 | 0 | 15574 | 37335 | 212 |
| Phosphoric Acid | 175 | 49587 | 32213 | 0 | 319 | 0 | 82119 | 469 |
| Nickel Compounds | 158 | 7538 | 9311 | 876 | 48 | 1530 | 19303 | 122 |
| Methyl Isobutyl Ketone | 114 | 501363 | 1156914 | 5 | 0 | 5 | 1658287 | 14546 |
| Cyanide Compounds | 103 | 7686 | 8960 | 298 | 0 | 283 | 17227 | 167 |
| Copper Compounds | 93 | 4912 | 6028 | 1398 | 0 | 256 | 12594 | 135 |
| Lead | 83 | 5758 | 4400 | 809 | 0 | 254 | 11221 | 135 |
| Ammonia | 79 | 87916 | 412960 | 250 | 0 | 0 | 501126 | 6343 |
| Ethylbenzene | 74 | 234540 | 308927 | 5 | 0 | 0 | 543472 | 7344 |
| Hydrogen Fluoride | 74 | 12924 | 27671 | 0 | 0 | 0 | 40595 | 549 |
| Zinc (Fume Or Dust) | 70 | 100770 | 41693 | 290 | 0 | 10146 | 152899 | 2184 |
| Acetone | 61 | 407417 | 1090972 | 0 | 0 | 0 | 1498389 | 24564 |
| Manganese Compounds | 58 | 2197 | 795 | 0 | 0 | 12785 | 15777 | 272 |
| Dichloromethane | 57 | 991302 | 1159594 | 5 | 0 | 6829 | 2157730 | 37855 |
| 4-Trimethylbenzene | 53 | 255913 | 319541 | 5 | 0 | 0 | 575459 | 10858 |
| Tetrachloroethylene | 49 | 809152 | 434749 | 22 | 0 | 0 | 1243923 | 25386 |
| Methanol | 48 | 64182 | 182883 | 0 | 0 | 0 | 247065 | 5147 |
| Chlorine | 40 | 9181 | 1021 | 15 | 0 | 0 | 10217 | 255 |
| Methylenebis(Phenylis ocyanate) | 35 | 2562 | 1179 | 0 | 0 | 0 | 3741 | 107 |
| Naphthalene | 33 | 57791 | 70271 | 0 | 0 | 0 | 128062 | 3881 |
| Cobalt | 28 | 1534 | 1608 | 755 | 0 | 500 | 4397 | 157 |
| Barium Compounds | 25 | 3606 | 803 | 250 | 0 | 3114 | 7773 | 311 |
| Freon 113 | 19 | 282200 | 102624 | 0 | 0 | 0 | 384824 | 20254 |
| Lead Compounds | 19 | 967 | 1840 | 38 | 0 | 0 | 2845 | 150 |
| Styrene | 17 | 154377 | 25726 | 0 | 0 | 0 | 180103 | 10594 |
| Cadmium | 16 | 62 | 6 | 5 | 0 | 250 | 323 | 20 |
| Formaldehyde | 16 | 15561 | 9618 | 209 | 0 | 0 | 25388 | 1587 |
| Aluminum (Fume Or Dust) | 13 | 7042 | 506 | 0 | 0 | 0 | 7548 | 581 |
| Trichlorofluoro-methane | 13 | 45312 | 122318 | 0 | 0 | 250 | 167880 | 12914 |
| Cadmium Compounds | 11 | 276 | 266 | 0 | 0 | 0 | 542 | 49 |
| Ethylene Glycol | 11 | 37417 | 160907 | 0 | 0 | 0 | 198324 | 18029 |
| Propylene | 11 | 25423 | 771 | 0 | 0 | 0 | 26194 | 2381 |
| Cumene | 9 | 10383 | 24238 | 5 | 0 | 0 | 34626 | 3847 |
| 2-Ethoxyethanol | 8 | 14361 | 19390 | 0 | 0 | 0 | 33751 | 4219 |
| Cyclohexane | 7 | 611237 | 55929 | 0 | 0 | 0 | 667166 | 95309 |
| Isopropyl Alcohol (Manufacturing | 6 | 22111 | 29351 | 0 | 0 | 0 | 51462 | 8577 |
| Antimony Compounds | 5 | 4505 | 661 | 260 | 0 | 0 | 5426 | 1085 |
| Cobalt Compounds | 5 | 2 | 113 | 37 | 0 | 9 | 161 | 32 |
| M-Xylene | 5 | 898 | 12297 | 0 | 0 | 0 | 13195 | 2639 |
| Antimony | 4 | 0 | 423 | 0 | 0 | 0 | 423 | 106 |

## Exhibit 24 (cont'd)
## Releases for Metal Fabricating & Finishing Facilities (SIC 34) in TRI, by Number of Facilities (Releases reported in pounds/year)

| Chemical Name | # Facilities Reporting Chemical | Fugitive Air | Point Air | Water Discharges | Under-ground Injection | Land Disposal | Total Releases | Average Releases per Facility |
|---|---|---|---|---|---|---|---|---|
| Bis(2-Ethylhexyl) Adipate | 4 | 8850 | 14000 | 0 | 0 | 0 | 22850 | 5713 |
| Dimethyl Phthalate | 4 | 2407 | 6387 | 0 | 0 | 0 | 8794 | 2199 |
| Phenol | 4 | 12922 | 0 | 3 | 0 | 0 | 12925 | 3231 |
| Sec-Butyl Alcohol | 4 | 6350 | 19600 | 0 | 0 | 0 | 25950 | 6488 |
| Aluminum Oxide (Fibrous Form) | 3 | 250 | 250 | 0 | 0 | 0 | 500 | 167 |
| Di(2-Ethylhexyl) Phthalate | 3 | 250 | 3000 | 0 | 0 | 5 | 3255 | 1085 |
| Dichlorodifluoro-methane | 3 | 7406 | 16443 | 0 | 0 | 0 | 23849 | 7950 |
| Silver | 3 | 5 | 0 | 5 | 0 | 0 | 10 | 3 |
| Asbestos (Friable) | 2 | 10 | 0 | 0 | 0 | 0 | 10 | 5 |
| Barium | 2 | 5 | 0 | 0 | 0 | 0 | 5 | 3 |
| Butyl Benzyl Phthalate | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Diethyl Phthalate | 2 | 255 | 250 | 0 | 0 | 0 | 505 | 253 |
| Molybdenum Trioxide | 2 | 250 | 0 | 0 | 0 | 2000 | 2250 | 1125 |
| O-Xylene | 2 | 0 | 37928 | 0 | 0 | 0 | 37928 | 18964 |
| Phosphorus (Yellow Or White) | 2 | 10 | 5 | 5 | 0 | 0 | 20 | 10 |
| Toluenediisocyanate (Mixed Isomers) | 2 | 5 | 148 | 0 | 0 | 0 | 153 | 77 |
| 2-Methoxyethanol | 2 | 255 | 24825 | 0 | 0 | 0 | 25080 | 12540 |
| Ammonium Nitrate (Solution) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ammonium Sulfate (Solution) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arsenic | 1 | 5 | 0 | 0 | 0 | 0 | 5 | 5 |
| Benzene | 1 | 3122 | 836 | 0 | 0 | 0 | 3958 | 3958 |
| Diethanolamine | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ethyl Acrylate | 1 | 0 | 2578 | 0 | 0 | 0 | 2578 | 2578 |
| Mercury | 1 | 5 | 0 | 0 | 0 | 0 | 5 | 5 |
| P-Xylene | 1 | 0 | 22 | 0 | 0 | 0 | 22 | 22 |
| Polychlorinated Biphenyls | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Propane Sultone | 1 | 250 | 0 | 0 | 0 | 0 | 250 | 250 |
| Selenium | 1 | 5 | 0 | 0 | 0 | 0 | 5 | 5 |
| Silver Compounds | 1 | 250 | 250 | 0 | 0 | 0 | 500 | 500 |
| 2-Dichlorobenzene | 1 | 12000 | 0 | 0 | 0 | 0 | 12000 | 12000 |
| 2-Nitropropane | 1 | 186 | 182 | 0 | 0 | 0 | 368 | 368 |
| 4'-Isopropylidenediphenol | 1 | 0 | 250 | 0 | 0 | 0 | 250 | 250 |
| **Totals** | ---- | 24,768,891 | 46,819,995 | 73,195 | 1,490 | 351,356 | 72,014,927 | **----** |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

## Exhibit 25
## Transfers for Metal Fabricating & Finishing Facilities (SIC 34) in TRI, by Number of Facilities (Transfers reported in pounds/year)

| Chemical Name | # Facilities Reporting Chemical | POTW Discharges | Disposal | Recycling | Treatment | Energy Recovery | Total Transfers | Average Transfers per Facility |
|---|---|---|---|---|---|---|---|---|
| Sulfuric Acid | 861 | 1132535 | 2871580 | 4011148 | 4636541 | 0 | 12651804 | 14694 |
| Hydrochloric Acid | 652 | 446440 | 2768870 | 1472808 | 3169967 | 0 | 7935080 | 12170 |
| Nitric Acid | 390 | 37256 | 309134 | 946756 | 623265 | 0 | 1916411 | 4914 |
| Xylene (Mixed Isomers) | 336 | 51 | 10852 | 1661765 | 332850 | 2139660 | 4151607 | 12356 |
| Nickel | 311 | 17355 | 367278 | 8848547 | 464008 | 0 | 9727271 | 31277 |
| Chromium | 287 | 30170 | 465237 | 10143210 | 422090 | 10 | 11121986 | 38753 |
| Manganese | 271 | 5093 | 834964 | 8774505 | 8299 | 0 | 9623861 | 35512 |
| Glycol Ethers | 269 | 385087 | 55411 | 824664 | 142591 | 2295807 | 3746528 | 13928 |
| Copper | 267 | 8784 | 653024 | 53401212 | 60924 | 667 | 54124861 | 202715 |
| Methyl Ethyl Ketone | 254 | 141 | 32971 | 2787367 | 268783 | 4002200 | 7107644 | 27983 |
| Zinc Compounds | 228 | 31969 | 4797726 | 23980836 | 2004640 | 3249 | 30847198 | 135295 |
| N-Butyl Alcohol | 215 | 13302 | 9306 | 100928 | 43711 | 306263 | 497761 | 2315 |
| Toluene | 205 | 93 | 31782 | 603704 | 277628 | 1892116 | 2805323 | 13685 |
| 1-Trichloroethane | 189 | 65 | 34508 | 1342465 | 128708 | 101194 | 1606940 | 8502 |
| Trichloroethylene | 185 | 1083 | 34070 | 1045702 | 371432 | 102092 | 1554379 | 8402 |
| Chromium Compounds | 176 | 18099 | 721452 | 1222505 | 500300 | 2981 | 2490098 | 14148 |
| Phosphoric Acid | 175 | 268375 | 300139 | 5805346 | 280512 | 0 | 6669606 | 38112 |
| Nickel Compounds | 158 | 21635 | 463522 | 1839379 | 549790 | 6 | 2879204 | 18223 |
| Methyl Isobutyl Ketone | 114 | 5 | 1407 | 813193 | 30029 | 471629 | 1316263 | 11546 |
| Cyanide Compounds | 103 | 19581 | 17461 | 12188 | 140767 | 0 | 190497 | 1849 |
| Copper Compounds | 93 | 13826 | 341003 | 11781033 | 205196 | 7 | 12341065 | 132700 |
| Lead | 83 | 1160 | 78382 | 2392024 | 10184 | 281 | 2482031 | 29904 |
| Ammonia | 79 | 31527 | 1030 | 750 | 260 | 0 | 33567 | 425 |
| Ethylbenzene | 74 | 5 | 2 | 170492 | 14164 | 227471 | 412134 | 5569 |
| Hydrogen Fluoride | 74 | 382 | 2581 | 0 | 16618 | 0 | 19581 | 265 |
| Zinc (Fume Or Dust) | 70 | 75982 | 219289 | 666508 | 120336 | 61242 | 1143857 | 16341 |
| Acetone | 61 | 5 | 19917 | 705690 | 173168 | 134723 | 1033503 | 16943 |
| Manganese Compounds | 58 | 302 | 221084 | 1243001 | 1299 | 0 | 1465686 | 25270 |
| Dichloromethane | 57 | 647 | 5 | 289636 | 73238 | 26737 | 390263 | 6847 |
| 4-Trimethylbenzene | 53 | 5 | 5 | 23532 | 10506 | 58127 | 92175 | 1739 |
| Tetrachloroethylene | 49 | 65 | 6344 | 555166 | 129891 | 6692 | 698158 | 14248 |
| Methanol | 48 | 29686 | 0 | 35726 | 34952 | 80494 | 180858 | 3768 |
| Chlorine | 40 | 4470 | 750 | 250 | 6226 | 0 | 11696 | 292 |
| Methylenebis(Phenylisocyanate) | 35 | 0 | 25420 | 250 | 7014 | 500 | 33184 | 948 |
| Naphthalene | 33 | 0 | 70 | 34926 | 14821 | 39431 | 89248 | 2704 |
| Cobalt | 28 | 319 | 10978 | 405387 | 753 | 0 | 440451 | 15730 |
| Barium Compounds | 25 | 12 | 56251 | 2079 | 20823 | 0 | 79165 | 3167 |
| Freon 113 | 19 | 0 | 0 | 93230 | 21794 | 1917 | 116941 | 6155 |
| Lead Compounds | 19 | 797 | 198398 | 798893 | 1590 | 501 | 1000179 | 52641 |
| Styrene | 17 | 0 | 12000 | 1180 | 750 | 250 | 14180 | 834 |
| Cadmium | 16 | 1829 | 8006 | 9432 | 31506 | 0 | 50773 | 3173 |
| Formaldehyde | 16 | 41510 | 5 | 0 | 1611 | 7202 | 50328 | 3146 |
| Aluminum (Fume Or Dust) | 13 | 500 | 250 | 157757 | 5460 | 0 | 163967 | 12613 |
| Trichlorofluoro-methane | 13 | 0 | 7374 | 0 | 4263 | 0 | 11637 | 895 |
| Cadmium Compounds | 11 | 1288 | 65324 | 27000 | 42512 | 0 | 136124 | 12375 |
| Ethylene Glycol | 11 | 22685 | 86000 | 17100 | 19170 | 3110 | 148065 | 13460 |
| Propylene | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cumene | 9 | 5 | 0 | 2020 | 441 | 5618 | 8084 | 898 |
| 2-Ethoxyethanol | 8 | 5 | 0 | 516 | 0 | 2600 | 3121 | 390 |
| Cyclohexane | 7 | 0 | 750 | 0 | 1250 | 255 | 2255 | 322 |

## Exhibit 25 (cont'd)
## Transfers for Metal Fabricating & Finishing Facilities (SIC 34) in TRI, by Number of Facilities (Transfers reported in pounds/year)

| Chemical Name | # Facilities Reporting Chemical | POTW Discharges | Disposal | Recycling | Treatment | Energy Recovery | Total Transfers | Average Transfers per Facility |
|---|---|---|---|---|---|---|---|---|
| Isopropyl Alcohol (Manufacturing | 6 | 0 | 613 | 97513 | 15 | 5688 | 103829 | 17305 |
| Antimony Compounds | 5 | 10 | 104158 | 0 | 1104 | 0 | 105272 | 21054 |
| Cobalt Compounds | 5 | 15 | 18403 | 41566 | 5 | 1 | 59990 | 11998 |
| M-Xylene | 5 | 0 | 0 | 0 | 109 | 3819 | 3928 | 786 |
| Antimony | 4 | 0 | 0 | 3187 | 375 | 0 | 3562 | 891 |
| Bis(2-Ethylhexyl) Adipate | 4 | 6400 | 3145 | 0 | 0 | 0 | 9545 | 2386 |
| Dimethyl Phthalate | 4 | 0 | 0 | 0 | 269 | 1802 | 2071 | 518 |
| Phenol | 4 | 250 | 1176 | 0 | 0 | 0 | 1426 | 357 |
| Sec-Butyl Alcohol | 4 | 0 | 0 | 0 | 840 | 250 | 1090 | 273 |
| Aluminum Oxide (Fibrous Form) | 3 | 0 | 0 | 25000 | 0 | 0 | 25000 | 8333 |
| Di(2-Ethylhexyl) Phthalate | 3 | 5 | 8440 | 0 | 0 | 0 | 8445 | 2815 |
| Dichlorodifluoromethane | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Silver | 3 | 10 | 15 | 250 | 0 | 0 | 275 | 92 |
| Asbestos (Friable) | 2 | 0 | 73822 | 0 | 0 | 0 | 73822 | 36911 |
| Barium | 2 | 5 | 10 | 0 | 0 | 0 | 15 | 8 |
| Butyl Benzyl Phthalate | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Diethyl Phthalate | 2 | 500 | 0 | 2052 | 2061 | 0 | 4613 | 2307 |
| Molybdenum Trioxide | 2 | 0 | 419 | 3900 | 0 | 0 | 4319 | 2160 |
| O-Xylene | 2 | 0 | 0 | 0 | 61 | 0 | 61 | 31 |
| Phosphorus (Yellow Or White) | 2 | 0 | 0 | 12250 | 0 | 0 | 12250 | 6125 |
| Toluenediisocyanate (Mixed Isomers) | 2 | 0 | 0 | 0 | 0 | 1374 | 1374 | 687 |
| 2-Methoxyethanol | 2 | 5 | 0 | 0 | 0 | 8520 | 8525 | 4263 |
| Ammonium Nitrate (Solution) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ammonium Sulfate (Solution) | 1 | 128241 | 0 | 0 | 0 | 0 | 128241 | 128241 |
| Arsenic | 1 | 5 | 10 | 0 | 0 | 0 | 15 | 15 |
| Benzene | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Diethanolamine | 1 | 0 | 0 | 440 | 0 | 0 | 440 | 440 |
| Ethyl Acrylate | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mercury | 1 | 5 | 10 | 0 | 0 | 0 | 15 | 15 |
| P-Xylene | 1 | 0 | 0 | 0 | 51 | 0 | 51 | 51 |
| Polychlorinated Biphenyls | 1 | 0 | 0 | 0 | 2286 | 0 | 2286 | 2286 |
| Propane Sultone | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Selenium | 1 | 5 | 10 | 0 | 0 | 0 | 15 | 15 |
| Silver Compounds | 1 | 250 | 0 | 4000 | 0 | 0 | 4250 | 4250 |
| 2-Dichlorobenzene | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2-Nitropropane | 1 | 0 | 0 | 0 | 95 | 103 | 198 | 198 |
| 4'-Isopropylidene-diphenol | 1 | 0 | 250 | 0 | 0 | 0 | 250 | 250 |
| **Totals** | **----** | **2,800,087** | **16,352,393** | **149,241,964** | **15,433,902** | **12,002,720** | **196,188,152** | **----** |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

Exhibits 26 - 29 illustrate the TRI releases and transfers for the coating, engraving, and allied services portion (SIC 347) of the fabricated metal products industry. For these activities, solvents, as well as acids, constitute the largest number of TRI releases. Solvents are primarily used during painting operations, while acids are used during most finishing operations (e.g., anodizing, chemical conversion coating, electroplating). The solvents usually produce air emissions, contaminated wastewater, and solid-phase wastes, while the acids generally result in contaminated wastewater. Because NPDES permits do not allow low PH levels, the wastewater is pretreated to reduce the acidity prior to being discharged from the facility.

**Exhibit 26**
**Top 10 TRI Releasing Metal Finishing Facilities (SIC 347)**

| Rank | Total TRI Releases in Pounds | Facility Name | City | State |
|---|---|---|---|---|
| 1 | ″708,285 | Plastene Supply Co. | Portageville | MO |
| 2 | ″619,436 | Ken-Koat, Inc. | Huntington | IN |
| 3 | ″492,872 | Tennessee Electroplating, Inc. | Ripley | TN |
| 4 | ″430,781 | SR of Tennessee | Ripley | TN |
| 5 | ″418,912 | Ken-Koat of Tennessee, Inc., Plant 1 | Lewisburg | TN |
| 6 | ″408,628 | Anomatic Corp. | Newark | OH |
| 7 | ″406,419 | Roll Coater, Inc. | Greenfield | IN |
| 8 | ″381,788 | Reynolds Metals Co., Sheffield Plant | Sheffield | AL |
| 9 | ″368,014 | Roll Coater, Inc. | Kingsbury | IN |
| 10 | ″344,572 | Mottley Foils, Inc. | Farmville | VA |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

*Note: Being included on this list does not mean that the release is associated with non-compliance with environmental laws.*

## Exhibit 27
## TRI Reporting Metal Finishing Facilities (SIC 347) by State

| State | Number of Facilities | State | Number of Facilities |
|---|---|---|---|
| AL | 19 | MO | 23 |
| AR | 4 | MS | 6 |
| AZ | 9 | NC | 11 |
| CA | 117 | NE | 1 |
| CO | 11 | NH | 1 |
| CT | 36 | NJ | 27 |
| DE | 1 | NY | 43 |
| FL | 14 | OH | 112 |
| GA | 14 | OK | 9 |
| HI | 1 | OR | 11 |
| IA | 6 | PA | 41 |
| IL | 121 | PR | 4 |
| IN | 49 | RI | 23 |
| KS | 7 | SC | 9 |
| KY | 13 | TN | 17 |
| LA | 5 | TX | 48 |
| MA | 39 | UT | 4 |
| MD | 7 | VA | 7 |
| ME | 1 | WA | 14 |
| MI | 109 | WI | 35 |
| MN | 36 | WV | 4 |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

## Exhibit 28
## Releases for Metal Finishing (SIC 347) in TRI, by Number of Facilities
## (Releases reported in pounds/year)

| Chemical Name | # Facilities Reporting Chemical | Fugitive Air | Point Air | Water Discharges | Under-ground Injection | Land Disposal | Total Releases | Average Releases per Facility |
|---|---|---|---|---|---|---|---|---|
| Sulfuric Acid | 577 | 159575 | 103935 | 38232 | 0 | 54450 | 356192 | 617 |
| Hydrochloric Acid | 490 | 229596 | 186461 | 505 | 250 | 255 | 417067 | 851 |
| Nitric Acid | 290 | 51229 | 140639 | 1510 | 0 | 0 | 193378 | 667 |
| Zinc Compounds | 158 | 75329 | 23316 | 12202 | 0 | 93054 | 203901 | 1291 |
| Phosphoric Acid | 120 | 24772 | 26993 | 0 | 0 | 0 | 51765 | 431 |
| Methyl Ethyl Ketone | 103 | 945484 | 2251059 | 555 | 0 | 71335 | 3268433 | 31732 |
| Chromium Compounds | 101 | 4572 | 10765 | 625 | 0 | 15 | 15977 | 158 |
| Nickel Compounds | 95 | 5821 | 4572 | 564 | 0 | 0 | 10957 | 115 |
| Cyanide Compounds | 87 | 6759 | 4098 | 224 | 0 | 283 | 11364 | 131 |
| Nickel | 87 | 4685 | 3257 | 1433 | 0 | 500 | 9875 | 114 |
| Trichloroethylene | 81 | 844061 | 847701 | 20 | 0 | 0 | 1691782 | 20886 |
| Xylene (Mixed Isomers) | 79 | 395089 | 1226943 | 5 | 0 | 0 | 1622037 | 20532 |
| 1,1,1-Trichloroethane | 73 | 763993 | 817417 | 5 | 0 | 0 | 1581415 | 21663 |
| Toluene | 69 | 375222 | 1566048 | 5 | 0 | 300 | 1941575 | 28139 |
| Glycol Ethers | 59 | 344040 | 1463579 | 0 | 0 | 0 | 1807619 | 30638 |
| Copper | 54 | 880 | 3508 | 1646 | 0 | 0 | 6034 | 112 |
| Chromium | 48 | 2517 | 2372 | 131 | 0 | 255 | 5275 | 110 |
| N-Butyl Alcohol | 44 | 114102 | 188305 | 0 | 0 | 0 | 302407 | 6873 |
| Copper Compounds | 43 | 2874 | 1955 | 207 | 0 | 0 | 5036 | 117 |
| Ammonia | 35 | 75738 | 11644 | 0 | 0 | 0 | 87382 | 2497 |
| Chlorine | 32 | 5828 | 1011 | 5 | 0 | 0 | 6844 | 214 |
| Lead | 31 | 89 | 1715 | 536 | 0 | 0 | 2340 | 75 |

## Exhibit 28 (cont'd)
## Releases for Metal Finishing (SIC 347) in TRI, by Number of Facilities
## (Releases reported in pounds/year)

| Chemical Name | # Facilities Reporting Chemical | Fugitive Air | Point Air | Water Discharges | Under-ground Injection | Land Disposal | Total Releases | Average Releases per Facility |
|---|---|---|---|---|---|---|---|---|
| Methyl Isobutyl Ketone | 30 | 127088 | 269586 | 0 | 0 | 0 | 396674 | 13222 |
| Tetrachloroethylene | 25 | 401718 | 211664 | 0 | 0 | 0 | 613382 | 24535 |
| Acetone | 21 | 166232 | 250318 | 0 | 0 | 0 | 416550 | 19836 |
| Ethylbenzene | 20 | 46499 | 68675 | 0 | 0 | 0 | 115174 | 5759 |
| Naphthalene | 20 | 25677 | 52326 | 0 | 0 | 0 | 78003 | 3900 |
| Zinc (Fume Or Dust) | 20 | 14713 | 405 | 0 | 0 | 0 | 15118 | 756 |
| 1,2,4-Trimethylbenzene | 20 | 87617 | 118935 | 0 | 0 | 0 | 206552 | 10328 |
| Dichloromethane | 15 | 420391 | 395882 | 5 | 0 | 0 | 816278 | 54419 |
| Formaldehyde | 15 | 14409 | 8992 | 209 | 0 | 0 | 23610 | 1574 |
| Methanol | 15 | 53243 | 138202 | 0 | 0 | 0 | 191445 | 12763 |
| Cadmium | 13 | 57 | 6 | 0 | 0 | 0 | 63 | 5 |
| Barium Compounds | 12 | 1601 | 482 | 0 | 0 | 0 | 2083 | 174 |
| Hydrogen Fluoride | 10 | 6216 | 3208 | 0 | 0 | 0 | 9424 | 942 |
| Cadmium Compounds | 9 | 266 | 11 | 0 | 0 | 0 | 277 | 31 |
| Manganese | 8 | 21 | 69 | 0 | 0 | 0 | 90 | 11 |
| Cumene | 7 | 9178 | 18933 | 0 | 0 | 0 | 28111 | 4016 |
| Cobalt | 6 | 12 | 542 | 5 | 0 | 0 | 559 | 93 |
| Freon 113 | 6 | 93785 | 0 | 0 | 0 | 0 | 93785 | 15631 |
| Lead Compounds | 5 | 255 | 500 | 0 | 0 | 0 | 755 | 151 |
| Manganese Compounds | 4 | 15 | 5 | 0 | 0 | 0 | 20 | 5 |
| Methylenebis (Phenylisocyanate) | 4 | 5 | 150 | 0 | 0 | 0 | 155 | 39 |
| Aluminum (Fume Or Dust) | 3 | 250 | 250 | 0 | 0 | 0 | 500 | 167 |
| Antimony | 3 | 0 | 418 | 0 | 0 | 0 | 418 | 139 |
| Dimethyl Phthalate | 3 | 2407 | 5438 | 0 | 0 | 0 | 7845 | 2615 |
| Ethylene Glycol | 3 | 1160 | 18552 | 0 | 0 | 0 | 19712 | 6571 |
| Propylene | 3 | 503 | 516 | 0 | 0 | 0 | 1019 | 340 |
| Aluminum Oxide (Fibrous Form) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Isopropyl Alcohol (Manufacturing) | 2 | 250 | 15000 | 0 | 0 | 0 | 15250 | 7625 |
| M-Xylene | 2 | 0 | 6109 | 0 | 0 | 0 | 6109 | 3055 |
| Sec-Butyl Alcohol | 2 | 1000 | 3000 | 0 | 0 | 0 | 4000 | 2000 |
| Silver | 2 | 5 | 0 | 0 | 0 | 0 | 5 | 3 |
| 2-Methoxyethanol | 2 | 255 | 24825 | 0 | 0 | 0 | 25080 | 12540 |
| Ammonium Nitrate (Solution) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arsenic | 1 | 5 | 0 | 0 | 0 | 0 | 5 | 5 |
| Barium | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bis(2-Ethylhexyl) Adipate | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ethyl Acrylate | 1 | 0 | 2578 | 0 | 0 | 0 | 2578 | 2578 |
| Mercury | 1 | 5 | 0 | 0 | 0 | 0 | 5 | 5 |
| O-Xylene | 1 | 0 | 37911 | 0 | 0 | 0 | 37911 | 37911 |
| Phenol | 1 | 12000 | 0 | 0 | 0 | 0 | 12000 | 12000 |
| Selenium | 1 | 5 | 0 | 0 | 0 | 0 | 5 | 5 |
| Silver Compounds | 1 | 250 | 250 | 0 | 0 | 0 | 500 | 500 |
| Trichlorofluoromethane | 1 | 5 | 12000 | 0 | 0 | 0 | 12005 | 12005 |
| 1,2-Dichlorobenzene | 1 | 12000 | 0 | 0 | 0 | 0 | 12000 | 12000 |
| 2-Ethoxyethanol | 1 | 250 | 7000 | 0 | 0 | 0 | 7250 | 7250 |
| 2-Nitropropane | 1 | 186 | 182 | 0 | 0 | 0 | 368 | 368 |
| 4,4-Isopropylidenediphenol | 1 | 0 | 250 | 0 | 0 | 0 | 250 | 250 |
| **Total** | **----** | **5,931,789** | **10,560,463** | **58,629** | **250** | **220,447** | **16,771,578** | **----** |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

## Exhibit 29
## Transfers for Metal Finishing (SIC 347) in TRI, by Number of Facilities
## (Transfers reported in pounds/year)

| Chemical Name | # Facilities Reporting Chemical | POTW Discharges | Disposal | Recycling | Treatment | Energy Recovery | Total Transfers | Average Transfers per Facility |
|---|---|---|---|---|---|---|---|---|
| Sulfuric Acid | 577 | 804908 | 1947304 | 3112900 | 2266082 | 0 | 8131194 | 14092 |
| Hydrochloric Acid | 490 | 382255 | 2691567 | 1467208 | 3058084 | 0 | 7676109 | 15666 |
| Nitric Acid | 290 | 32756 | 274177 | 822830 | 562997 | 0 | 1692760 | 5837 |
| Zinc Compounds | 158 | 25225 | 4286331 | 16726872 | 1865137 | 2994 | 22906591 | 144978 |
| Phosphoric Acid | 120 | 160428 | 296366 | 5126632 | 120242 | 0 | 5718883 | 47657 |
| Methyl Ethyl Ketone | 103 | 10 | 0 | 2060497 | 110831 | 1994068 | 4181588 | 40598 |
| Chromium Compounds | 101 | 14423 | 594848 | 249365 | 364291 | 2980 | 1244457 | 12321 |
| Nickel Compounds | 95 | 17937 | 375149 | 1171327 | 501971 | 0 | 2066384 | 21751 |
| Cyanide Compounds | 87 | 18577 | 16451 | 12127 | 126143 | 0 | 173798 | 1998 |
| Nickel | 87 | 12239 | 255282 | 777750 | 399252 | 0 | 1445523 | 16615 |
| Trichloroethylene | 81 | 353 | 4873 | 214013 | 103537 | 63712 | 386488 | 4771 |
| Xylene (Mixed Isomers) | 79 | 10 | 2465 | 373083 | 110740 | 499378 | 985676 | 12477 |
| 1,1,1-Trichloroethane | 73 | 45 | 1090 | 359456 | 30856 | 25528 | 416975 | 5712 |
| Toluene | 69 | 6 | 3248 | 323174 | 212714 | 912937 | 1452079 | 21045 |
| Glycol Ethers | 59 | 206381 | 4168 | 209411 | 44590 | 530166 | 994966 | 16864 |
| Copper | 54 | 3810 | 215903 | 4247604 | 14524 | 0 | 4481841 | 82997 |
| Chromium | 48 | 4297 | 253964 | 245168 | 402593 | 0 | 923657 | 19243 |
| N-Butyl Alcohol | 44 | 13300 | 1615 | 19334 | 19951 | 68165 | 122365 | 2781 |
| Copper Compounds | 43 | 8404 | 109090 | 3397732 | 118222 | 0 | 3633448 | 84499 |
| Ammonia | 35 | 19727 | 260 | 0 | 255 | 0 | 20242 | 578 |
| Chlorine | 32 | 4210 | 750 | 250 | 6221 | 0 | 11431 | 357 |
| Lead | 31 | 61 | 10814 | 428225 | 7169 | 0 | 446269 | 14396 |
| Methyl Isobutyl Ketone | 30 | 0 | 0 | 467583 | 8208 | 70164 | 545955 | 18199 |
| Tetrachloroethylene | 25 | 20 | 0 | 198381 | 10999 | 4542 | 213942 | 8558 |
| Acetone | 21 | 5 | 0 | 482911 | 134524 | 37649 | 655089 | 31195 |
| Ethylbenzene | 20 | 0 | 0 | 95670 | 2795 | 67994 | 166459 | 8323 |
| Naphthalene | 20 | 0 | 0 | 1000 | 7046 | 23833 | 31879 | 1594 |
| Zinc (Fume Or Dust) | 20 | 4580 | 9250 | 181479 | 75065 | 0 | 270624 | 13531 |
| 1,2,4-Trimethylbenzene | 20 | 0 | 0 | 12825 | 8538 | 37488 | 58851 | 2943 |
| Dichloromethane | 15 | 377 | 0 | 92499 | 22453 | 15138 | 130467 | 8698 |
| Formaldehyde | 15 | 41510 | 5 | 0 | 1588 | 7202 | 50305 | 3354 |
| Methanol | 15 | 29686 | 0 | 1513 | 34930 | 56354 | 122483 | 8166 |
| Cadmium | 13 | 1814 | 6186 | 9432 | 31256 | 0 | 48688 | 3745 |
| Barium Compounds | 12 | 5 | 26665 | 29 | 7756 | 0 | 34455 | 2871 |
| Hydrogen Fluoride | 10 | 0 | 2581 | 0 | 16618 | 0 | 19199 | 1920 |
| Cadmium Compounds | 9 | 1287 | 65319 | 27000 | 250 | 0 | 93856 | 10428 |
| Manganese | 8 | 889 | 851 | 113 | 1751 | 0 | 3604 | 451 |
| Cumene | 7 | 0 | 0 | 2020 | 400 | 5618 | 8038 | 1148 |
| Cobalt | 6 | 30 | 7590 | 1431 | 193 | 0 | 9244 | 1541 |
| Freon 113 | 6 | 0 | 0 | 3900 | 0 | 0 | 3900 | 650 |
| Lead Compounds | 5 | 751 | 1520 | 42677 | 319 | 0 | 45267 | 9053 |
| Manganese Compounds | 4 | 5 | 22024 | 87789 | 0 | 0 | 109818 | 27455 |
| Methylenebis (Phenylisocyanate) | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Aluminum (Fume Or Dust) | 3 | 250 | 0 | 0 | 5460 | 0 | 5710 | 1903 |
| Antimony | 3 | 0 | 0 | 1955 | 375 | 0 | 2330 | 777 |
| Dimethyl Phthalate | 3 | 0 | 0 | 0 | 269 | 1802 | 2071 | 690 |
| Ethylene Glycol | 3 | 5 | 0 | 0 | 250 | 994 | 1249 | 416 |
| Propylene | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Aluminum Oxide (Fibrous Form) | 2 | 0 | 0 | 25000 | 0 | 0 | 25000 | 12500 |
| Isopropyl Alcohol (Manufacturing) | 2 | 0 | 0 | 87932 | 0 | 2300 | 90232 | 45116 |
| M-Xylene | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sec-Butyl Alcohol | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Silver | 2 | 5 | 10 | 250 | 0 | 0 | 265 | 133 |
| 2-Methoxyethanol | 2 | 5 | 0 | 0 | 0 | 8520 | 8525 | 4263 |

**Exhibit 29 (cont'd)**
**Transfers for Metal Finishing (SIC 347) in TRI, by Number of Facilities**
**(Transfers reported in pounds/year)**

| Chemical Name | # Facilities Reporting Chemical | POTW Discharges | Disposal | Recycling | Treatment | Energy Recovery | Total Transfers | Average Transfers per Facility |
|---|---|---|---|---|---|---|---|---|
| Ammonium Nitrate (Solution) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arsenic | 1 | 5 | 10 | 0 | 0 | 0 | 15 | 15 |
| Barium | 1 | 5 | 10 | 0 | 0 | 0 | 15 | 15 |
| Bis(2-Ethylhexyl) Adipate | 1 | 0 | 250 | 0 | 0 | 0 | 250 | 250 |
| Ethyl Acrylate | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mercury | 1 | 5 | 10 | 0 | 0 | 0 | 15 | 15 |
| O-Xylene | 1 | 0 | 0 | 0 | 20 | 0 | 20 | 20 |
| Phenol | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Selenium | 1 | 5 | 10 | 0 | 0 | 0 | 15 | 15 |
| Silver Compounds | 1 | 250 | 0 | 4000 | 0 | 0 | 4250 | 4250 |
| Trichlorofluoromethane | 1 | 0 | 3400 | 0 | 0 | 0 | 3400 | 3400 |
| 1,2-Dichlorobenzene | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2-Ethoxyethanol | 1 | 5 | 0 | 0 | 0 | 750 | 755 | 755 |
| 2-Nitropropane | 1 | 0 | 0 | 0 | 95 | 103 | 198 | 198 |
| 4,4-Isopropylidenediphenol | 1 | 0 | 250 | 0 | 0 | 0 | 250 | 250 |
| **Totals** | **----** | **1,810,861** | **11,491,656** | **43,172,347** | **10,817,560** | **4,440,379** | **71,879,412** | **---** |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

## IV.B. Summary of the Selected Chemicals Released

The following is a synopsis of current scientific toxicity and fate information for the top chemicals (by weight) that facilities within this sector self-reported as released to the environment based upon 1993 TRI data. Because this section is based upon self-reported release data, it does not attempt to provide information on management practices employed by the sector to reduce the release of these chemicals. Information regarding pollutant release reductions over time may be available from EPA's TRI and 33/50 programs, or directly from the industrial trade associations that are listed in Section IX of this document. Since these descriptions are cursory, please consult the sources referenced below for a more detailed description of both the chemicals described in this section, and the chemicals that appear on the full list of TRI chemicals appearing in Section IV.A.

The brief descriptions provided below were taken from the *1993 Toxics Release Inventory Public Data Release* (EPA, 1994), the Hazardous Substances Data Bank (HSDB), and the Integrated Risk Information System (IRIS), both accessed via TOXNET[1]. The information

[1] TOXNET is a computer system run by the National Library of Medicine that includes a number of toxicological databases managed by EPA, National Cancer Institute, and the National Institute for Occupational Safety and Health. For more information on TOXNET, contact the TOXNET help line at 1-800-231-3766. Databases included in TOXNET are: CCRIS (Chemical Carcinogenesis Research

contained below is based upon exposure assumptions that have been conducted using standard scientific procedures. The effects listed below must be taken in context of these exposure assumptions that are more fully explained within the full chemical profiles in HSDB.

The top ten TRI releases for the Fabricated Metal Products industry (SIC 34) as a whole include: glycol ethers, n-butyl, xylene, methyl ethyl ketone, trichloroethylene, toluene-1, dichloromethane, methyl isobutyl ketone, acetone, and tetrachloroethylene. The top ten TRI releases for the coating, engraving, and allied services portion of the fabricated metal products industry (SIC 347) include: methyl ethyl ketone, toluene, glycol ethers, trichloroethylene, xylene (mixed isomers), 1,1,1-trichloroethane, dichloromethane, tetrachloroethylene, hydrochloric acid, and methyl isobutyl ketone. Summaries of most of these chemicals follow.

## Acetone

Toxicity. Acetone is irritating to the eyes, nose, and throat. Symptoms of exposure to large quantities of acetone may include headache, unsteadiness, confusion, lassitude, drowsiness, vomiting, and respiratory depression.

Reactions of acetone (see environmental fate) in the lower atmosphere contribute to the formation of ground-level ozone. Ozone (a major component of urban smog) can affect the respiratory system, especially in sensitive individuals such as asthmatics or allergy sufferers.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. If released into water, acetone will be degraded by microorganisms or will evaporate into the atmosphere.

---

Information System), DART (Developmental and Reproductive Toxicity Database), DBIR (Directory of Biotechnology Information Resources), EMICBACK (Environmental Mutagen Information Center Backfile), GENE-TOX (Genetic Toxicology), HSDB (Hazardous Substances Data Bank), IRIS (Integrated Risk Information System), RTECS (Registry of Toxic Effects of Chemical Substances), and TRI (Toxic Chemical Release Inventory). HSDB contains chemical-specific information on manufacturing and use, chemical and physical properties, safety and handling, toxicity and biomedical effects, pharmacology, environmental fate and exposure potential, exposure standards and regulations, monitoring and analysis methods, and additional references.

Degradation by microorganisms will be the primary removal mechanism.

Acetone is highly volatile, and once it reaches the troposphere (lower atmosphere), it will react with other gases, contributing to the formation of ground-level ozone and other air pollutants. EPA is reevaluating acetone's reactivity in the lower atmosphere to determine whether this contribution is significant.

Physical Properties. Acetone is a volatile and flammable organic chemical.

*Note: Acetone was removed from the list of TRI chemicals on June 16, 1995 (60 FR 31643) and will not be reported for 1994 or subsequent years.*

## Glycol Ethers

Due to data limitations, data on diethylene glycol (glycol ether) are used to represent all glycol ethers.

Toxicity. Diethylene glycol is only a hazard to human health if concentrated vapors are generated through heating or vigorous agitation or if appreciable skin contact or ingestion occurs over an extended period of time. Under normal occupational and ambient exposures, diethylene glycol is low in oral toxicity, is not irritating to the eyes or skin, is not readily absorbed through the skin, and has a low vapor pressure so that toxic concentrations of the vapor can not occur in the air at room temperatures.

At high levels of exposure, diethylene glycol causes central nervous depression and liver and kidney damage. Symptoms of moderate diethylene glycol poisoning include nausea, vomiting, headache, diarrhea, abdominal pain, and damage to the pulmonary and cardiovascular systems. Sulfanilamide in diethylene glycol was once used therapeutically against bacterial infection; it was withdrawn from the market after causing over 100 deaths from acute kidney failure.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. Diethylene glycol is a water-soluble, volatile organic chemical. It may enter the environment in liquid form via petrochemical plant effluents or as an unburned gas from combustion sources. Diethylene glycol typically does not occur in sufficient concentrations to pose a hazard to human health.

## Hydrochloric Acid

Toxicity. Hydrochloric acid is primarily a concern in its aerosol form. Acid aerosols have been implicated in causing and exacerbating a variety of respiratory ailments. Dermal exposure and ingestion of highly concentrated hydrochloric acid can result in corrosivity.

Ecologically, accidental releases of solution forms of hydrochloric acid may adversely affect aquatic life by including a transient lowering of the pH (i.e., increasing the acidity) of surface waters.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. Releases of hydrochloric acid to surface waters and soils will be neutralized to an extent due to the buffering capacities of both systems. The extent of these reactions will depend on the characteristics of the specific environment.

Physical Properties. Concentrated hydrochloric acid is highly corrosive.

## Methylene Chloride (Dichloromethane)

Toxicity. Short-term exposure to dichloromethane (DCM) is associated with central nervous system effects, including headache, giddiness, stupor, irritability, and numbness and tingling in the limbs. More severe neurological effects are reported from longer-term exposure, apparently due to increased carbon monoxide in the blood from the break down of DCM. Contact with DCM causes irritation of the eyes, skin, and respiratory tract.

Occupational exposure to DCM has also been linked to increased incidence of spontaneous abortions in women. Acute damage to the eyes and upper respiratory tract, unconsciousness, and death were reported in workers exposed to high concentrations of DCM. Phosgene (a degradation product of DCM) poisoning has been

reported to occur in several cases where DCM was used in the presence of an open fire.

Populations at special risk from exposure to DCM include obese people (due to accumulation of DCM in fat), and people with impaired cardiovascular systems.

Carcinogenicity. DCM is a probable human carcinogen via both oral and inhalation exposure, based on inadequate human data and sufficient evidence in animals.

Environmental Fate. When spilled on land, DCM is rapidly lost from the soil surface through volatilization. The remainder leaches through the subsoil into the groundwater.

Biodegradation is possible in natural waters but will probably be very slow compared with evaporation. Little is known about bioconcentration in aquatic organisms or adsorption to sediments but these are not likely to be significant processes. Hydrolysis is not an important process under normal environmental conditions.

DCM released into the atmosphere degrades via contact with other gases with a half-life of several months. A small fraction of the chemical diffuses to the stratosphere where it rapidly degrades through exposure to ultraviolet radiation and contact with chlorine ions. Being a moderately soluble chemical, DCM is expected to partially return to earth in rain.

## Methyl Ethyl Ketone

Toxicity. Breathing moderate amounts of methyl ethyl ketone (MEK) for short periods of time can cause adverse effects on the nervous system ranging from headaches, dizziness, nausea, and numbness in the fingers and toes to unconsciousness. Its vapors are irritating to the skin, eyes, nose, and throat and can damage the eyes. Repeated exposure to moderate to high amounts may cause liver and kidney effects.

Carcinogenicity. No agreement exists over the carcinogenicity of MEK. One source believes MEK is a possible carcinogen in humans based on limited animal evidence. Other sources believe that there is insufficient evidence to make any statements about possible carcinogenicity.

Environmental Fate. Most of the MEK released to the environment will end up in the atmosphere. MEK can contribute to the formation of air pollutants in the lower atmosphere. It can be degraded by microorganisms living in water and soil.

Physical Properties. Methyl ethyl ketone is a flammable liquid.

**Toluene**

Toxicity. Inhalation or ingestion of toluene can cause headaches, confusion, weakness, and memory loss. Toluene may also affect the way the kidneys and liver function.

Reactions of toluene (see environmental fate) in the atmosphere contribute to the formation of ozone in the lower atmosphere. Ozone can affect the respiratory system, especially in sensitive individuals such as asthma or allergy sufferers.

Some studies have shown that unborn animals were harmed when high levels of toluene were inhaled by their mothers, although the same effects were not seen when the mothers were fed large quantities of toluene. Note that these results may reflect similar difficulties in humans.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. The majority of releases of toluene to land and water will evaporate. Toluene may also be degraded by microorganisms. Once volatized, toluene in the lower atmosphere will react with other atmospheric components contributing to the formation of ground-level ozone and other air pollutants.

Physical Properties. Toluene is a volatile organic chemical.

**1,1,1-Trichloroethane**

Toxicity. Repeated contact of 1,1,1-trichloroethane (TCE) with skin may cause serious skin cracking and infection. Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations.

Exposure to high concentrations of TCE causes reversible mild liver and kidney dysfunction, central nervous system depression, gait disturbances, stupor, coma, respiratory depression, and even death. Exposure to lower concentrations of TCE leads to light-headedness, throat irritation, headache, disequilibrium, impaired coordination, drowsiness, convulsions and mild changes in perception.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. Releases of TCE to surface water or land will almost entirely volatilize. Releases to air may be transported long distances and may partially return to earth in rain. In the lower atmosphere, TCE degrades very slowly by photooxidation and slowly diffuses to the upper atmosphere where photodegradation is rapid.

Any TCE that does not evaporate from soils leaches to groundwater. Degradation in soils and water is slow. TCE does not hydrolyze in water, nor does it significantly bioconcentrate in aquatic organisms.

**Trichloroethylene**

Toxicity. Trichloroethylene was once used as an anesthetic, though its use caused several fatalities due to liver failure. Short term inhalation exposure to high levels of trichloroethylene may cause rapid coma followed by eventual death from liver, kidney, or heart failure. Short-term exposure to lower concentrations of trichloroethylene causes eye, skin, and respiratory tract irritation. Ingestion causes a burning sensation in the mouth, nausea, vomiting and abdominal pain. Delayed effects from short-term trichloroethylene poisoning include liver and kidney lesions, reversible nerve degeneration, and psychic disturbances. Long-term exposure can produce headache, dizziness, weight loss, nerve damage, heart damage, nausea, fatigue, insomnia, visual impairment, mood perturbation, sexual problems, dermatitis, and rarely jaundice. Degradation products of trichloroethylene (particularly phosgene) may cause rapid death due to respiratory collapse.

Carcinogenicity. Trichloroethylene is a probable human carcinogen via both oral and inhalation exposure, based on limited human evidence and sufficient animal evidence.

Environmental Fate. Trichloroethylene breaks down slowly in water in the presence of sunlight and bioconcentrates moderately in aquatic

organisms. The main removal of trichloroethylene from water is via rapid evaporation.

Trichloroethylene does not photodegrade in the atmosphere, though it breaks down quickly under smog conditions, forming other pollutants such as phosgene, dichloroacetyl chloride, and formyl chloride. In addition, trichloroethylene vapors may be decomposed to toxic levels of phosgene in the presence of an intense heat source such as an open arc welder.

When spilled on the land, trichloroethylene rapidly volatilizes from surface soils. The remaining chemical leaches through the soil to groundwater.

**Xylene (Mixed Isomers)**

Toxicity. Xylenes are rapidly absorbed into the body after inhalation, ingestion, or skin contact. Short-term exposure of humans to high levels of xylenes can cause irritation of the skin, eyes, nose, and throat, difficulty in breathing, impaired lung function, impaired memory, and possible changes in the liver and kidneys. Both short- and long-term exposure to high concentrations can cause effects such as headaches, dizziness, confusion, and lack of muscle coordination. Reactions of xylenes (see environmental fate) in the atmosphere contribute to the formation of ozone in the lower atmosphere. Ozone can affect the respiratory system, especially in sensitive individuals such as asthma or allergy sufferers.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. The majority of releases to land and water will quickly evaporate, although some degradation by microorganisms will occur.

Xylenes are moderately mobile in soils and may leach into groundwater, where they may persist for several years.

Xylenes are volatile organic chemicals. As such, xylenes in the lower atmosphere will react with other atmospheric components, contributing to the formation of ground-level ozone and other air pollutants.

## IV.C. Other Data Sources

The Aerometric Information Retrieval System (AIRS) contains a wide range of information related to stationary sources of air pollution, including the emissions of a number of air pollutants which may be of concern within a particular industry. With the exception of volatile organic compounds (VOCs), there is little overlap with the TRI chemicals reported above. Exhibit 30 summarizes annual releases of carbon monoxide (CO), nitrogen dioxide ($NO_2$), particulate matter of 10 microns or less (PM10), total particulates (PT), sulfur dioxide ($SO_2$), and volatile organic compounds (VOCs).

**Exhibit 30**
**Pollutant Releases (Short Tons/Years)**

| Industry | CO | $NO_2$ | $PM_{10}$ | PT | $SO_2$ | VOC |
|---|---|---|---|---|---|---|
| U.S. Total | 97,208,000 | 23,402,000 | 45,489,000 | 7,836,000 | 21,888,000 | 23,312,000 |
| Metal Mining | 5,391 | 28,583 | 39,359 | 140,052 | 84,222 | 1,283 |
| Nonmetal Mining | 4,525 | 28,804 | 59,305 | 167,948 | 24,129 | 1,736 |
| Lumber and Wood Products | 123,756 | 42,658 | 14,135 | 63,761 | 9,149 | 41,423 |
| Wood Furniture and Fixtures | 2,069 | 2,981 | 2,165 | 3,178 | 1,606 | 59,426 |
| Pulp and Paper | 624,291 | 394,448 | 35,579 | 113,571 | 341,002 | 96,875 |
| Printing | 8,463 | 4,915 | 399 | 1,031 | 1,728 | 101,537 |
| Inorganic Chemicals | 166,147 | 108,575 | 4,107 | 39,082 | 182,189 | 52,091 |
| Organic Chemicals | 146,947 | 236,826 | 26,493 | 44,860 | 132,459 | 201,888 |
| Petroleum Refining | 419,311 | 380,641 | 18,787 | 36,877 | 648,153 | 309,058 |
| Rubber and Misc. Plastic Products | 2,090 | 11,914 | 2,407 | 5,355 | 29,364 | 140,741 |
| Stone, Clay, Glass, and Concrete | 58,043 | 338,482 | 74,623 | 171,853 | 339,216 | 30,262 |
| Iron and Steel | 1,518,642 | 138,985 | 42,368 | 83,017 | 238,268 | 82,292 |
| Nonferrous Metals | 448,758 | 55,658 | 20,074 | 22,490 | 373,007 | 27,375 |
| **Fabricated Metals** | **3,851** | **16,424** | **1,185** | **3,136** | **4,019** | **102,186** |
| Electronics | 367 | 1,129 | 207 | 293 | 453 | 4,854 |
| Motor Vehicles, Bodies, Parts, and Accessories | 35,303 | 23,725 | 2,406 | 12,853 | 25,462 | 101,275 |
| Dry Cleaning | 101 | 179 | 3 | 28 | 152 | 7,310 |

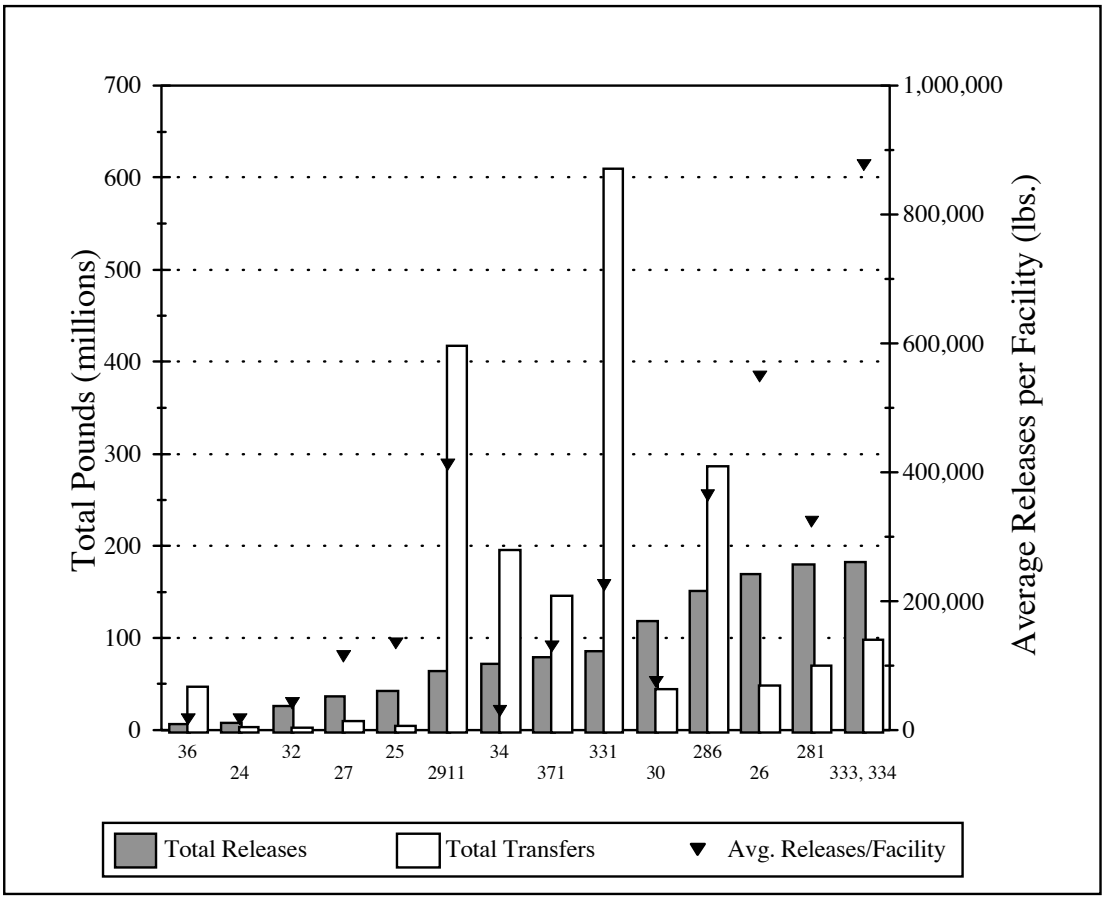
*Source U.S. EPA Office of Air and Radiation, AIRS Database, May 1995.*

## IV.D. Comparison of Toxic Release Inventory Between Selected Industries

The following information is presented as a comparison of pollutant release and transfer data across industrial categories. It is provided to give a general sense as to the relative scale of releases and transfers within each sector profiled under this project. Please note that the following table does not contain releases and transfers for industrial categories that are not included in this project, and thus cannot be used to draw conclusions regarding the total release and transfer amounts that are reported to TRI. Similar information is available within the annual TRI Public Data Release book.

Exhibit 31 is a graphical representation of a summary of the 1993 TRI data for the Fabricated Metals Products industry and the other sectors profiled in separate notebooks. The bar graph presents the total TRI releases and total transfers on the left axis and the triangle points show the average releases per facility on the right axis. Industry sectors are presented in the order of increasing total TRI releases. The graph is based on the data shown in Exhibit 32 and is meant to facilitate comparisons between the relative amounts of releases, transfers, and releases per facility both within and between these sectors. The reader should note, however, that differences in the proportion of facilities captured by TRI exist between industry sectors. This can be a factor of poor SIC matching and relative differences in the number of facilities reporting to TRI from the various sectors. In the case of Fabricated Metal Products industry, the 1993 TRI data presented here covers 2,363 facilities. These facilities listed SIC 34 (Fabricated Metal Products industry) as a primary SIC code.

## Exhibit 31 Bar graph
## Summary of 1993 TRI Data




| SIC Range | Industry Sector | SIC Range | Industry Sector | SIC Range | Industry Sector |
|---|---|---|---|---|---|
| 36 | Electronic Equipment and Components | 2911 | Petroleum Refining | 286 | Organic Chemical Mfg. |
| 24 | Lumber and Wood Products | 34 | Fabricated Metals | 26 | Pulp and Paper |
| 32 | Stone, Clay, and Concrete | 371 | Motor Vehicles, Bodies, Parts, and Accessories | 281 | Inorganic Chemical Mfg. |
| 27 | Printing | 331 | Iron and Steel | 333,334 | Nonferrous Metals |
| 25 | Wood Furniture and Fixtures | 30 | Rubber and Misc. Plastics | | |

## Exhibit 32
## Toxic Release Inventory Data for Selected Industries

| Industry Sector | SIC Range | # TRI Facilities | Releases | | Transfers | | Total Releases + Transfers ($10^6$ pounds) | Average Release+ Transfers per Facility (pounds) |
|---|---|---|---|---|---|---|---|---|
| | | | Total Releases ($10^6$ pounds) | Average Releases per Facility (pounds) | 1993 Total ($10^6$ pounds) | Average Transfers per Facility (pounds) | | |
| Stone, Clay, and Concrete | 32 | 634 | 26.6 | 41,895 | 2.2 | 3,500 | 28.2 | 46,000 |
| Lumber and Wood Products | 24 | 491 | 8.4 | 17,036 | 3.5 | 7,228 | 11.9 | 24,000 |
| Furniture and Fixtures | 25 | 313 | 42.2 | 134,883 | 4.2 | 13,455 | 46.4 | 148,000 |
| Printing | 2711-2789 | 318 | 36.5 | 115,000 | 10.2 | 732,000 | 46.7 | 147,000 |
| Electronics/Computers | 36 | 406 | 6.7 | 16,520 | 47.1 | 115,917 | 53.7 | 133,000 |
| Rubber and Misc. Plastics | 30 | 1,579 | 118.4 | 74,986 | 45.0 | 28,537 | 163.4 | 104,000 |
| Motor Vehicle, Bodies, Parts and Accessories | 371 | 609 | 79.3 | 130,158 | 145.5 | 238,938 | 224.8 | 369,000 |
| Pulp and paper | 2611-2631 | 309 | 169.7 | 549,000 | 48.4 | 157,080 | 218.1 | 706,000 |
| Inorganic Chem. Mfg. | 2812-2819 | 555 | 179.6 | 324,000 | 70.0 | 126,000 | 249.7 | 450,000 |
| Petroleum Refining | 2911 | 156 | 64.3 | 412,000 | 417.5 | 2,676,000 | 481.9 | 3,088,000 |
| Fabricated Metals | 34 | 2,363 | 72.0 | 30,476 | 195.7 | 82,802 | 267.7 | 123,000 |
| Iron and Steel | 3312-3313<br>3321-3325 | 381 | 85.8 | 225,000 | 609.5 | 1,600,000 | 695.3 | 1,825,000 |
| Nonferrous Metals | **333, 334** | **208** | **182.5** | **877,269** | **98.2** | **472,335** | **280.7** | **1,349,000** |
| Organic Chemical Mfg. | 2861-2869 | 417 | 151.6 | 364,000 | 286.7 | 688,000 | 438.4 | 1,052,000 |
| Metal Mining | 10 | Industry sector not subject to TRI reporting | | | | | | |
| Nonmetal Mining | 14 | Industry sector not subject to TRI reporting | | | | | | |
| Dry Cleaning | 7215, 7216, 7218 | Industry sector not subject to TRI reporting | | | | | | |

*Source: U.S. EPA, Toxics Release Inventory Database, 1993.*

# V. POLLUTION PREVENTION OPPORTUNITIES

The best way to reduce pollution is to prevent it in the first place. Some companies have creatively implemented pollution prevention techniques that improve efficiency and increase profits while at the same time minimizing environmental impacts. This can be done in many ways such as reducing material inputs, re-engineering processes to reuse by-products, improving management practices, and employing substitution of toxic chemicals. Some smaller facilities are able to actually get below regulatory thresholds just by reducing pollutant releases through aggressive pollution prevention policies.

In order to encourage these approaches, this section provides both general and company-specific descriptions of some pollution prevention advances that have been implemented within the Fabricated Metal Products industry. While the list is not exhaustive, it does provide core information that can be used as the starting point for facilities interested in beginning their own pollution prevention projects. When possible, this section provides information from real activities that can, or are being implemented by this sector -- including a discussion of associated costs, time frames, and expected rates of return. This section provides summary information from activities that may be, or are being implemented by this sector. When possible, information is provided that gives the context in which the techniques can be effectively used. Please note that the activities described in this section do not necessarily apply to all facilities that fall within this sector. Facility-specific conditions must be carefully considered when pollution prevention options are evaluated, and the full impacts of the change must examine how each option affects, air, land, and water pollutant releases.

## V.A. Identification of Pollution Prevention Activities in Use and Environmental and Economic Benefits of Each Pollution Prevention Activity

Pollution prevention (sometimes referred to as source reduction) is the use of materials, processes, or practices that reduce or eliminate the creation of pollutants or wastes at the source. Pollution prevention includes practices that reduce the use of hazardous materials, energy, water or other resources, and practices that protect natural resources through conservation or more efficient use.

EPA and the Fabricated Metal Products industry are working together to promote pollution prevention because it is often the most cost-effective way to reduce pollution and the associated risks to human health and the environment. Pollution prevention is often cost effective because it may reduce raw material losses; reduce reliance on expensive "end-of-pipe" treatment technologies and disposal practices; conserve energy, water, chemicals, and other inputs; and mitigate the potential liability associated with waste generation and disposal. Pollution prevention often involves complex re-engineering however, and companies must balance the desired savings in materials and benefits to the environment against the cost of changing operating practices.

All companies in the Fabricated Metal Products industry, regardless of their size, must comply with environmental regulations related to metal fabricating and/or metal finishing processes. Therefore, all companies benefit from the knowledge of pollution prevention techniques which, if implemented, may increase a company's ability to meet these requirements. Many large companies have been successful in identifying and implementing pollution prevention and other techniques allowing them to operate in an efficient and environmentally protective manner. This capability may be due in part because large companies often have resources to devote to tracking and implementing pollution prevention techniques, and maintaining an awareness and understanding of regulations that apply to their facilities.

Smaller companies may have limited resources to devote to these activities, which may make monitoring and understanding regulations more difficult and may result in limited pollution prevention participation. Increased awareness and publication of pollution prevention techniques improve the ability of companies to comply with regulations. Pollution prevention techniques also permit industrial processes to be more efficient and less costly, providing all companies with an opportunity to maximize the efficiency of their operations and reduce their costs while protecting the environment.

Pollution Prevention techniques and processes currently used by the metal fabricating and finishing industry can be grouped into seven general categories:

- Production planning and sequencing
- Process or equipment modification
- Raw material substitution or elimination

- Loss prevention and housekeeping
- Waste segregation and separation
- Closed-loop recycling
- Training and supervision.

Each of these categories is discussed briefly below. Refer to Section V.D. for a list of specific pollution prevention techniques and associated costs, savings, and other information. It should be kept in mind that every pollution prevention option may not be available for each facility.

*Production planning and sequencing* is used to ensure that only necessary operations are performed and that no operation is needlessly reversed or obviated by a following operation. One example is to sort out substandard parts prior to painting or electroplating. A second example is to reduce the frequency with which equipment requires cleaning by painting all products of the same color at the same time. A third example is to schedule batch processing in a manner that allows the wastes or residues from one batch to be used as an input for the subsequent batch (e.g., to schedule paint formulation from lighter shades to darker) so that equipment need not be cleaned between batches.

*Process or equipment modification* is used to reduce the amount of waste generated. For example, manufacturers can change to a paint application technique that is more efficient than spray painting, reduce overspray by reducing the atomizing air pressure, reduce drag-out by reducing the withdrawal speed of parts from plating tanks, or improve a plating line by incorporating drag-out recovery tanks or reactive rinsing.

*Raw material substitution or elimination* is the replacement of existing raw materials with other materials that produce less waste, or a non-toxic waste. Examples include substituting alkali washes for solvent degreasers, and replacing oil with lime or borax soap as the drawing agent in cold forming.

*Loss prevention and housekeeping* is the performance of preventive maintenance and equipment and materials management so as to minimize opportunities for leaks, spills, evaporative losses, and other releases of potentially toxic chemicals. For example, spray guns can be cleaned in a manner that does not damage leather packings and cause the guns to leak; or drip pans can be placed under leaking machinery to allow recovery of the leaking fluid.

*Waste segregation and separation* involves avoiding the mixture of different types of wastes and avoiding the mixture of hazardous wastes with non-hazardous wastes. This makes the recovery of hazardous wastes easier by minimizing the number of different hazardous constituents in a given waste stream. It also prevents the contamination of non-hazardous wastes. Specific examples include segregating scrap metal by metal type, and segregating different kinds of used oils.

*Closed-loop recycling* is the on-site use or reuse of a waste as an ingredient or feedstock in the production process. For example, in-plant paper fiber waste can be collected and recycled to make pre-consumer recycled paper products.

*Training and supervision* provides employees with the information and the incentive to minimize waste generation in their daily duties. This might include ensuring that employees know and practice proper and efficient use of tools and supplies, and that they are aware of, understand, and support the company's pollution prevention goals.

## V.B. Possible Pollution Prevention Future Trends

There are numerous pollution prevention trends in the metal fabrication and finishing industry. These include recycling liquids, employing better waste control techniques, using mechanical forms of surface preparation, and/or substituting raw materials. One major trend is the increased recycling (e.g., reuse) of most process liquids (e.g., rinse water, acids, alkali cleaning compounds, solvents, etc.) used during the metal forming and finishing processes. For instance, instead of discarding liquids, companies are containing them and reusing them to cut down on the volume of process liquids that must eventually be disposed of. Also, many companies are replacing aqueous plating with ion vapor deposition.

Another common approach to reducing pollution is to reduce rinse contamination via drag-out by slowing and smoothing the removal of parts (rotating them if necessary), maximizing drip time, using drainage boards to direct dripping solutions back to process tanks, and/or installing drag-out recovery tanks to capture dripping solutions. By slowing down the processes and developing structures to contain the dripping solutions, a facility can better control the potential wastes emitted.

To reduce the use of acids when cleaning parts, the industry is using and encouraging the use of mechanical scraping/scrubbing techniques to clean and prepare the metal surface. Emphasizing mechanical approaches would greatly diminish the need for acids, solvents, and alkalis. In addition to the mechanical technique for cleaning surfaces, companies are encouraged to substitute acids and solvents with less harmful liquids (e.g., alcohol). Section V.D. lists numerous specific pollution prevention techniques that have been employed in the industry.

## V.C. Pollution Prevention Case Studies

Numerous pollution prevention case histories have been documented for the metal fabricating and finishing industries. Many of these have dealt primarily with electroplating or general finishing operations. The Eastside Plating case, presented in this section, is a classic example of the numerous pollution prevention techniques that can be implemented at an electroplating company. For other pollution prevention case studies, see section V.D. Pollution Prevention Options, and the list of pollution prevention contacts in section V.E.

Eastside Plating, an Oregon-based company, has made money complying with new environmental regulations. Under the direction of its Maintenance and Water Treatment Manager, the electroplating firm implemented operational changes that save more than $300,000 annually. Eastside Plating management made the commitment to implement a hazardous waste reduction program in 1982. By changing rinsing techniques, substituting materials, and segregating wastes for treatment, the firm has become a more cost-effective operation.

By setting priorities and upgrading in phases, the firm was able to work toward compliance yet meet increased demand for services during a period of rapid growth. The first operational modification addressed counterflow and cascade rinsing systems. The changes decreased water used for rinsing, a process that accounts for 90 percent of all water used in electroplating. In counterflow rinsing, water is used a number of times, thus dramatically reducing volume. Cascade rinsing requires only one tank with a center divider which allows water to spill into the other side. The filling/draining process is continuous and very slow to reduce the amount of water used. Both systems cut water bills and wastewater treatment costs.

Management next searched for waste treatment chemicals that decreased, rather than increased, the production of sludge. Total chromium and cyanide wastes were cut in half simply by changing reducing agents. Chromium acid wastes are now oxidized by using sodium bisulfite and sulfuric acid instead of ferrous sulfate, while cyanide reduction is now accomplished more efficiently with gaseous, instead of liquid, chlorine.

Eastside Plating also upgraded its three major waste treatment components: the cyanide oxidation tank, the chromium reduction tank, and the acid/alkaline neutralizing tank. The goal was to separate tank flow, eliminate contamination of the acid/alkaline neutralizing tank, and increase efficiency. Automated metering equipment reduced the quantity of costly caustic chemicals needed to treat acid wastes by 50 percent. To eliminate the risks associated with pump failure and the equalize flow rate, cyanide and chromic acid oxidation and reduction tanks were redesigned as gravity flow systems. Additionally, plumbing was segregated to prevent cross-contamination. These simple solutions saved Eastside Plating hundreds of thousands of dollars.

Next, management consulted with suppliers when they modified the company's mixing sump (sometimes called a reaction tank) and a flocculent mix tank (sometimes called a neutralizing tank). The modification to each prohibits 'indigestion' in the mixing sump interfering with the neutralization process. The suppliers helped resolve the problems of inadequate mixing by baffling the neutralization tank.

Since employees can make or break the best anti-pollution plan, Eastside Plating offers an extensive employee education program. The company says "it's a matter of changing how we do business." In addition, Eastside Plating's Safety Committee helps all employees work together more safely. Additionally, the company reported that working with regulators helped the company make the move toward compliance: "The City of Portland and the Department of Environmental Quality were more interested in helping us solve our problems than in blaming us."

Industry Pollution Prevention Activities

Several pollution prevention initiatives focus on the fabricated metal products industry. As identified below, some efforts include Georgia's

Pollution Prevention Assistance Division ($P^2AD$) strategy, the Industrial Technology Corporation collaborative effort, and the Merit Partnership.

*Georgia Department of Natural Resources*

A core strategy of the Pollution Prevention Assistance Division ($P^2AD$) of the Georgia Department of Natural Resources (DNR) is to focus technical assistance efforts on Georgia manufacturers that release chemicals posing the greatest risk to the public and the environment. After reviewing those industries which provide significant opportunities for pollution prevention, various strategies will be developed, including on-site technical assistance, financial assistance, fact sheets, workshops, and other outreach activities that will help manufacturers reduce their generation of toxic chemicals. The first phase is an on-going targeting effort, which evaluates waste generation characteristics of Georgia manufacturers producing toxic and hazardous wastes. The fabricated metal products industry was selected as a high priority manufacturing sector, along with the paper and paper products industry, chemical and allied products industry, transportation equipment industry, rubber and plastic products, and printing and publishing.

*ITAC*

The Industrial Technology Assistance Corporation (ITAC), in collaboration with the New York Branch of the AESF, the New York Masters Association of Metal Finishers, Utility Metal Research Corporation, and ten electroplating companies applied for and received funding to deliver a program coordinated and written by the Wastewater Technology Center of Canada. This is an industry-specific hands on 24 hour training session that integrates the assessment and incorporation of pollution prevention techniques into all types of electroplating and metal finishing operations. The training also includes an economic evaluation of the benefits of resource recovery on a multi-media basis.

*Merit Partnership*

The Merit Partnership brings industry and government representatives together to identify pollution prevention needs and accelerate pollution prevention technology diffusion. Merit partners and participants include EPA Region 9, The Metal Finishing

Association of Southern California (MFASC), the National Institute of Standards and Testing/California Manufacturing Technology Center, EPA's Office of Research and Development/Risk Reduction Engineering Lab, large companies processing pollution prevention technologies applicable to the metal finishing industry, local regulatory agencies, and participating companies. The Merit Partnership is working closely with its members to develop metal finishing projects that are transferable to small businesses. There is an emphasis on having large companies that are involved with metal finishing share their proven metal finishing methods with smaller companies. The Merit Partnership and MFASC have already begun to identify programmatic areas for metal plating pollution prevention opportunities, from which potential projects will be chosen.

## V.D. Pollution Prevention Options

The following sections list numerous pollution prevention techniques that may be useful to companies specializing in metal fabrication and finishing operations. These are options available to facilities, but are not to be construed as requirements. The information is organized by metal shaping, surface preparation, plating, and other finishing operations.

### V.D.1. Metal Shaping Operations

*Technique - Production Planning and Sequencing*

**Option 1** - Improve scheduling of processes that require use of varying oil types in order to reduce the number of cleanouts.

*Technique - Process or Equipment Modification*

**Option 1** - Standardize the oil types used for machining, turning, lathing, etc. This reduces the number of equipment cleanouts, and the amount of leftovers and mixed wastes.

**Option 2** - Use specific pipes and lines for each set of metals or processes that require a specific oil in order to reduce the amount of cleanouts.

**Option 3** - Save on coolant costs by extending machine coolant life through the use of a centrifuge and the addition of biocides. **Costs and Savings:** Waste Savings/Reductions: 25 percent reduction in plant-wide waste coolant generation. Product/Waste Throughput Information: based on handling 20,600 gallons of coolant per year.

**Option 4** - Install a second high speed centrifuge on a system already operating with a single centrifuge to improve recovery efficiency even more. **Costs and Savings:** Capital

Investment: $126,000. Payback Period: 3.1 years. Product/Waste Throughput Information: based on handling 20,600 gallons of coolant per year.

**Option 5** - Install a chip wringer to recover excess coolant on aluminum chips. **Costs and Savings**: Capital Investment: $11,000 to $23,000 (chip wringer and centrifuge system).Payback Period: 0.9 years. Product/Waste Throughput Information: based on handling 20,600 gallons of coolant per year.
**Option 6** - Install a coolant recovery system and collection vehicle for machines not on a central coolant sump. **Costs and Savings:** Capital Investment: $104,000. Payback Period: 1.9 years. Product/Waste Throughput Information: based on handling 20,600 gallons of coolant per year.

**Option 7** - Use a coolant analyzer to allow better control of coolant quality. **Costs and Savings:** Capital Investment: $5,000. Payback Period: 0.7 years. Product/Waste Throughput Information: based on handling 20,600 gallons of coolant per year.

**Option 8** - Use an ultrafiltration system to remove soluble oils from wastewater streams. **Costs and Savings:** Annual Savings: $200,000 (in disposal costs). Product/Waste Throughput Information: based on a wastewater flow rate of 860 to 1,800 gallons per day.

**Option 9** - Use disk or belt skimmers to remove oil from machine coolants and prolong coolant life. Also, design sumps for ease of cleaning. **Costs and Savings:** Waste Savings/Reduction: coolant is now disposed once per year rather than 3-6 times per year.

*Technique - Raw Material Substitution*

**Option 1** - In cold forming or other processes where oil is used only as a lubricant, substitute a hot lime bath or borax soap for oil.

**Option 2** - Use a stamping lubricant that can remain on the piece until the annealing process, where it is burned off. This eliminates the need for hazardous degreasing solvents and alkali cleaners. **Costs and Savings:** Annual Savings: $12,000 (results from reduced disposal, raw material, and labor costs). Waste Throughput Information: The amount of waste solvents and cleaners was reduced from 30,000 pounds in 1982 to 13,000 pounds in 1986. Employee working conditions were also improved by removing vapors associated with the old cleaners.

*Technique - Waste Segregation and Separation*

**Option 1** - If filtration or reclamation of oil is required before reuse, segregate the used oils in order to prevent mixing wastes.

**Option 2** - Segregation of metal dust or scrap by type often increases the value of metal for resale (e.g., sell metallic dust to a zinc smelter instead of disposing of it in a landfill). **Costs and Savings**: Capital Investment: $0. Annual Savings: $130,000. Payback Period: immediate. Waste Savings/Reduction: 2,700 tons per year. (Savings will vary with metal type and market conditions.)

**Option 3** - Improve housekeeping techniques and segregate waste streams (e.g., use care when cleaning cutting equipment to prevent the mixture of cutting oil and cleaning solvent).

**Costs and Savings:** Capital Investment: $0. Annual Savings: $3,000 in disposal costs. Waste Savings/Reduction: 66 percent (30 tons reduced to 10 tons).

*Technique - Recycling*

**Option 1** - Where possible, recycle oil from cutting/machining operations. Often oils need no treatment before recycling. **Costs and Savings:** Capital Investment: $1,900,000. Annual Savings: $156,000. Waste Throughput Information: 2 million gallons per year. Facility reclaims oil and metal from process water.

**Option 2** - Oil scrap mixtures can be centrifuged to recover the bulk of the oil for reuse.

**Option 3** - Follow-up magnetic and paper filtration of cutting fluids with ultrafiltration. By so doing, a much larger percentage of cutting fluids can be reused. **Costs and Savings:** Capital Investment: $42,000 (1976). Annual Savings: $33,800 (1980).

**Option 4** - Perform on-site purification of hydraulic oils using commercial "off-the-shelf" cartridge filter systems. **Costs and Savings:** Capital Investment: $28,000. Annual Savings: $17,800/year based on operating costs, avoided new oil purchase, and lost resale revenues. Payback Period: less than 2 years. Product/Waste Throughput Information: example facility handles 12,300 gallons/year of waste hydraulic oil.

**Option 5** - Use a continuos flow treatment system to regenerate and reuse aluminum chemical milling solutions. **Costs and Savings:** Capital Investment: $465,000. Annual Savings: $342,000. Payback Period: less than 2 years. Waste Savings/Reduction: 90 percent

**Option 6** - Use a settling tank (to remove solids) and a coalescing unit (to remove tramp oils) to recover metal-working fluids. **Costs and Savings:** Annual Savings: $26,800 (resulting from reduced material, labor, and disposal costs).

## V.D.2. Surface Preparation Operations

### SOLVENT CLEANING

*Technique - Training and Supervision*

**Option 1** - Improve solvent management by requiring employees to obtain solvent through their shop foreman. Also, reuse "waste" solvents from cleaner up-stream operations in down-stream, machines shop-type processes. **Costs and Savings:** Capital Investment: $0. Annual Savings: $7,200. Waste Savings/Reduction 49 percent (310 tons reduced to 152 tons). Product/Waste Throughput Information: original waste stream history: reactive anions (6,100 gallons/year), waste oils (1,250 gallons/year), halogenated solvents (500 gallons/year).

*Technique - Production Planning and Sequencing*

**Option 1** - Pre-cleaning will extent the life of the aqueous or vapor degreasing solvent (wipe, squeeze, or blow part with air, shot, etc.). **Costs and Savings:** Annual Savings: $40,000. Payback Period: 2 years. Waste Savings/Reduction: 48,000 gallons of aqueous waste. Aluminum shot was used to preclean parts.

**Option 2** - Use countercurrent solvent cleaning (i.e., rinse initially in previously used solvent and progress to new, clean solvent).

**Options 3** - Cold clean with a recycled mineral spirits stream to remove the bulk of oil before final vapor degreasing.

**Option 4** - Only degrease parts that must be cleaned. Do not routinely degrease all parts.

*Technique - Process or Equipment Modification*

**Option 1** - The loss of solvent to the atmosphere from vapor degreasing equipment can be reduced by:

- increasing the freeboard height above the vapor level to 100 percent of tank width;
- covering the degreasing unit (automatic covers are available);
- installing refrigerator coils (or additional coils) above the vapor zone;
- rotating parts before removal from the vapor degreaser to allow all condensed solvent to return to degreasing unit;
- controlling the speed at which parts are removed (10 feet or less per minute is desirable) so as not to disturb the vapor line;
- installing thermostatic heating controls on solvent tanks; and
- adding in-line filters to prevent particulate buildup in the degreaser.

**Option 2** - Reduce grease accumulation by adding automatic oilers to avoid excess oil applications.

**Option 3** - Use plastic blast media for paint stripping rather than conventional solvent stripping techniques. **Costs and Savings:** Waste Savings/Reduction: volume of waste sludge is reduced by as much as 99 percent over chemical solvents; wastewater fees are eliminated.

*Technique - Raw Material Substitution*

**Option 1** - Use less hazardous degreasing agents such as petroleum solvents or alkali washes. For example, replace halogenated solvents (e.g., trichloroethylene) with liquid alkali cleaning compounds. (Note that compatibility of aqueous cleaners with wastewater treatment systems should be ensured.) **Costs and Savings:** Capital Investment: $0. Annual Savings: $12,000. Payback Period: immediate. Waste Savings/Reduction: 30 percent of 1,1,1-trichloroethane replaced with an aqueous cleaner.

**Option 2** - Substitute chromic acid cleaner with non-fuming cleaners such as sulfuric acid and hydrogen peroxide. **Costs and Savings:** Annual Savings: $10,000 in treatment equipment costs and $2.50/lb. of chromium in treatment chemical costs. Product/Waste Throughput Information: rinse water flowrate of 2 gallons per minute.

**Option 3** - Substitute less polluting cleaners such as trisodium phosphate or ammonia for cyanide cleaners. **Costs and Savings:** Annual Savings: $12,000 in equipment costs and $3.00/lb. of cyanide in treatment chemical costs. Product/Waste Throughput Information: rinse water flowrate of 2 gallons per minute.

*Technique - Recycling*

**Option 1** - Recycle spent degreasing solvents on site using batch stills. **Costs and Savings:** Capital Investment: $2,600-$4,100 and $4,200-$17,000. Product Throughput Information: 35-60 gallons per hour and 0.6-20 gallons per hour, respectively. Two cost and throughput estimates for distillation units from two vendors.

**Option 2** - Use simple batch distillation to extend the life of 1,1,1-trichloroethane. **Costs and Savings:** Capital Investment: $3,500 (1978). Annual Savings: $50,400. Product/Waste Throughput Information: facility handles 40,450 gallons 1,1,1-trichloroethane per year.

**Option 3** - When on-site recycling is not possible, agreements can be made with supply companies to remove old solvents. **Costs and Savings:** Capital Investment: $3,250 for a temporary storage building. Annual Savings: $8,260. Payback Period: less than 6 months. Waste Savings/Reduction: 38,000 pounds per year of solvent sent off site for recycling.

**Option 4** - Arrange a cooperative agreement with other small companies to centrally recycle solvent.

## CHEMICAL TREATMENT

### *Technique - Process or Equipment Modification*

**Option 1**- Increase the number of rinses after each process bath and keep the rinsing counter-current in order to reduce drag-out losses.

**Option 2** - Recover unmixed acids in the wastewater by evaporation.

**Option 3** - Reduce rinse contamination via drag-out by:

- slowing and smoothing removal of parts, rotating them if necessary;
- using surfactants and other wetting agents;
- maximizing drip time;
- using drainage boards to direct dripping solutions back to process tanks;
- installing drag-out recovery tanks to capture dripping solutions;
- using a fog spray rinsing technique above process tanks;
- using techniques such as air knives or squeegees to wipe bath solutions off of the part; and
- changing bath temperature or concentrations to reduce the solution surface tension.

**Option 4** - Instead of pickling brass parts in nitric acid, place them in a vibrating apparatus with abrasive glass marbles or steel balls. A slightly acidic additive is used with the glass marbles, and a slightly basic additive is used with the steel balls. **Costs and Savings:** Capital Investment: $62,300 (1979); 50 percent less than conventional nitric acid pickling.

**Option 5** - Use mechanical scraping instead of acid solution to remove oxides of titanium. **Costs and Savings:** Annual Savings: $0; cost of mechanical stripping equals cost of chemical disposal. Waste Savings/Reduction: 100 percent. Waste Throughput Information: previously disposed 15 tons/year of acid with metals.

**Option 6** - For cleaning nickel and titanium alloy, replace alkaline etching bath with a mechanical abrasive system that uses a silk and carbide pad and pressure to clean or "brighten" the metal. **Costs and Savings:** Capital Investment: $3,250. Annual Savings:

$7,500. Waste Savings/Reduction: 100 percent. Waste Throughput Information: previous etching bath waste total was 12,000 gallons/year.

**Option 7** - Clean copper sheeting mechanically with a rotating brush machine that scrubs with pumice, instead of cleaning with ammonium persulfate, phosphoric acid, or sulfuric acid; may generate non-hazardous waste sludge. **Costs and Savings:** Capital Investment: $59,000. Annual Savings: more than $15,000. Payback Period: 3 years. Waste Savings/Reduction: 40,000 pounds of copper etching waste reduced to zero.

**Option 8**- Reduce molybdenum concentration in wastewaters by using a reverse osmosis/precipitation system. **Costs and Savings:** Capital Investment: $320,000. Waste Throughput Information: permeate capacity of 18,000 gallons per day. Savings Relative to an Evaporative System: installed capital cost savings: $150,000; annual operating cost savings: $90,000.

**Option 9** - When refining precious metals, reduce the acid/metals waste stream by maximizing reaction time in the gold and silver extraction process. **Costs and Savings:** Capital Investment: $0. Annual Savings: $9,000. Waste Savings/Reduction: 70 percent (waste total reduced from 50 tons to 15 tons).

*Technique - Raw Material Substitution*

**Option 1** - Change copper bright-dipping process from a cyanide dip and chromic acid dip to a sulfuric acid/hydrogen peroxide dip. The new bath is less toxic and copper can be recovered.

**Option 2** - Use alcohol instead of sulfuric acid to clean copper wire. One ton of wire requires 4 liters of alcohol solution, versus 2 kilograms of sulfuric acid. **Costs and Savings:** Capital Investment: $0.

**Option 3** - Replace caustic wire cleaner with a biodegradable detergent.

**Option 4** - Replace chromated desmutting solutions with nonchromated solutions for alkaline etch cleaning of wrought aluminum. **Costs and Savings:** Annual Savings: $44,541. Waste Savings/Reduction: sludge disposal costs reduced by 50 percent.

**Option 5** - Replace barium and cyanide salt heat treating with a carbonate/chloride carbon mixture, or with furnace heat treating.

**Option 6** - Replace thermal treatment of metals with condensation of saturated chlorite vapors on the surface to be heated. **Costs and Savings:** Waste Savings/Reduction: this process is fast, nonoxidizing, and uniform; pickling is no longer necessary.

*Technique - Recycling*

**Option 1** - Sell waste pickling acids as feedstock for fertilizer manufacture or neutralization/precipitation.

**Option 2** - Recover metals from solutions for resale. **Costs and Savings:** Annual Savings: $22,000. Payback Period: 14 months. Company sells copper recovered from a bright-dip bath regeneration process employing ion exchange and electrolytic recovery.

**Option 3** - Send used copper pickling baths to a continuous electrolysis process for regeneration and copper recovery. **Costs and Savings:** Capital Investment: $28,500 (1977). Product Throughput Information: pickling 12,000 tons of copper; copper recovery is at the rate of 200 gallons/ton of processed copper.

**Option 4** - Recover copper from brass bright dipping solutions using a commercially available ion exchange system. **Costs and Savings:** Annual Savings: $17,047; based on labor savings, coppers sulfate elimination, sludge reduction, copper metal savings, and bright dip chemicals savings. Product Throughput Information: example facility processes approximately 225,000 pounds of brass per month.

**Option 5** - Treat industrial wastewater high in soluble iron and heavy metals by chemical precipitation. **Costs and Savings:** Annual Savings: $28,000; based on reduced water and sewer rates. Waste Throughput Information: wastewater flow from facility's "patening" line is 100 gallons per minute.

**Option 6** - Oil quench baths may be recycled on site by filtering out the metals.

**Option 7** - Alkaline wash life can be extended by skimming the layer of oil (the skimmed oil may be reclaimed).

## V.D.3. Plating Operations

### *Technique - Training and Supervision*

**Option 1** - Educate plating shop personnel in the conservation of water during processing and in material segregation.

### *Technique - Production Planning and Sequencing*

**Option 1** - Preinspect parts to prevent processing of obvious rejects.

### *Technique - Process or Equipment Modification*

**Option 1 -** Modify rinsing methods to control drag-out by:

- Increasing bath temperature
- Decreasing withdrawal rate of parts from plating bath
- Increasing drip time over solution tanks; racking parts to avoid cupping solution within part cavities
- Shaking, vibrating, or passing the parts through an air knife, angling drain boards between tanks
- Using wetting agents to decrease surface tension in tank.

**Contact:** Braun Intertec Environmental, Inc., and MN Office of Waste Management (612) 649-5750.

**Option 2** - Utilize water conservation methods including:

- Flow restrictors on flowing rinses
- Counter current rinsing systems
- Fog or spray rinsing
- Reactive rinsing
- Purified or softened water

- Dead rinses
- Conductivity controllers
- Agitation to assure adequate rinsing and homogeneity in rinse tank
- Flow control valves.

**Contact:** Braun Intertec Environmental, Inc., and MN Office of Waste Management (612) 649-5750.

**Option 3 -** Implement counter flow rinsing and cascade rinsing systems to conserve consumption of water. **Costs and Savings:** Costs: $75,000 to upgrade existing equipment and purchasing new and used equipment. Waste Savings/Reduction: reduce water use and wastewater treatment costs. **Contact:** Eastside Plating and OR Department of Environmental Quality (800)452-4011**.**

**Option 4 -** Use drip bars to reduce drag-out. **Costs and Savings:** Capital Investment: $100 per tank. Savings: $600. **Contact:** NC Department of Natural Resources & Community Development, Gary Hunt (919) 733-7015.

**Option 5 -** Use drain boards between tanks to reduce generations of drag-out. **Costs and Savings:** Capital Investment: $25 per tank. Savings: $450. **Contact:** NC Department of Natural Resources & Community Development, Gary Hunt (919) 733-7015.

**Option 6** - Install racking to reduce generations of drag-out. **Costs and Savings:** Capital Investment: zero dollars. Operating Costs: minimal. Savings: $600. **Contact:** NC Department of Natural Resources & Community Development, Gary Hunt (919) 733-7015.

**Option 7** - Employ drag out recovery tanks to reduce generations of drag-out. **Costs and Savings:** Capital Investment: $500 per tank. Savings: $4,700. **Contact:** NC Department of Natural Resources & Community Development, Gary Hunt (919) 733-7015.

**Option 8** - Install counter-current rinsing operation to reduce water consumption. **Costs and Savings:** Capital Investment: $1,800-2,300. Savings: $1,350 per year. Waste Savings/Reductions: reduce water use by 90-99 percent. **Contact:** NC Department of Natural Resources & Community Development, Gary Hunt (919) 733-7015.

**Option 9** - Redesign rinse tank to reduce water conservation. **Costs and Savings:** Capital Investment: $100. Savings: $750 per year. **Contact:** NC Department of Natural Resources & Community Development, Gary Hunt (919) 733-7015.

**Option 10 -** Increase parts drainage time to reduce drag-out. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 11** - Regenerate plating bath by activated carbon filtration to remove built up organic contaminants. **Costs and Savings:** Capital Investment: $9,192. Costs: $7,973. Savings: $122,420. Waste Savings/Reduction: 10,800 gallons. Reduce volume of plating baths disposed and requirements for virgin chemicals. **Contact:** EPA Hazardous Waste Engineering Research Laboratory, Cincinnati, OH, Harry Freeman.

**Option 12 -** Install pH controller to reduce the alkaline and acid concentrations in tanks. **Contact:** Securus, Inc., and DBA Hubbard Enterprises.

**Option 13 -** Install atmospheric evaporator to reduce metal concentrations. **Contact:** Securus, Inc., and DBA Hubbard Enterprises.

**Option 14** - Install process (e.g., CALFRAN) to reduce pressure to vaporize water at cooler temperatures and recycle water by condensing the vapors in another container, thus concentrating and precipitating solutes out. **Costs and Savings:** Waste Savings/Reduction: reduce volume and quantity of aqueous waste solutions by recovering pure water. **Contact**: CALFRAN International, Inc., (413) 525-4957.

**Option 15** - Use reactive rinsing and multiple drag-out baths. **Costs and Savings:** Savings: Reduce cost of treating spent process baths and rinse waters. Waste Savings/Reduction: increase lifetime of process baths and reduce the quantity or rinse water requiring treatment. **Contact:** SAIC, Edward R. Saltzberg.

**Option 16** - Improve control of water level in rinse tanks, improve sludge separation, and enhance recycling of supernatant to the process by aerating the sludge. **Costs and Savings:** Savings: $2,000. Waste Savings/Reduction: reduce sludge generation by 32 percent. **Contact:** NJ Hazardous Waste Facilities Siting Commission, Hazardous Waste Source Reduction and Recycling Task Force.

**Option 17** - Install system (e.g., Low Solids Fluxer) that applies flux to printed wiring boards, leaving little residue and eliminates the need for cleaning CFCs. **Costs and Savings:** Waste Savings/Reduction: reduce CFC emissions over 50 percent. **Contact:** AT&T Bell Laboratories, Princeton, NJ.

*Technique - Raw Material Substitution*

**Option 1** - Substitute cyanide plating solutions with alkaline zinc, acid zinc, acid sulfate copper, pyrophosphate copper, alkaline copper, copper fluoborate, electroless nickel, ammonium silver, halide silver, methanesulfonate-potassium iodide silver, amino or thio complex silver, no free cyanide silver, cadmium chloride, cadmium sulfate, cadmium fluoborate, cadmium perchlorate, gold sulfite, and cobalt harden gold. **Contact:** Braun Intertec Environmental Inc., and MN Office of Waste Management (612) 649-5750.

**Option 2** - Substitute sodium bisulfite and sulfuric acid for ferrous sulfate in order to oxidize chromic acid wastes, and substitute gaseous chlorine for liquid chlorine in order to reduce cyanide reduction. **Costs and Savings:** Savings: $300,000 per year. Waste Savings/Reduction: reduces feedstock by 50 percent. **Contact:** Eastside Plating and OR Department of Environmental Quality (800) 452-4011.

**Option 3** - Replace hexavalent chromium with trivalent chromium plating systems. **Contact:** City of Los Angeles Hazardous and Toxic Material Project. Board of Public Works (213) 237-1209.

**Option 4** - Replace cyanide with non-cyanide baths. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 5** - Replace conventional chelating agents such as tartarates, phosphates, EDTA, and ammonia with sodium sulfides and iron sulfates in removing metal from rinse water which reduces the amount of waste generated from precipitation of metals from aqueous wastestreams. **Costs and Savings:** Costs: $178,830 per year. Savings: $382,995 per year. Waste Savings/Reduction: 496 tons of sludge per year. **Contact:** Tyndall Air Force Base, FL, (904) 283-2942, Charles Carpenter, Dan Sucia, Penny Wilcoff; and John Beller at EG&G (108) 526-1149.

**Option 6** - Replace methylene chloride, 1,1,1-trichloroethane, and perchloroethylene (solvent-based photochemical coatings) with aqueous base coating of 1 percent sodium carbonate. **Costs and Savings:** Waste Savings/Reduction: reduce solvent use by 60 tons per year. **Contact:** American Etching and Manufacturing, Pacoima, CA.

**Option 7** - Replace methanol with nonflammable alkaline cleaners. **Costs and Savings:** Waste Savings/Reduction: eliminate 32 tons per year of flammable methyl alcohol. **Contact:** American Etching and Manufacturing, Pacoima, CA.

**Option 8** - Substitute a non-cyanide for a sodium cyanide solution used in copper plating baths. **Costs and Savings:** Waste Savings/Reduction: reduce 7,630 pounds per year. **Contact:** Highland Plating Company, Los Angeles, CA.

*Technique - Waste Segregation and Separation*

**Option 1** - Wastewaters containing recoverable metals should be segregated from other wastewater streams.

*Technique - Recycling*

**Option 1** - Install ion exchange system to reduce generation of drag-out. **Costs and Savings:** Capital Investment: $78,000. Operating Costs: $3,200 per year. **Contact:** NC Department of Natural Resources & Community Development; Gary Hunt (919) 733-7015.

**Option 2** - Employ reverse osmosis system to reduce generation of drag-out. **Costs and Savings:** Savings: $40,000 per year. Capital Investment: $62,000. **Contact:** NC Department of Natural Resources & Community Development; Gary Hunt (919) 733-7015.

**Option 3** - Use electrolytic metal recovery to reduce generation of drag-out. **Costs and Savings:** Capital Investment: $1,000. **Contact:** NC Department of Natural Resources & Community Development; Gary Hunt (919) 733-7015.

**Option 4** - Utilize electrodialysis to reduce generation of drag-out. **Costs and Savings:** Capital Investment: $50,000. **Contact:** NC Department of Natural Resources & Community Development; Pollution Prevention Pays Program Gary Hunt (919) 733-7015.

**Option 5** - Implement evaporative recovery to reduce generation of drag-out. **Costs and Savings:** Capital Investment: $2,500. **Contact:** NC Department of Natural Resources & Community Development; Gary Hunt (919) 733-7015.

**Option 6**- Reuse rinse water. **Costs and Savings:** Savings: $1,500 per year. Capital Investment: $340 per tank. No direct costs. **Contact:** NC Department of Natural Resources & Community Development; Gary Hunt (919) 733-7015.

**Option 7**- Reuse drag-out waste back into process tank. **Contact:** NC Department of Natural Resources & Community Development; Gary Hunt (919) 733-7015.

**Option 8**- Recover process chemicals with fog rinsing parts over plating bath. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 9**- Evaporate and concentrate rinse baths for recycling. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 10** - Use ion exchange and electrowinning, reverse osmosis, and thermal bonding when possible. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 11** - Use sludge slagging techniques to extract and recycle metals. **Costs and Savings:** Capital Investment: $80,000 for 80 tons/year and $400,000 for 1,000 tons/year. Operating Costs: $18,000 per year for an 80 ton facility. Waste Savings/Reduction: reduces volume of waste by 94 percent. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 12** - Use hydrometallurgical processes to extract metals from sludge. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 13**- Convert sludge to smelter feed. **Contact:** City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works (213) 237-1209.

**Option 14**- Remove and recover lead and tin from boards by electrolysis or chemical precipitation. **Contact:** Control Data Corporation and MN Office of Waste Management (612) 649-5750.

**Option 15** - Install a closed loop batch treatment system for rinse water to reduce water use and waste volume. **Costs and Savings:** Savings: $58,460 per year. Capital Investment: $210,000. Waste Savings/Reduction: 40,000 gallons per year (40 percent). **Contact:** Pioneer Metal Finishing, Inc., Harry Desoi (609) 694-0400.

**Option 16** - Install an electrolytic cell which recovers 92 percent of dissolved copper in drag-out rinses and atmospheric evaporator to recover 95 percent of chromatic acid drag-out, and recycle it into chromic acid etch line. **Contact:** Digital Equipment Corporation and Lancy International Consulting Firm, William McLay (412) 452-9360.

**Option 17** - Implement the electrodialysis reversal process for metal salts in wastewater. **Costs and Savings**: Savings: $40,100 per year in operating costs. **Contact:** Ionics, Inc., Separations Technology Division.

**Option 18** - Oxidize cyanide and remove metallic copper to reduce metal concentrations. **Contact:** Securus, Inc. and DBA Hubbard Enterprises.

## V.D.4. Other Finishing Operations

### FINISHING OPERATIONS

*Technique - Training and Supervision*

**Option 1** - Always use proper spraying techniques.

**Option 2** - Improved paint quality, work efficiency, and lower vapor emissions can be attained by formal training of operators.

**Option 3** - Avoid buying excess finishing material at one time due to its short shelf-life.

*Technique - Production Planing and Sequencing*

**Option 1** - Use the correct spray gun for particular applications:

- conventional air spray gun for thin-film-build requirements
- airless gun for heavy film application
- air assisted airless spray gun for a wide range of fluid output.

**Option 2** - Preinspect parts to prevent painting of obvious rejects.

*Technique - Process or Equipment Modification*

**Option 1** - Ensure the spray gun air supply is free of water, oil, and dirt.

**Option 2** - Replace galvanizing processes requiring high temperature and flux with one that is low temperature and does not require flux. **Costs and Savings:** Capital Investment: $900,000. Annual Savings: 50 percent ( as compared to conventional galvanizing). Product Throughput Information: 1,000 kg/h.

**Option 3** - Investigate use of transfer methods that reduce material loss such as:
- dip and flow coating
- electrostatic spraying
- electrodeposition.

**Option 4** - Change from conventional air spray to an electrostatic finishing system. **Costs and Savings:** $15,000 per year. Payback Period: less than 2 years.

**Option 5** - Use solvent recovery or incineration to reduce the emissions of volatile organics from curing ovens. **Costs and Savings:** Annual Savings: $400,000.

**Option 6** - Regenerate anodizing and alkaline silking baths with contemporary recuperation of aluminum salts. **Costs and Savings:** $0.20 per meter of aluminum treated per year. Waste Throughput Information: based on an example plant that previously disposed 180,000 liters of acid solution per year at $0.07 per litre.

*Technique - Raw Material Substitution*

**Option 1** - Use alternative coatings for solvent based paints to reduce volatile organic materials use and emissions, such as:

- high solids coatings (this may require modifying the painting process; including high speed/high pressure equipment, a paint distributing system, and paint heaters); **Costs and Savings:** Waste Savings/Reduction: 30 percent net savings in applied costs per square foot.

- water based coatings - **Costs and Savings:** Waste Savings/Reduction: 87 percent drop in solvent emissions and decreased hazardous waste production;

- powder coatings - **Costs and Savings:** Capital Investment: $1.5 million. Payback Period: 2 years. Example is for a large, wrought iron patio furniture company.

*Technique - Waste Segregation and Separation*

**Option 1** - Segregate non-hazardous paint solids from hazardous paint solvents and thinners.

*Technique - Recycling*

**Option 1** - Do not dispose of extended shelf life items that do not meet your facility's specifications. They may be returned to the manufacturer, or sold or donated as a raw material.

**Option 2** - Recycle metal sludges through metal recovery vendors.

**Option 3** - Use activated carbon to recover solvent vapors, then recover the solvent from the carbon by steam stripping, and distill the resulting water/solvent mixture. **Costs and Savings:** Capital Investment: $817,000 (1978). Waste Savings/Reduction: releases of solvent to the atmosphere were reduced from 700 kg/ton of solvent used to 20 kg/ton.

**Option 4** - Regenerate caustic soda etch solution for aluminum by using hydrolysis of sodium aluminate to liberate free sodium hydroxide and produce a dry, crystalline hydrate alumina byproduct. **Costs and Savings:** Capital Investment: $260,000. Savings: $169,282 per year; from reduced caustic soda use, income from the sale of the byproduct, and a reduction in the cost of solid waste disposal. Payback Period: 1.54 years. Product/Waste Throughput Information: anodizing operation for which the surface area is processed at a rate of 200 $M^2$/hour.

## PAINT CLEANUP

*Technique - Production Planning and Sequencing*

**Option 1** - Reduce equipment cleaning by painting with lighter colors before darker ones.

**Option 2** - Reuse cleaning solvents for the same resin system by first allowing solids to settle out of solution.

**Option 3** - Flush equipment first with dirty solvent before final cleaning with virgin solvent. **Costs and Savings:** Waste Savings/Reduction: 98 percent; from 25,000 gallons of paint cleanup solvents to 400 gallons. Company uses cleanup solvents in formulation of subsequent batches.

**Option 4** - Use virgin solvents for final equipment cleaning, then as paint thinner.

**Option 5** - Use pressurized air mixed with a mist of solvent to clean equipment.

*Technique - Raw Material Substitution*

**Option 1** - Replace water-based paint booth filters with dry filters. Dry filters will double paint booth life and allow more efficient treatment of wastewater. **Costs and Savings:** Savings per year: $1,500. Waste Savings/Reduction: 3,000 gallons/year.

*Technique - Loss Prevention and Housekeeping*

**Option 1** - To prevent spray gun leakage, submerge only the front end (or fluid control) of the gun into the cleaning solvent.

*Technique - Waste Segregation and Separation*

**Option 1** - Solvent waste streams should be kept segregated and free from water contamination.

*Technique - Recycling*

**Option 1** - Solvent recovery units can be used to recycle spent solvents generated in flushing operations.

- Install a recovery system for solvents contained in air emissions. **Costs and Savings:** Savings: $1,000 per year.
- Use batch distillation to recover isopropyl acetate generated during equipment cleanup. **Costs and Savings:** Payback Period: 2 years.
- Use batch distillation to recover xylene from paint equipment cleanup. **Costs and Savings:** Payback Period: 13 months. Savings: $5,000 per year.
- Use a small solvent recovery still to recover spent paint thinner from spray gun cleanups and excess paint batches. **Costs and Savings:** Capital Investment: $6,000 for a 15 gallons capacity still. Savings: $3,600 per year in new thinner savings; $5,400 in disposal savings. Payback Period: less than 1 year. Waste Savings/Reduction: 75 percent (745 gallons of thinner recovered from 1,003 gallons). Product/Waste Throughput Information: 1,500 gallons of spent thinner processed per year.

- Install a methyl ethyl ketone solvent recovery system to recover and reuse waste solvents. **Costs and Savings:** Savings: $43,000 per year; MEK recovery rate: 20 gallons per day, reflecting a 90 percent reduction in waste.

**Option 2** - Arrange an agreement with other small companies to jointly recycle cleaning wastes.

## V.E. Pollution Prevention Contacts

| Organization | Technique(s) to Promote Pollution Prevention Plating Operations | Telephone Number |
|---|---|---|
| Braun Intertec Environmental, Inc.<br>Minnesota Office of Waste Management | Process or Equipment Modification<br>Raw Material Substitution | (612) 649-5750 |
| Eastside Plating<br>Oregon Department of Environmental Quality | Process or Equipment Modification<br>Raw Material Substitution | (800) 452-4011 |
| North Carolina Department of Natural Resources & Community Development (Gary Hunt) | Process or Equipment Modification<br>Recycling | (919) 733-7015 |
| City of Los Angeles Hazardous and Toxic Material Project, Board of Public Works | Process or Equipment Modification<br>Raw Material Substitution<br>Recycling | (213) 237-1209 |
| EPA Hazardous Waste Engineering Research Laboratory, Cincinnati, OH (Harry Freeman) | Process or Equipment Modification | |
| Securus, Inc.<br>DBA Hubbard Enterprises | Process or Equipment Modification<br>Recycling | |

| Organization | Technique(s) to Promote Pollution Prevention Plating Operations | Telephone Number |
|---|---|---|
| CALFRAN International, Inc. | Process or Equipment Modification | (413) 525-4957 |
| SAIC (Edward R. Saltzberg) | Process or Equipment Modification | |
| New Jersey Hazardous Waste Facilities Siting Commission, Hazardous Waste Source Reduction and Recycling Task Force | Process or Equipment Modification | |
| AT&T Bell Laboratories, Princeton, NJ | Process or Equipment Modification | |
| Tyndall Air Force Base (Charles Carpenter)<br>EG&G Idaho (Dan Sucia, Penny Wilcoff, John Beller) | Raw Material Substitution | (904) 283-2942<br>(208) 526-1149 |
| American Etching and Manufacturing, Pacoima, CA | Raw Material Substitution | |
| Highland Plating Company, Los Angeles, CA | Raw Material Substitution | |
| Control Data Corporation<br>Minnesota Office of Waste Management | Recycling | (612) 649-5750 |
| Pioneer Metal Finishing, Inc. (Harry Desoi) | Recycling | (609) 694-0400 |
| Digital Equipment Corporation<br>Lancy International Consulting Firm (William McLay) | Recycling | (412) 452-9360 |
| Ionics, Inc., Separations Technology Division | Recycling | |

## VI. SUMMARY OF APPLICABLE FEDERAL STATUTES AND REGULATIONS

This section discusses the Federal statutes and regulations that may apply to this sector. The purpose of this section is to highlight, and briefly describe the applicable Federal requirements, and to provide citations for more detailed information. The three following sections are included.

- Section IV.A contains a general overview of major statutes
- Section IV.B contains a list of regulations specific to this industry
- Section IV.C contains a list of pending and proposed regulations

The descriptions within Section IV are intended solely for general information. Depending upon the nature or scope of the activities at a particular facility, these summaries may or may not necessarily describe all applicable environmental requirements. Moreover, they do not constitute formal interpretations or clarifications of the statutes and regulations. For further information, readers should consult the Code of Federal Regulations and other state or local regulatory agencies. EPA Hotline contacts are also provided for each major statute.

### VI.A. General Description of Major Statutes

#### Resource Conservation And Recovery Act

The Resource Conservation And Recovery Act (RCRA) of 1976 which amended the Solid Waste Disposal Act, addresses solid (Subtitle D) and hazardous (Subtitle C) waste management activities. The Hazardous and Solid Waste Amendments (HSWA) of 1984 strengthened RCRA's waste management provisions and added Subtitle I, which governs underground storage tanks (USTs).

Regulations promulgated pursuant to Subtitle C of RCRA (40 CFR Parts 260-299) establish a "cradle-to-grave" system governing hazardous waste from the point of generation to disposal. RCRA hazardous wastes include the specific materials listed in the regulations (commercial chemical products, designated with the code "P" or "U"; hazardous wastes from specific industries/sources, designated with the code "K"; or hazardous wastes from non-specific

sources, designated with the code "F") or materials which exhibit a hazardous waste characteristic (ignitibility, corrosivity, reactivity, or toxicity and designated with the code "D").

Regulated entities that generate hazardous waste are subject to waste accumulation, manifesting, and recordkeeping standards. Facilities that treat, store, or dispose of hazardous waste must obtain a permit, either from EPA or from a State agency which EPA has authorized to implement the permitting program. Subtitle C permits contain general facility standards such as contingency plans, emergency procedures, recordkeeping and reporting requirements, financial assurance mechanisms, and unit-specific standards. RCRA also contains provisions (40 CFR Part 264 Subpart S and §264.10) for conducting corrective actions which govern the cleanup of releases of hazardous waste or constituents from solid waste management units at RCRA-regulated facilities.

Although RCRA is a Federal statute, many States implement the RCRA program. Currently, EPA has delegated its authority to implement various provisions of RCRA to 46 of the 50 States.

Most RCRA requirements are not industry specific but apply to any company that transports, treats, stores, or disposes of hazardous waste. Here are some important RCRA regulatory requirements:

- **Identification of Solid and Hazardous Wastes** (40 CFR Part 261) lays out the procedure every generator should follow to determine whether the material created is considered a hazardous waste, solid waste, or is exempted from regulation.

- **Standards for Generators of Hazardous Waste** (40 CFR Part 262) establishes the responsibilities of hazardous waste generators including obtaining an ID number, preparing a manifest, ensuring proper packaging and labeling, meeting standards for waste accumulation units, and recordkeeping and reporting requirements. Generators can accumulate hazardous waste for up to 90 days (or 180 days depending on the amount of waste generated) without obtaining a permit.

- **Land Disposal Restrictions** (LDRs) are regulations prohibiting the disposal of hazardous waste on land without prior treatment. Under the LDRs (40 CFR 268), materials must meet land disposal restriction (LDR) treatment standards prior to placement in a RCRA land disposal unit (landfill, land

treatment unit, waste pile, or surface impoundment). Wastes subject to the LDRs include solvents, electroplating wastes, heavy metals, and acids. Generators of waste subject to the LDRs must provide notification of such to the designated TSD facility to ensure proper treatment prior to disposal.

- **Used Oil Management Standards** (40 CFR Part 279) impose management requirements affecting the storage, transportation, burning, processing, and re-refining of the used oil. For parties that merely generate used oil, regulations establish storage standards. For a party considered a used oil marketer (one who generates and sells off-specification used oil directly to a used oil burner), additional tracking and paperwork requirements must be satisfied.

- **Tanks and Containers** used to store hazardous waste with a high volatile organic concentration must meet emission standards under RCRA. Regulations (40 CFR Part 264-265, Subpart CC) require generators to test the waste to determine the concentration of the waste, to satisfy tank and container emissions standards, and to inspect and monitor regulated units. These regulations apply to all facilities who store such waste, including generators operating under the 90-day accumulation rule.

- **Underground Storage Tanks** (USTs) containing petroleum and hazardous substance are regulated under Subtitle I of RCRA. Subtitle I regulations (40 CFR Part 280) contain tank design and release detection requirements, as well as financial responsibility and corrective action standards for USTs. The UST program also establishes increasingly stringent standards, including upgrade requirements for existing tanks, that must be met by 1998.

- **Boilers and Industrial Furnaces** (BIFs) that use or burn fuel containing hazardous waste must comply with strict design and operating standards. BIF regulations (40 CFR Part 266, Subpart H) address unit design, provide performance standards, require emissions monitoring, and restrict the type of waste that may be burned.

*EPA's RCRA/Superfund/UST Hotline, at (800) 424-9346, responds to questions and distributes guidance regarding all RCRA regulations. The RCRA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., EST, excluding Federal holidays.*

## Comprehensive Environmental Response, Compensation, And Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a 1980 law commonly known as Superfund, authorizes EPA to respond to releases, or threatened releases, of hazardous substances that may endanger public health, welfare, or the environment. CERCLA also enables EPA to force parties responsible for environmental contamination to clean it up or to reimburse the Superfund for response costs incurred by EPA. The Superfund Amendments and Reauthorization Act (SARA) of 1986 revised various sections of CERCLA, extended the taxing authority for the Superfund, and created a free-standing law, SARA Title III, also known as the Emergency Planning and Community Right-to-Know Act (EPCRA).

The CERCLA **hazardous substance release reporting regulations** (40 CFR Part 302) direct the person in charge of a facility to report to the National Response Center (NRC) any environmental release of a hazardous substance which exceeds a reportable quantity. Reportable quantities are defined and listed in 40 CFR § 302.4. A release report may trigger a response by EPA, or by one or more Federal or State emergency response authorities.

EPA implements **hazardous substance responses** according to procedures outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). The NCP includes provisions for permanent cleanups, known as remedial actions, and other cleanups referred to as "removals." EPA generally takes remedial actions only at sites on the National Priorities List (NPL), which currently includes approximately 1300 sites. Both EPA and states can act at other sites; however, EPA provides responsible parties the opportunity to conduct removal and remedial actions and encourages community involvement throughout the Superfund response process.

*EPA's RCRA/Superfund/UST Hotline, at (800) 424-9346, answers questions and references guidance pertaining to the Superfund program. The CERCLA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., EST, excluding Federal holidays.*

## Emergency Planning And Community Right-To-Know Act

The Superfund Amendments and Reauthorization Act (SARA) of 1986 created the Emergency Planning and Community Right-to-Know Act (EPCRA, also known as SARA Title III), a statute designed to improve

community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by State and local governments. EPCRA required the establishment of State emergency response commissions (SERCs), responsible for coordinating certain emergency response activities and for appointing local emergency planning committees (LEPCs).

EPCRA and the EPCRA regulations (40 CFR Parts 350-372) establish four types of reporting obligations for facilities which store or manage specified chemicals:

- **EPCRA §302** requires facilities to notify the SERC and LEPC of the presence of any "extremely hazardous substance" (the list of such substances is in 40 CFR Part 355, Appendices A and B) if it has such substance in excess of the substance's threshold planning quantity, and directs the facility to appoint an emergency response coordinator.

- **EPCRA §304** requires the facility to notify the SERC and the LEPC in the event of a release exceeding the reportable quantity of a CERCLA hazardous substance or an EPCRA extremely hazardous substance.

- **EPCRA §§311 and 312** require a facility at which a hazardous chemical, as defined by the Occupational Safety and Health Act, is present in an amount exceeding a specified threshold to submit to the SERC, LEPC, and local fire department material safety data sheets (MSDSs) or lists of MSDSs and hazardous chemical inventory forms (also known as Tier I and II forms). This information helps the local government respond in the event of a spill or release of the chemical.

- **EPCRA §313** requires manufacturing facilities included in SIC codes 20 through 39, which have ten or more employees, and which manufacture, process, or use specified chemicals in amounts greater than threshold quantities, to submit an annual toxic chemical release report. This report, commonly known as the Form R, covers releases and transfers of toxic chemicals to various facilities and environmental media, and allows EPA to compile the national Toxic Release Inventory (TRI) database.

All information submitted pursuant to EPCRA regulations is publicly accessible, unless protected by a trade secret claim.

*EPA's EPCRA Hotline, at (800) 535-0202, answers questions and distributes guidance regarding the emergency planning and community right-to-know regulations. The EPCRA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., EST, excluding Federal holidays.*

## Clean Water Act

The primary objective of the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), is to restore and maintain the chemical, physical, and biological integrity of the nation's surface waters. Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants; "conventional" pollutants, such as biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform, oil and grease, and pH; and "non-conventional" pollutants, including any pollutant not identified as either conventional or priority.

The CWA regulates both direct and indirect discharges. The **National Pollutant Discharge Elimination System (NPDES)** program (CWA §402) controls direct discharges into navigable waters. Direct discharges or "point source" discharges are from sources such as pipes and sewers. NPDES permits, issued by either EPA or an authorized State (EPA has presently authorized forty States to administer the NPDES program), contain industry-specific, technology-based and/or water quality-based limits, and establish pollutant monitoring and reporting requirements. A facility that intends to discharge into the nation's waters must obtain a permit prior to initiating its discharge. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. The permit will then set forth the conditions and effluent limitations under which a facility may make a discharge.

A NPDES permit may also include discharge limits based on Federal or State water quality criteria or standards, that were designed to protect designated uses of surface waters, such as supporting aquatic life or recreation. These standards, unlike the technological standards, generally do not take into account technological feasibility or costs. Water quality criteria and standards vary from State to State, and site to site, depending on the use classification of the receiving body of water. Most States follow EPA guidelines which propose aquatic life and human health criteria for many of the 126 priority pollutants.

**Storm Water Discharges**

In 1987 the CWA was amended to require EPA to establish a program to address **storm water discharges**. In response, EPA promulgated the NPDES storm water permit application regulations. Storm water discharge associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying storm water and which is directly related to manufacturing, processing or raw materials storage areas at an industrial plant (40 CFR 122.26(b)(14)). These regulations require that facilities with the following storm water discharges apply for a NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal storm sewer system; or (3) a discharge which EPA or the State determines to contribute to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.

The term "storm water discharge associated with industrial activity" means a storm water discharge from one of 11 categories of industrial activity defined at 40 CFR 122.26. Six of the categories are defined by SIC codes while the other five are identified through narrative descriptions of the regulated industrial activity. If the primary SIC code of the facility is one of those identified in the regulations, the facility is subject to the storm water permit application requirements. If any activity at a facility is covered by one of the five narrative categories, storm water discharges from those areas where the activities occur are subject to storm water discharge permit application requirements.

Those facilities/activities that are subject to storm water discharge permit application requirements are identified below. To determine whether a particular facility falls within one of these categories, the regulation should be consulted.

**Category i**: Facilities subject to storm water effluent guidelines, new source performance standards, or toxic pollutant effluent standards.

**Category ii:** Facilities classified as SIC 24-lumber and wood products (except wood kitchen cabinets); SIC 26-paper and allied products (except paperboard containers and products); SIC 28-chemicals and allied products (except drugs and paints); SIC 29-petroleum refining; and SIC 311-leather tanning and finishing.

**Category iii:** Facilities classified as SIC 10-metal mining; SIC 12-coal mining; SIC 13-oil and gas extraction; and SIC 14-nonmetallic mineral mining.

**Category iv:** Hazardous waste treatment, storage, or disposal facilities.

**Category v:** Landfills, land application sites, and open dumps that receive or have received industrial wastes.

**Category vi:** Facilities classified as SIC 5015-used motor vehicle parts; and SIC 5093-automotive scrap and waste material recycling facilities.

**Category vii:** Steam electric power generating facilities.

**Category viii:** Facilities classified as SIC 40-railroad transportation; SIC 41-local passenger transportation; SIC 42-trucking and warehousing (except public warehousing and storage); SIC 43-U.S. Postal Service; SIC 44-water transportation; SIC 45-transportation by air; and SIC 5171-petroleum bulk storage stations and terminals.

**Category ix:** Sewage treatment works.

**Category x:** Construction activities except operations that result in the disturbance of less than five acres of total land area.

**Category xi:** Facilities classified as SIC 20-food and kindred products; SIC 21-tobacco products; SIC 22-textile mill products; SIC 23-apparel related products; SIC 2434-wood kitchen cabinets manufacturing; SIC 25-furniture and fixtures; SIC 265-paperboard containers and boxes; SIC 267-converted paper and paperboard products; SIC 27-printing, publishing, and allied industries; SIC 283-drugs; SIC 285-paints, varnishes, lacquer, enamels, and allied products; SIC 30-rubber and plastics; SIC 31-leather and leather products (except leather and tanning and finishing); SIC 323-glass products; SIC 34-fabricated metal products (except fabricated structural metal); SIC 35-industrial and commercial machinery and computer equipment; SIC 36-electronic and other electrical equipment and components; SIC 37-transportation equipment (except ship and boat building and repairing); SIC 38-measuring, analyzing, and controlling instruments; SIC 39-miscellaneous manufacturing industries; and SIC 4221-4225-public warehousing and storage.

### Pretreatment Program

Another type of discharge that is regulated by the CWA is one that goes to a publicly-owned treatment works (POTWs). The national **pretreatment program** (CWA §307(b)) controls the indirect discharge of pollutants to POTWs by "industrial users." Facilities regulated under §307(b) must meet certain pretreatment standards. The goal of the pretreatment program is to protect municipal wastewater treatment plants from damage that may occur when hazardous, toxic, or other wastes are discharged into a sewer system and to protect the quality of sludge generated by these plants. Discharges to a POTW are regulated primarily by the POTW itself, rather than the State or EPA.

EPA has developed technology-based standards for industrial users of POTWs. Different standards apply to existing and new sources within each category. "Categorical" pretreatment standards applicable to an industry on a nationwide basis are developed by EPA. In addition, another kind of pretreatment standard, "local limits," are developed by the POTW in order to assist the POTW in achieving the effluent limitations in its NPDES permit.

Regardless of whether a State is authorized to implement either the NPDES or the pretreatment program, if it develops its own program, it may enforce requirements more stringent than Federal standards.

*EPA's Office of Water, at (202) 260-5700, will direct callers with questions about the CWA to the appropriate EPA office. EPA also maintains a bibliographic database of Office of Water publications which can be accessed through the Ground Water and Drinking Water resource center, at (202) 260-7786.*

## Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) mandates that EPA establish regulations to protect human health from contaminants in drinking water. The law authorizes EPA to develop national drinking water standards and to create a joint Federal-State system to ensure compliance with these standards. The SDWA also directs EPA to protect underground sources of drinking water through the control of underground injection of liquid wastes.

EPA has developed primary and secondary drinking water standards under its SDWA authority. EPA and authorized States enforce the

primary drinking water standards, which are, contaminant-specific concentration limits that apply to certain public drinking water supplies. Primary drinking water standards consist of maximum contaminant level goals (MCLGs), which are non-enforceable health-based goals, and maximum contaminant levels (MCLs), which are enforceable limits set as close to MCLGs as possible, considering cost and feasibility of attainment.

The SDWA **Underground Injection Control (UIC)** program (40 CFR Parts 144-148) is a permit program which protects underground sources of drinking water by regulating five classes of injection wells. UIC permits include design, operating, inspection, and monitoring requirements. Wells used to inject hazardous wastes must also comply with RCRA corrective action standards in order to be granted a RCRA permit, and must meet applicable RCRA land disposal restrictions standards. The UIC permit program is primarily State-enforced, since EPA has authorized all but a few States to administer the program.

The SDWA also provides for a Federally-implemented Sole Source Aquifer program, which prohibits Federal funds from being expended on projects that may contaminate the sole or principal source of drinking water for a given area, and for a State-implemented Wellhead Protection program, designed to protect drinking water wells and drinking water recharge areas.

*EPA's Safe Drinking Water Hotline, at (800) 426-4791, answers questions and distributes guidance pertaining to SDWA standards. The Hotline operates from 9:00 a.m. through 5:30 p.m., EST, excluding Federal holidays.*

**Toxic Substances Control Act**

The Toxic Substances Control Act (TSCA) granted EPA authority to create a regulatory framework to collect data on chemicals in order to evaluate, assess, mitigate, and control risks which may be posed by their manufacture, processing, and use. TSCA provides a variety of control methods to prevent chemicals from posing unreasonable risk.

TSCA standards may apply at any point during a chemical's life cycle. Under TSCA §5, EPA has established an inventory of chemical substances. If a chemical is not already on the inventory, and has not been excluded by TSCA, a premanufacture notice (PMN) must be submitted to EPA prior to manufacture or import. The PMN must identify the chemical and provide available information on health and

environmental effects. If available data are not sufficient to evaluate the chemical's effects, EPA can impose restrictions pending the development of information on its health and environmental effects. EPA can also restrict significant new uses of chemicals based upon factors such as the projected volume and use of the chemical.

Under TSCA §6, EPA can ban the manufacture or distribution in commerce, limit the use, require labeling, or place other restrictions on chemicals that pose unreasonable risks. Among the chemicals EPA regulates under §6 authority are asbestos, chlorofluorocarbons (CFCs), and polychlorinated biphenyls (PCBs).

*EPA's TSCA Assistance Information Service, at (202) 554-1404, answers questions and distributes guidance pertaining to Toxic Substances Control Act standards. The Service operates from 8:30 a.m. through 4:30 p.m., EST, excluding Federal holidays.*

**Clean Air Act**

The Clean Air Act (CAA) and its amendments, including the Clean Air Act Amendments (CAAA) of 1990, are designed to "protect and enhance the nation's air resources so as to promote the public health and welfare and the productive capacity of the population." The CAA consists of six sections, known as Titles, which direct EPA to establish national standards for ambient air quality and for EPA and the States to implement, maintain, and enforce these standards through a variety of mechanisms. Under the CAAA, many facilities will be required to obtain permits for the first time. State and local governments oversee, manage, and enforce many of the requirements of the CAAA. CAA regulations appear at 40 CFR Parts 50-99.

Pursuant to Title I of the CAA, EPA has established national ambient air quality standards (NAAQSs) to limit levels of "criteria pollutants," including carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide. Geographic areas that meet NAAQSs for a given pollutant are classified as attainment areas; those that do not meet NAAQSs are classified as non-attainment areas. Under §110 of the CAA, each State must develop a State Implementation Plan (SIP) to identify sources of air pollution and to determine what reductions are required to meet Federal air quality standards.

Title I also authorizes EPA to establish New Source Performance Standards (NSPSs), which are nationally uniform emission standards for new stationary sources falling within particular industrial

categories. NSPSs are based on the pollution control technology available to that category of industrial source but allow the affected industries the flexibility to devise a cost-effective means of reducing emissions.

Under Title I, EPA establishes and enforces National Emission Standards for Hazardous Air Pollutants (NESHAPs), nationally uniform standards oriented towards controlling particular hazardous air pollutants (HAPs). Title III of the CAAA further directed EPA to develop a list of sources that emit any of 189 HAPs, and to develop regulations for these categories of sources. To date EPA has listed 174 categories and developed a schedule for the establishment of emission standards. The emission standards will be developed for both new and existing sources based on "maximum achievable control technology" (MACT). The MACT is defined as the control technology achieving the maximum degree of reduction in the emission of the HAPs, taking into account cost and other factors.

Title II of the CAA pertains to mobile sources, such as cars, trucks, buses, and planes. Reformulated gasoline, automobile pollution control devices, and vapor recovery nozzles on gas pumps are a few of the mechanisms EPA uses to regulate mobile air emission sources.

Title IV establishes a sulfur dioxide emissions program designed to reduce the formation of acid rain. Reduction of sulfur dioxide releases will be obtained by granting to certain sources limited emissions allowances, which, beginning in 1995, will be set below previous levels of sulfur dioxide releases.

Title V of the CAAA of 1990 created a permit program for all "major sources" (and certain other sources) regulated under the CAA. One purpose of the operating permit is to include in a single document all air emissions requirements that apply to a given facility. States are developing the permit programs in accordance with guidance and regulations from EPA. Once a State program is approved by EPA, permits will be issued and monitored by that State.

Title VI is intended to protect stratospheric ozone by phasing out the manufacture of ozone-depleting chemicals and restrict their use and distribution. Production of Class I substances, including 15 kinds of chlorofluorocarbons (CFCs), will be phased out entirely by the year 2000, while certain hydrochlorofluorocarbons (HCFCs) will be phased out by 2030.

*EPA's Control Technology Center, at (919) 541-0800, provides general assistance and information on CAA standards. The Stratospheric Ozone Information Hotline, at (800) 296-1996, provides general information about regulations promulgated under Title VI of the CAA, and EPA's EPCRA Hotline, at (800) 535-0202, answers questions about accidental release prevention under CAA §112(r). In addition, the Technology Transfer Network Bulletin Board System (modem access (919) 541-5742)) includes recent CAA rules, EPA guidance documents, and updates of EPA activities.*

This section discusses the Federal regulations that may apply to this sector. The purpose of this section is to highlight, and briefly describe the applicable Federal requirements so that the reader is aware of these requirements. The section provides a summary of each major environmental statute, and a description of regulations that may specifically apply to the profiled industry. Some profiles also provide information regarding current rulemaking activity that might specifically impact this sector. The descriptions within Section VI are intended solely for guidance. No statutory or regulatory requirements are in any way altered by any statement(s) contained herein. For more in-depth information, readers should consult the United States Code and the Code of Federal Regulations as well as State or local regulatory agencies. EPA Hotline contacts are also provided for each major statute.

## VI.B. Industry Specific Regulations

A number of statutes and regulations affect the metal fabrication and finishing industry. The electroplating and metal finishing pretreatment standards promulgated under the Clean Water Act regulate the chemicals in wastewater, the Clean Air Act regulates air emissions, and the Resource Conservation and Recovery Act regulates hazardous waste generation, transportation, treatment, storage, and disposal. Each is discussed briefly below.

Clean Water Act (CWA)

Two Clean Water Act regulations affect the fabricated metal products industry (SIC 34): the Effluent Guidelines and Standards for Metal Finishing (40 CFR Part 433) and the Effluent Guidelines and Standards for Electroplating (40 CFR Part 413). The regulations targeting the electroplating industry were issued before those targeting the metal finishing industry as a whole. Companies regulated by the electroplating standards (40 CFR Part 413) before the metal finishing standards (40 CFR Part 433) were promulgated, become subject to the

requirements of the metal finishing standards when (or if) they make modifications to their facility's operating functions (e.g., facility, equipment, process modifications). If companies made no such modifications, they remain regulated by the electroplating standards. All new facilities are subject to the standards set forth in 40 CFR Part 433.

The Effluent Guidelines and Standards for Metal Finishing (40 CFR Part 433) are applicable to wastewater generated by any of these operations:

- Electroplating
- Electroless Plating
- Anodizing
- Coating
- Chemical Etching and Milling
- Printed Circuit Board Manufacturing.

If any of the above processes are performed, the metal finishing standards will also apply to discharges from 40 additional processes, including: cleaning, polishing, shearing, hot dip coating, solvent degreasing, painting, etc.

The standards include daily maximums and maximum monthly average concentration limitations. The standards are based on milligrams per square meter of operation and determine the amount of wastewater pollutants from various operations that may be discharged. The uniformity in standards meets industry requests for equivalent limits for process lines often found together. The metal finishing standards also reduce the need to use the Combined Wastestream Formula.

Specific pretreatment standards may also apply to wastewater discharges from other metal finishing operations. The more specific standards will apply to those metal finishing wastestreams which appear to be covered by both standards. The requirements in the following regulations take precedence over those contained in the general metal finishing regulation:

- Iron and Steel Manufacturing (40 CFR Part 420)
- Battery Manufacturing (40 CFR Part 461)
- Plastic Molding and Forming (40 CFR Part 463)

- Coil Coating (40 CFR Part 465)
- Porcelain Enameling (40 CFR Part 466)
- Aluminum Forming (40 CFR Part 467)
- Copper Forming (40 CFR Part 468)
- Electrical and Electronic Components (40 CFR Part 469)
- Nonferrous Forming (40 CFR Part 471)
- Lead-Tin-Bismuth Forming Category (40 CFR Part 471, Subpart A)
- Zinc Forming Subcategory (40 CFR Part 471, Subpart H).

The Effluent Guidelines and Standards for Electroplating (40 CFR Part 413) cover wastewater dischargers from electroplating operations, in which metal is electroplated on any basis material, and to related metal finishing operations. As stated previously, facilities regulated by the electroplating standards may become subject to the metal finishing standards if they make modifications to their facility's operating functions (e.g., facility, equipment, process modifications). Independent printed circuit board manufacturers are defined as facilities which manufacture printed circuit boards principally for sale to other companies. These facilities remain subject only to the electroplating standards (40 CFR Part 413), primarily to minimize the economic impact to these relatively small facilities. Also excluded from the metal finishing regulations are facilities which perform metallic platemaking and gravure cylinder preparation conducted within printing and publishing facilities.

Operations similar to electroplating which are specifically exempt from coverage under the electroplating standards include:

- Continuous strip electroplating conducted within iron and steel manufacturing facilities (40 CFR Part 420)
- Electrowinning and electrorefining conducted as part of nonferrous metal smelting and refining (40 CFR Part 421)
- Electrodeposition of active electrode materials, electroimpregnation, and electroforming conducted as part of battery manufacturing (40 CFR Part 461)

- Metal surface preparation and conversion coating conducted as part of coil coating (40 CFR Part 465)
- Metal surface preparation and immersion plating or electroless plating conducted as a part of porcelain enameling (40 CFR Part 466)
- Metallic platemaking and gravure cylinder preparation conducted within printing and publishing facilities
- Surface treatment including anodizing and conversion coating conducted as part of aluminum forming (40 CFR Part 467).

Clean Air Act (CAA)

The following standards and requirements promulgated under the CAA apply to metal finishing processes:

- National Emission Standards for Chromium Emissions From Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks (40 CFR Parts 9 and 63, Subpart N, 60 FR 498, January 1995)
- Standards of Performance for Surface Coating of Metal Furniture (40 CFR Part 60, Subpart EE)
- Standards of Performance for Automobile and Light-Duty Truck Surface Coating Operations (40 CFR Part 60, Subpart MM)
- Standards of Performance for Industrial Surface Coatings: Large Appliances (40 CFR Part 60, Subpart SS)
- Standards of Performance for Metal Coil Surface Coating (40 CFR Part 60, Subpart TT)
- Standards of Performance for the Beverage Can Surface Coating Industry (40 CFR Part 60, Subpart WW)
- Standards of Performance for Industrial Surface Coating: Surface Coating of Plastic Parts for Business Machines (40 CFR Part 60, Subpart TTT).

These standards and requirements, although to varying degrees, regulate the discharge of volatile organic chemicals (VOCs).

Resource Conservation and Recovery Act (RCRA)

The greatest quantities of RCRA listed waste and characteristic hazardous waste present in the fabricated metal products industry are identified in Exhibit 33. For more information on RCRA hazardous waste, refer to 40 CFR Part 261.

**Exhibit 33**
**Hazardous Wastes Relevant to the Metal Finishing Industry**

| EPA Hazardous Waste No. | Hazardous Waste |
|---|---|
| D006 (cadmium)<br>D007 (chromium)<br>D008 (lead)<br>D009 (mercury)<br>D010 (selenium)<br>D011 (silver) | Wastes which are hazardous due to the characteristic of toxicity for each of the constituents. |
| F001 | Halogenated solvents used in degreasing: tetrachloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of 10 percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. |
| F002 | Spent halogenated solvents; tetrachloroethylene, methylene chloride, trichlorethylene, 1,1,1-trichloroethane chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, one or more of the above halogenated solvents or those listed in F001, F004, F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. |
| F003 | Spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of 10 percent or more (by volume) of one of those solvents listed in F001, F002, F004, F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. |
| F004 | Spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. |

| | |
|---|---|
| F005 | Spent non-halogenated solvents: toluene, methy ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvents mixtures. |
| F006 | Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc, and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum. |
| F007 | Spent cyanide plating bath solutions from electroplating operations. |
| F008 | Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process. |

**Exhibit 33**
**Hazardous Wastes Relevant to the Metal Finishing Industry**

| EPA Hazardous Waste No. | Hazardous Waste |
|---|---|
| F009 | Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process. |
| F010 | Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process. |
| F011 | Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations. |
| F012 | Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process. |
| F019 | Wastewater treatment sludges from the chemical conversion coating of aluminum from zirconium phosphating is an exclusive conversion coating process. |
| K090 | Emission control dust or sludge from ferrochromiumsilicon production (ferroalloy industry). |
| K091 | Emission control dust or sludge from ferrochromium production (ferroalloy industry). |

*Source: Sustainable Industry: Promoting Strategic Environmental Protection in the Industrial Sector, Phase 1 Report, U.S. EPA, OERR, June 1994.*

## VI.C. Pending and Proposed Regulatory Requirements

Clean Water Act (CWA)

The effluent guidelines and standards for Electroplaters (40 CFR Part 413) and Metal Finishers (40 CFR Part 433) are currently under review. EPA is also currently developing effluent guidelines and standards for the metal products and machinery industry (40 CFR Part 438), which are due by May 1996. It appears that EPA will integrate new regulatory options for the metal finishing industry into this new guideline. Under the anticipated scenario, effluent guidelines for electroplaters and metal finishers would most likely reference appropriate sections of the guideline for the metal products and machinery industry. In is unclear, however, how "job shop" operations, which are not part of the metal products and machinery industry, would be covered under this scenario.

For Phase I of the regulation, EPA will propose effluent limitation guidelines for facilities that generate wastewater while processing metal parts, metal products, and machinery, including: manufacture, assembly, rebuilding, repair, and maintenance. The Phase I regulation will cover seven major industrial groups, including: aircraft, aerospace, hardware (including machine tools, screw machines, metal

forgings and stampings, metal springs, heating equipment, and fabricated structural metal, ordinance, stationary industrial equipment (including electrical equipment), mobile industrial equipment, and electronic equipment (including communication equipment). The legal deadline is May 1996.

Phase II, EPA will propose effluent limitation guidelines for facilities that generate wastewater while processing metal parts, metal products and machinery, including: manufacture, assembly, rebuilding, repair, and maintenance. The Phase II regulation will cover eight major industrial groups, including: motor vehicles, buses and trucks, household equipment, business equipment, instruments, precious and nonprecious metals, shipbuilding, and railroads. The legal deadline is December 31, 1997.

Clean Air Act (CAA)

In addition to the CAA requirements discussed above, EPA is currently working on several regulations that will directly affect the metal finishing industry. Many proposed standards will limit the air emissions from various industries by proposing Maximum Achievable Control Technology (MACT) based performance standards that will set limits on emissions based upon concentrations in the waste stream. Various potential standards are described below.

*Organic Solvent Degreasing/Cleaning*

EPA proposed a NESHAP (58 FR 62566, November 19, 1993) for the source category of halogenated solvent degreasing/cleaning that will directly affect the metal finishing industry. This will apply to new and existing organic halogenated solvent emissions to a MACT-equivalent level, and will apply to new and existing organic halogenated solvent cleaners (degreasers) using any of the HAPs listed in the CAA Amendments. EPA is specifically targeting vapor degreasers that use the following HAPs: methylene chloride, perchloroethylene, trichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, and chloroform.

This NESHAP proposes to implement a MACT-based equipment and work practice compliance standard. This would require that a facility use a designated type of pollution prevention technology along with proper operating procedures. However, EPA has also provided an alternative compliance standard. Existing operations, which utilize performance-based standards, can continue to do so if such standards

can be shown to achieve the same emission limit as the equipment and work practice compliance standard.

*Steel Pickling, HCl*

Hydrochloric acid (HCl) and chlorine are among the pollutants listed as hazardous air pollutants in Section 112 of the Clean Air Act Amendments of 1990. Steel pickling processes that use HCl solution and HCl regeneration processes have been identified by the EPA as potentially significant sources of HCl and chlorine air emissions and, as such, a source category for which national emission standards may be warranted. EPA is required to promulgate national emission standards for 50 percent of the source categories listed in Section 112(e) by November 15, 1997.

*Other Future Regulatory Actions*

EPA is developing MACT standards for several industries, including: miscellaneous metal parts and products (surface coating), asphalt/coal tar application-metal pipes, metal can (surface coating), metal coil (surface coating), and metal furniture (surface coating). The legal deadline for these rulemakings is November 15, 2000.

## VII. COMPLIANCE AND ENFORCEMENT PROFILE

*Background*

To date, EPA has focused much of its attention on measuring compliance with specific environmental statutes. This approach allows the Agency to track compliance with the Clean Air Act, the Resource Conservation and Recovery Act, the Clean Water Act, and other environmental statutes. Within the last several years, the Agency has begun to supplement single-media compliance indicators with facility-specific, multimedia indicators of compliance. In doing so, EPA is in a better position to track compliance with all statutes at the facility level, and within specific industrial sectors.

A major step in building the capacity to compile multimedia data for industrial sectors was the creation of EPA's Integrated Data for Enforcement Analysis (IDEA) system. IDEA has the capacity to "read into" the Agency's single-media databases, extract compliance records, and match the records to individual facilities. The IDEA system can match Air, Water, Waste, Toxics/Pesticides/EPCRA, TRI, and Enforcement Docket records for a given facility, and generate a list of historical permit, inspection, and enforcement activity. IDEA also has the capability to analyze data by geographic area and corporate holder. As the capacity to generate multimedia compliance data improves, EPA will make available more in-depth compliance and enforcement information. Additionally, sector-specific measures of success for compliance assistance efforts are under development.

*Compliance and Enforcement Profile Description*

Using inspection, violation, and enforcement data from the IDEA system, this section provides information regarding the historical compliance and enforcement activity of this sector. In order to mirror the facility universe reported in the Toxic Chemical Profile, the data reported within this section consists of records only from the TRI reporting universe. With this decision, the selection criteria are consistent across sectors with certain exceptions. For the sectors that do not normally report to the TRI program, data have been provided from EPA's Facility Indexing System (FINDS) which tracks facilities in all media databases. Please note, in this section, EPA does not attempt to define the actual number of facilities that fall within each sector. Instead, the section portrays the records of a subset of facilities within the sector that are well defined within EPA databases.

As a check on the relative size of the full sector universe, most notebooks contain an estimated number of facilities within the sector according to the Bureau of Census (See Section II). With sectors dominated by small businesses, such as metal finishers and printers, the reporting universe within the EPA databases may be small in comparison to Census data. However, the group selected for inclusion in this data analysis section should be consistent with this sector's general make-up.

Following this introduction is a list defining each data column presented within this section. These values represent a retrospective summary of inspections and enforcement actions, and solely reflect EPA, State, and local compliance assurance activities that have been entered into EPA databases. To identify any changes in trends, the EPA ran two data queries, one for the past five calendar years (August 10, 1990 to August 9, 1995) and the other for the most recent twelve-month period (August 10, 1994 to August 9, 1995). The five-year analysis gives an average level of activity for that period for comparison to the more recent activity.

Because most inspections focus on single-media requirements, the data queries presented in this section are taken from single media databases. These databases do not provide data on whether inspections are State/local or EPA-led. However, the table breaking down the universe of violations does give the reader a crude measurement of the EPA's and States' efforts within each media program. The presented data illustrate the variations across regions for certain sectors.[2] This variation may be attributable to State/local data entry variations, specific geographic concentrations, proximity to population centers, sensitive ecosystems, highly toxic chemicals used in production, or historical noncompliance. Hence, the exhibited data do not rank regional performance or necessarily reflect which regions may have the most compliance problems.

[2] EPA Regions include the following States: I (CT, MA, ME, RI, NH, VT); II (NJ, NY, PR, VI); III (DC, DE, MD, PA, VA, WV); IV (AL, FL, GA, KY, MS, NC, SC, TN); V (IL, IN, MI, MN, OH, WI); VI (AR, LA, NM, OK, TX); VII (IA, KS, MO, NE); VIII (CO, MT, ND, SD, UT, WY); IX (AZ, CA, HI, NV, Pacific Trust Territories); X (AK, ID, OR, WA).

## Compliance and Enforcement Data Definitions

*General Definitions*

**Facilities Indexing System (FINDS)** --- this system assigns a common facility number to EPA single-media permit records. The FINDS identification number allows EPA to compile and review all permit, compliance, enforcement, and pollutant release data for any given regulated facility.

**Integrated Data for Enforcement Analysis (IDEA)** -- is a data integration system that can retrieve information from the major EPA program office databases. IDEA uses the FINDS identification number to "glue together" separate data records from EPA's databases. This is done to create a "master list" of data records for any given facility. Some of the data systems accessible through IDEA are: AIRS (Air Facility Indexing and Retrieval System, Office of Air and Radiation), PCS (Permit Compliance System, Office of Water), RCRIS (Resource Conservation and Recovery Information System, Office of Solid Waste), NCDB (National Compliance Data Base, Office of Prevention, Pesticides, and Toxic Substances), CERCLIS (Comprehensive Environmental and Liability Information System, Superfund), and TRIS (Toxic Release Inventory System). IDEA also contains information from outside sources such as Dun and Bradstreet and the Occupational Safety and Health Administration (OSHA). Most data queries displayed in notebook Sections IV and VII were conducted using IDEA.

*Data Table Column Heading Definitions*

**Facilities in Search** -- are based on the universe of TRI reporters within the listed SIC code range. For industries not covered under TRI reporting requirements, the notebook uses the FINDS universe for executing data queries. The SIC code range selected for each search is defined by each notebook's selected SIC code coverage described in Section II.

**Facilities Inspected** --- indicates the level of EPA and State agency facility inspections for the facilities in this data search. These values show what percentage of the facility universe is inspected in a 12 or 60 month period. This column does not count non-inspectional compliance activities such as the review of facility-reported discharge reports.

**Number of Inspections** -- measures the total number of inspections conducted in this sector. An inspection event is counted each time it is entered into a single media database.

**Average Time Between Inspections** -- provides an average length of time, expressed in months, that a compliance inspection occurs at a facility within the defined universe.

**Facilities with One or More Enforcement Actions** -- expresses the number of facilities that were party to at least one enforcement action within the defined time period. This category is broken down further into Federal and State actions. Data are obtained for administrative, civil/judicial, and criminal enforcement actions. Administrative actions include Notices of Violation (NOVs). A facility with multiple enforcement actions is only counted once in this column (facility with 3 enforcement actions counts as 1). All percentages that appear are referenced to the number of facilities inspected.

**Total Enforcement Actions** -- describes the total number of enforcement actions identified for an industrial sector across all environmental statutes. A facility with multiple enforcement actions is counted multiple times (a facility with 3 enforcement actions counts as 3).

**State Lead Actions** -- shows what percentage of the total enforcement actions are taken by State and local environmental agencies. Varying levels of use by States of EPA data systems may limit the volume of actions accorded State enforcement activity. Some States extensively report enforcement activities into EPA data systems, while other States may use their own data systems.

**Federal Lead Actions** -- shows what percentage of the total enforcement actions are taken by the U.S. EPA. This value includes referrals from State agencies. Many of these actions result from coordinated or joint State/Federal efforts.

**Enforcement to Inspection Rate** -- expresses how often enforcement actions result from inspections. This value is a ratio of enforcement actions to inspections, and is presented for comparative purposes only. This measure is a rough indicator of the relationship between inspections and enforcement. This measure simply indicates historically how many enforcement actions can be attributed to inspection activity. Related inspections and enforcement actions under the Clean Water Act (PCS), the Clean Air Act (AFS) and the

Resource Conservation and Recovery Act (RCRA) are included in this ratio. Inspections and actions from the TSCA/FIFRA/EPCRA database are not factored into this ratio because most of the actions taken under these programs are not the result of facility inspections. This ratio does not account for enforcement actions arising from non-inspection compliance monitoring activities (e.g., self-reported water discharges) that can result in enforcement action within the CAA, CWA and RCRA.

**Facilities with One or More Violations Identified** -- indicates the number and percentage of inspected facilities having a violation identified in one of the following data categories: In Violation or Significant Violation Status (CAA); Reportable Noncompliance, Current Year Noncompliance, Significant Noncompliance (CWA); Noncompliance and Significant Noncompliance (FIFRA, TSCA, and EPCRA); Unresolved Violation and Unresolved High Priority Violation (RCRA). The values presented for this column reflect the extent of noncompliance within the measured time frame, but do not distinguish between the severity of the noncompliance. Percentages within this column can exceed 100 percent because facilities can be in violation status without being inspected. Violation status may be a precursor to an enforcement action, but does not necessarily indicate that an enforcement action will occur.

**Media Breakdown of Enforcement Actions and Inspections** -- four columns identify the proportion of total inspections and enforcement actions within EPA Air, Water, Waste, and TSCA/FIFRA/EPCRA databases. Each column is a percentage of either the "Total Inspections," or the "Total Actions" column.

## VII.A. Fabricated Metal Products Industry Compliance History

Exhibit 34 presents enforcement and compliance information specific to the fabricated metal products industry. As indicated in this exhibit, Regions IV, V, and IX conduct the largest number of inspections in this industry. This is consistent with the fact that the fabricated metal products industry is geographically concentrated near industrial areas. The data also indicates that nearly all of Region IV's enforcement actions are State-lead.

## VII.B. Comparison of Enforcement Activity Between Selected Industries

Exhibits 35 - 38 provide enforcement and compliance information for selected industries. The fabricated metal products industry comprises the largest number of facilities tracked by EPA across the selected industries. Likewise, it has the largest number of inspections and enforcement actions. For this industry, RCRA inspections comprise over half of all inspections conducted, while CWA inspections account for 15 percent of these inspections. The low CWA inspection rate is in conflict with the large number of water discharges that are generated by this industry.

# Exhibit 34
# Fab. Metal Product-Specific
## Five Year Enforcement and Compliance Summary for the Fabricated Metal Industry

| A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| Fabricated Metal SIC 34 | Facilities in Search | Facilities Inspected | Number of Inspections | Average Number of Months Between Inspections | Facilities w/one or more Enforcement Actions | Total Enforcement Actions | State Lead Actions | Federal Lead Actions | Enforcement to Inspection Rate |
| Region I | 199 | 139 | 585 | 20 | 40 | 99 | 66% | 34% | 0.17 |
| Region II | 171 | 127 | 515 | 20 | 39 | 139 | 78% | 22% | 0.27 |
| Region III | 186 | 130 | 626 | 18 | 43 | 156 | 86% | 14% | 0.25 |
| Region IV | 320 | 220 | 1480 | 13 | 48 | 178 | 94% | 6% | 0.12 |
| Region V | 880 | 466 | 1549 | 34 | 54 | 128 | 75% | 25% | 0.08 |
| Region VI | 171 | 85 | 268 | 38 | 17 | 54 | 89% | 11% | 0.20 |
| Region VII | 109 | 71 | 238 | 27 | 13 | 31 | 71% | 29% | 0.13 |
| Region VIII | 36 | 14 | 50 | 43 | 7 | 8 | 38% | 63% | 0.16 |
| Region IX | 228 | 65 | 125 | 109 | 7 | 20 | 65% | 35% | 0.16 |
| Region X | 46 | 23 | 73 | 38 | 12 | 27 | 63% | 37% | 0.37 |
| | | | | | | | | | |
| Total/Average | 2,346 | 1,340 | 5,509 | 26 | 280 | 840 | 80% | 20% | 0.15 |
| | | | | | | | | | |

## Exhibits 35
## Five Year Enforcement and Compliance Summary for Selected Industries

| A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| Industry Sector | Facilities in Search | Facilities Inspected | Number of Inspections | Average Number of Months Between Inspections | Facilities w/One or More Enforcement Actions | Total Enforcement Actions | State Lead Actions | Federal Lead Actions | Enforcement to Inspection Rate |
| Metal Mining | 873 | 339 | 1,519 | 34 | 67 | 155 | 47% | 53% | 0.10 |
| Non-metallic Mineral Mining | 1,143 | 631 | 3,422 | 20 | 84 | 192 | 76% | 24% | 0.06 |
| Lumber and Wood | 464 | 301 | 1,891 | 15 | 78 | 232 | 79% | 21% | 0.12 |
| Furniture | 293 | 213 | 1,534 | 11 | 34 | 91 | 91% | 9% | 0.06 |
| Rubber and Plastic | 1,665 | 739 | 3,386 | 30 | 146 | 391 | 78% | 22% | 0.12 |
| Stone, Clay, and Glass | 468 | 268 | 2,475 | 11 | 73 | 301 | 70% | 30% | 0.12 |
| Nonferrous Metals | 844 | 474 | 3,097 | 16 | 145 | 470 | 76% | 24% | 0.15 |
| Fabricated Metal | 2,346 | 1,340 | 5,509 | 26 | 280 | 840 | 80% | 20% | 0.15 |
| Electronics/Computers | 405 | 222 | 777 | 31 | 68 | 212 | 79% | 21% | 0.27 |
| Motor Vehicle Assembly | 598 | 390 | 2,216 | 16 | 81 | 240 | 80% | 20% | 0.11 |
| Pulp and Paper | 306 | 265 | 3,766 | 5 | 115 | 502 | 78% | 22% | 0.13 |
| Printing | 4,106 | 1,035 | 4,723 | 52 | 176 | 514 | 85% | 15% | 0.11 |
| Inorganic Chemicals | 548 | 298 | 3,034 | 11 | 99 | 402 | 76% | 24% | 0.13 |
| Organic Chemicals | 412 | 316 | 3,864 | 6 | 152 | 726 | 66% | 34% | 0.19 |
| Petroleum Refining | 156 | 145 | 3,257 | 3 | 110 | 797 | 66% | 34% | 0.25 |
| Iron and Steel | 374 | 275 | 3,555 | 6 | 115 | 499 | 72% | 28% | 0.14 |
| Dry Cleaning | 933 | 245 | 633 | 88 | 29 | 103 | 99% | 1% | 0.16 |
| | | | | | | | | | |

## Exhibits 36
## One Year Enforcement and Compliance Summary for Selected Industries

| A | B | C | D | E | | F | | G | H |
|---|---|---|---|---|---|---|---|---|---|
| Industry Sector | Facilities in Search | Facilities Inspected | Number of Inspections | Facilities w/One or More Violations | | Facilities w/One or More Enforcement Actions | | Total Enforcement Actions | Enforcement to Inspection Rate |
| | | | | Number | Percent* | Number | Percent* | | |
| Metal Mining | 873 | 114 | 194 | 82 | 72% | 16 | 14% | 24 | 0.13 |
| Non-metallic Mineral Mining | 1,143 | 253 | 425 | 75 | 30% | 28 | 11% | 54 | 0.13 |
| Lumber and Wood | 464 | 142 | 268 | 109 | 77% | 18 | 13% | 42 | 0.58 |
| Furniture | 293 | 160 | 113 | 66 | 41% | 3 | 2% | 5 | 0.55 |
| Rubber and Plastic | 1,665 | 271 | 435 | 289 | 107% | 19 | 7% | 59 | 0.14 |
| Stone, Clay, and Glass | 468 | 146 | 330 | 116 | 79% | 20 | 14% | 66 | 0.20 |
| Nonferrous Metals | 844 | 202 | 402 | 282 | 140% | 22 | 11% | 72 | 0.18 |
| Fabricated Metal | 2,346 | 477 | 746 | 525 | 110% | 46 | 10% | 114 | 0.15 |
| Electronics/Computers | 405 | 60 | 87 | 80 | 133% | 8 | 13% | 21 | 0.24 |
| Motor Vehicle Assembly | 598 | 169 | 284 | 162 | 96% | 14 | 8% | 28 | 0.10 |
| Pulp and Paper | 306 | 189 | 576 | 162 | 86% | 28 | 15% | 88 | 0.15 |
| Printing | 4,106 | 397 | 676 | 251 | 63% | 25 | 6% | 72 | 0.11 |
| Inorganic Chemicals | 548 | 158 | 427 | 167 | 106% | 19 | 12% | 49 | 0.12 |
| Organic Chemicals | 412 | 195 | 545 | 197 | 101% | 39 | 20% | 118 | 0.22 |
| Petroleum Refining | 156 | 109 | 437 | 109 | 100% | 39 | 36% | 114 | 0.26 |
| Iron and Steel | 374 | 167 | 488 | 165 | 99% | 20 | 12% | 46 | 0.09 |
| Dry Cleaning | 933 | 80 | 111 | 21 | 26% | 5 | 6% | 11 | 0.10 |

*Percentages in Columns E and F are based on the number of facilities inspected (Column C). Percentages can exceed 100% because violations and actions can occur without a facility inspection.

## Exhibits 37
## Five Year Inspection and Enforcement Summary by Statute for Selected Industries

| Industry Sector | Number of Facilities Inspected | Total Inspections | Enforcement Actions | Clean Air Act | | Clean Water Act | | Resource Conservation and Recovery Act | | FIFRA/TSCA/ EPCRA/Other* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | % of Total Inspections | % of Total Actions | % of Total Inspections | % of Total Actions | % of Total Inspections | % of Total Actions | % of Total Inspections | % of Total Actions |
| Metal Mining | 339 | 1,519 | 155 | 35% | 17% | 57% | 60% | 6% | 14% | 1% | 9% |
| Non-metallic Mineral Mining | 631 | 3,422 | 192 | 65% | 46% | 31% | 24% | 3% | 27% | <1% | 4% |
| Lumber and Wood | 301 | 1,891 | 232 | 31% | 21% | 8% | 7% | 59% | 67% | 2% | 5% |
| Furniture | 293 | 1,534 | 91 | 52% | 27% | 1% | 1% | 45% | 64% | 1% | 8% |
| Rubber and Plastic | 739 | 3,386 | 391 | 39% | 15% | 13% | 7% | 44% | 68% | 3% | 10% |
| Stone, Clay and Glass | 268 | 2,475 | 301 | 45% | 39% | 15% | 5% | 39% | 51% | 2% | 5% |
| Nonferrous Metals | 474 | 3,097 | 470 | 36% | 22% | 22% | 13% | 38% | 54% | 4% | 10% |
| Fabricated Metal | 1,340 | 5,509 | 840 | 25% | 11% | 15% | 6% | 56% | 76% | 4% | 7% |
| Electronics/ Computers | 222 | 777 | 212 | 16% | 2% | 14% | 3% | 66% | 90% | 3% | 5% |
| Motor Vehicle Assembly | 390 | 2,216 | 240 | 35% | 15% | 9% | 4% | 54% | 75% | 2% | 6% |
| Pulp and Paper | 265 | 3,766 | 502 | 51% | 48% | 38% | 30% | 9% | 18% | 2% | 3% |
| Printing | 1,035 | 4,723 | 514 | 49% | 31% | 6% | 3% | 43% | 62% | 2% | 4% |
| Inorganic Chemicals | 302 | 3,034 | 402 | 29% | 26% | 29% | 17% | 39% | 53% | 3% | 4% |
| Organic Chemicals | 316 | 3,864 | 726 | 33% | 30% | 16% | 21% | 46% | 44% | 5% | 5% |
| Petroleum Refining | 145 | 3,237 | 797 | 44% | 32% | 19% | 12% | 35% | 52% | 2% | 5% |
| Iron and Steel | 275 | 3,555 | 499 | 32% | 20% | 30% | 18% | 37% | 58% | 2% | 5% |
| Dry Cleaning | 245 | 633 | 103 | 15% | 1% | 3% | 4% | 83% | 93% | <1% | 1% |

* Actions taken to enforce the Federal Insecticide, Fungicide, and Rodenticide Act; the Toxic Substances and Control Act, and the Emergency Planning and Community Right-to-Know Act as well as other Federal environmental laws.

## Exhibits 38
## One Year Inspection and Enforcement Summary by Statute for Selected Industries

| Industry Sector | Number of Facilities Inspected | Total Inspections | Enforcement Actions | Clean Air Act | | Clean Water Act | | Resource Conservation and Recovery Act | | FIFRA/TSCA/ EPCRA/Other | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | % of Total Inspections | % of Total Actions | % of Total Inspections | % of Total Actions | % of Total Inspections | % of Total Actions | % of Total Inspections | % of Total Actions |
| Metal Mining | 114 | 194 | 24 | 47% | 42% | 43% | 34% | 10% | 6% | <1% | 19% |
| Non-metallic Mineral Mining | 253 | 425 | 54 | 69% | 58% | 26% | 16% | 5% | 16% | <1% | 11% |
| Lumber and Wood | 142 | 268 | 42 | 29% | 20% | 8% | 13% | 63% | 61% | <1% | 6% |
| Furniture | 293 | 160 | 5 | 58% | 67% | 1% | 10% | 41% | 10% | <1% | 13% |
| Rubber and Plastic | 271 | 435 | 59 | 39% | 14% | 14% | 4% | 46% | 71% | 1% | 11% |
| Stone, Clay, and Glass | 146 | 330 | 66 | 45% | 52% | 18% | 8% | 38% | 37% | <1% | 3% |
| Nonferrous Metals | 202 | 402 | 72 | 33% | 24% | 21% | 3% | 44% | 69% | 1% | 4% |
| Fabricated Metal | 477 | 746 | 114 | 25% | 14% | 14% | 8% | 61% | 77% | <1% | 2% |
| Electronics/ Computers | 60 | 87 | 21 | 17% | 2% | 14% | 7% | 69% | 87% | <1% | 4% |
| Motor Vehicle Assembly | 169 | 284 | 28 | 34% | 16% | 10% | 9% | 56% | 69% | 1% | 6% |
| Pulp and Paper | 189 | 576 | 88 | 56% | 69% | 35% | 21% | 10% | 7% | <1% | 3% |
| Printing | 397 | 676 | 72 | 50% | 27% | 5% | 3% | 44% | 66% | <1% | 4% |
| Inorganic Chemicals | 158 | 427 | 49 | 26% | 38% | 29% | 21% | 45% | 36% | <1% | 6% |
| Organic Chemicals | 195 | 545 | 118 | 36% | 34% | 13% | 16% | 50% | 49% | 1% | 1% |
| Petroleum Refining | 109 | 439 | 114 | 50% | 31% | 19% | 16% | 30% | 47% | 1% | 6% |
| Iron and Steel | 167 | 488 | 46 | 29% | 18% | 35% | 26% | 36% | 50% | <1% | 6% |
| Dry Cleaning | 80 | 111 | 11 | 21% | 4% | 1% | 22% | 78% | 67% | <1% | 7% |

* Actions taken to enforce the Federal Insecticide, Fungicide, and Rodenticide Act; the Toxic Substances and Control Act, and the Emergency Planning and Community Right-to-Know Act as well as other Federal environmental laws.

## VII.C. Review of Major Legal Actions

### VII.C.1 Review of Major Cases

This section provides summary information about major cases that have affected this sector. As indicated in EPA's *Enforcement Accomplishments Report, FY 1991, FY 1992, FY 1993* publications, 15 significant enforcement actions were resolved between 1991 and 1993 for the metal finishing industry. CWA violations comprised eight of these actions, the most of any statute. Following CWA violations were five actions involving RCRA violations, three involving CERCLA violations, one with a CAA violation, and one with a SDWA violation. The companies against which the cases were brought are primarily metal finishers, including those that provide electroplating, coating, and plating services. Two of the companies perform metal forming and fabrication functions.

Twelve of the fifteen cases resulted in the assessment of a penalty. Penalties ranged from $15,000 to $500,000, and in four cases, additional money was spent by the defendant to improve the processes or technologies and to increase future compliance. For example, in U.S. v. North American Philips Corp. (1992), the company paid a $500,000 penalty and spent approximately $583,000 to eliminate wastewater discharges from some of its non-federally regulated processes. The average penalty per case was approximately $322,000. Supplemental Environmental Projects (SEPs) were required in two of the cases. Texas Instruments, Inc. (1993), for example, was required to pay a penalty and replace a vapor degreaser unit with a more environmentally-protective unit.

Although many cases involved civil penalties, four of the cases involved criminal convictions, resulting in penalties and/or jail sentences for the owners and/or operators of the facilities. For example, the case of U.S. v. John Borowski and Borjohn Optical Technology, Inc., resulted in the first criminal endangerment conviction under CWA; the company president was sentenced to 26 months in prison, folloshwed by two years of supervised release.

## VII.C.2 Supplemental Environmental Projects

Supplementary Environmental Projects (SEPs) are compliance agreements that reduce a facility's stipulated penalty in return for an environmental project that exceeds the value of the reduction. Often, these projects fund pollution prevention activities that can significantly reduce the future pollutant loadings of a facility.

In December, 1993, the Regions were asked by EPA's Office of Enforcement and Compliance Assurance to provide information on the number and type of SEPs entered into by the Regions. The following exhibit contains a representative sample of the Regional responses addressing the fabricated metal products industry. The information contained in the exhibit is not comprehensive and provides only a sample of the types of SEPs developed for the fabricated metal products industry. Please note that the projects describes in this section do not necessarily apply to all facilities in this sector. Facility-specific conditions must be considered carefully when evaluating potential supplemental environmental projects.

# Exhibit 39
# Supplemental Environmental Projects
# Fabrication of Metal Products (SIC 34)

| Case Name | EPA Region | Statute/ Type of Action | Type of SEP | Estimated Cost to Company | Expected Environmental Benefits | Final Assessed Penalty | Final Penalty After Mitigation |
|---|---|---|---|---|---|---|---|
| Truex, Inc. Pawtucket, RI (metal parts manufacturing) | 1 | EPCRA | Pollution Reduction | $ 70,000 | Install and operate a cooling water and process rinse recycling system and a metal recovery system to reduce the water used and to recover copper and zinc process waste for recycling. | $ 54,000 | $ 29,000 |
| Walton & Lonsbury Attleboro, MA (electroplating facility) | 1 | RCRA | Pollution Prevention and Pollution Reduction | $ 18,270 | Implement a system to reclaim and reuse chromic acid rinse waters. Eliminate the use of trichloroethane in the degreasing operation. Install a filtration system which will extend the life of the hydrochloric acid strip solution. | $ 15,100 | $ 15,100 |
| Verilyte Gold, Inc. Chelsea, MA (electroplatting facility) | 1 | RCRA | Pollution Prevention | $ 21,450 | Install a hot-air metal parts drying unit which eliminates 100 percent of the use of freon. | $ 26,400 | $ 15,675 |
| The Torrington Company (precision bearings, assemblies, gears, and couplings manufacture) | 1 | EPCRA | Equipment Donation | $ 16,792 | Donate emergency and/or computer equipment to the Local Emergency Planning Committee (LEPC) to respond to and/or plan for chemical emergencies. Participate in LEPC activities. | $ 35,364 | $ 18,572 |
| Texas Instruments, Inc. Attleboro, MA (metallurgic materials manufacture) | 1 | EPCRA | Equipment Donation | $ 8,063 | Purchase computer hardware and software for the LEPC and Attleboro Fire Department (AFD) to assist the LEPC in tracking and storing information about identity and location of hazardous chemicals and to assist the AFD in responding to accidental releases. | $ 14,025 | $ 5,962 |

# Exhibit 39
# Supplemental Environmental Projects
# Fabrication of Metal Products (SIC 34)

| Case Name | EPA Region | Statute/ Type of Action | Type of SEP | Estimated Cost to Company | Expected Environmental Benefits | Final Assessed Penalty | Final Penalty After Mitigation |
|---|---|---|---|---|---|---|---|
| Texas Instruments, Inc. Attleboro, MA (metal finishing) | 1 | CAA | Pollution Prevention | $ 170,000 | Replace the current vapor degreasor unit with a closed-loop degreaser unit to prevent the use of Freon 113. | $ 90,000 | $ 49,900 |
| L.S. Starrlett Company, Inc. Athol, MA (tool manufacture) | 1 | EPCRA | Pollution Prevention | $ 290,000 | Install three alkaline-based aqueous agitation wash systems, replace Freon cleaning units in two departments, and a methylene chloride cleaning unit in a third department to reduce Freon and methylene chloride by 100 percent. | $ 176,800 | $ 83,200 |
| Teradyne, Inc Nashua, NH (soldering products manufacture) | 1 | RCRA | Pollution Prevention | $ 800,000 | Purchase and install solvent replacement units for two facilities. Stop using Freon 113 in manufacturing operations at one facility and stop using 1,1,1-trichloroethane (except in water sensitive assemblies) at another facility. | $ 120,000 | $ 50,000 |
| M.W. Dunton Company West Warwick, RI (soldering products manufacture) | 1 | EPCRA | SERC/LERC | $ 4,754 | Donate emergency response equipment to the volunteer fire department to assist the LEPC in tracking and storing information about identity and location of hazardous chemicals and to assist the fire department in responding to accidental releases. | $ 9,500 | $ 4,745 |

# Exhibit 39
# Supplemental Environmental Projects
# Fabrication of Metal Products (SIC 34)

| Case Name | EPA Region | Statute/ Type of Action | Type of SEP | Estimated Cost to Company | Expected Environmental Benefits | Final Assessed Penalty | Final Penalty After Mitigation |
|---|---|---|---|---|---|---|---|
| The Drawn Metal Tube Company Thomaston, CT | 1 | CWA | Pollution Prevention | $ 145,000 | Install a closed loop evaporator system to eliminate the discharge of copper forming wastewater to the river. | $ 77,624 | $ 45,000 |
| Pioneer Metal Finishing | 2 | EPCRA | Pollution Prevention | $ 13,128 | Pretreat used nickel bags and used filter bags from nickel filters to recover waste nickel, thus minimizing the disposal of hazardous nickel waste. | | $ 5,000 |
| Elken Metals Company Alloy, WV | 3 | xxxx | Pollution Reduction | $ 449,000 | Remove PCB transforers, PCB capapcitors, and retrofilling PCB-contaminated transformers to reduce the amount of PCBs which may be released. | $ 280,000 | $ 17,250 |
| Southern Foundry Supply | 4 | EPCRA | Pollution Reduction | $ 34,000 | Assess the feasibility of a process to recover pure nickel from plant wastestreams and construct a pilot plant to perform the recovery to reduce the quantity of heavy metals entering the environment. | $ 15,840 | $ 2,376 |
| Cerro Metal Products, Inc. Bellefonte, PA | 3 | TSCA | Accelerated Compliance | $ 40,000 | Replace PCB transformers fluid with non-PCB fluid to eliminate the potential for uncontrolled releases of PCBs. | $ 31,700 | $ 18,450 |

## VIII. COMPLIANCE ACTIVITIES AND INITIATIVES

This section highlights the activities undertaken by this industry sector and public agencies to voluntarily improve the sector's environmental performance. These activities include those independently initiated by industrial trade associations. In this section, the notebook also contains a listing and description of national and regional trade associations.

### VIII.A. Sector-Related Environmental Programs and Activities

Numerous compliance activities and initiatives are occurring throughout the fabricated metal products industry. Many companies are conducting private research on developing new alloys and experimenting with the use of citric acid oils or terpenes instead of the more toxic degreasers (e.g., 1,1,1-trichloroethane).

Several projects currently underway are sponsored by Federal, State, and county governments; universities; and trade associations. Several of these initiatives are described below.

*Common Sense Initiative*

The Common Sense Initiative (CSI), a partnership between EPA and private industry, aims to create environmental protection strategies that are cleaner for the environment and cheaper for industry and taxpayers. As part of CSI, representatives from Federal, State, and local governments; industry; community-based and national environmental organizations; environmental justice groups; and labor organizations, come together to examine the full range of environmental requirements affecting the following six selected industries: automobile manufacturing; computers and electronics, iron and steel, metal finishing, petroleum refining; and printing.

CSI participants are looking for solutions that:

- Focus on the industry as a whole rather than one pollutant
- Seek consensus-based solutions
- Focus on pollution prevention rather than end-of-pipe controls
- Are industry-specific.

The Common Sense Initiative Council (CSIC), chaired by EPA Administrator Browner, consists of a parent council and six subcommittees (one per industry sector). Each of the subcommittees have met and identified issues and project areas for emphasis, and workgroups have been established to analyze and make recommendation on these issues. (Contact: Greg Waldrip at (202) 564-7024)

*Design for the Environment (DfE)*

DfE is an EPA program operated by the Office of Pollution Prevention and Toxics. DfE is a voluntary program which promotes the use of safer chemicals, processes, and technologies in the earliest product design stages. The DfE program assists industry in making informed, environmentally responsible design choices by providing standardized analytical tools for industry application and providing information on the comparative environmental and human health risk, cost, and performance of chemicals, processes, and technologies. DfE also helps small businesses by analyzing pollution prevention alternatives and disseminating the information to industry and the public. By helping to translate pollution prevention into meaningful terms, DfE contributes to building the institutional structure in corporations to support pollution prevention. DfE activities fall into two broad categories: (1) the industry-specific projects which encourage businesses to incorporate pollution prevention into their designs; and (2) long-term projects that translate pollution prevention into terms that make sense to professions such as chemistry, chemical engineering, marketing, accounting, and insurance.

One DfE effort (in partnership with the Manufacturing Extension Partnership) is the development of a benchmarking database and accompanying questionnaire to serve as an incentive mechanism for companies. Metal fabricators are encouraged to complete a company-specific questionnaire and return it to the Manufacturing Extension Partnership for analysis. The company will then receive a report comparing its data to that of other companies. Based on the results, companies are encouraged to voluntarily implement mechanisms that will minimize environmental damage resulting from the manufacturing processes. Subjects included in the questionnaire, database, and report range from the use of automation and monitoring technologies to the volumes of wastes generated, treated, and recycled.

*Minnesota Technical Assistance Program (MnTAP)*

In the State of Minnesota, waste reduction is receiving increased attention as an alternative to waste disposal. To help companies reduce waste, Minnesota developed MnTAP, a program that helps facilities identify waste reduction opportunities. MnTAP recognizes that each company's operations are unique and has, therefore, developed a series of checklists to help identify waste reduction possibilities. The checklists are designed to assist each facility evaluate wastestreams and identify waste reduction opportunities. The checklists cover several areas relevant to this profile, including operating procedures, cleaning, machining, plating/metal finishing, coating/painting, and formulating.

To ensure effective use of MnTAP's checklists, staff is available to answer questions over the phone or on-site once checklists have been completed. MnTAP has also gathered vendor and technical information for many of the options listed which may be useful in assessing a facility's waste reduction opportunities. In addition, MnTAP has developed lists of vendors who provide recycling services on a contract basis if it is not feasible to implement the options listed on the checklists. MnTAP staff can be reached at (612) 625-4949.

*Pollution Prevention and Waste Minimization in the Metal Finishing Industry Workshop*

The University of Nebraska-Lincoln sponsored a Pollution Prevention and Waste Minimization in the Metal Finishing Industry workshop in 1993. The workshop was designed for managers and operators of electroplating and galvanizing operations; engineers; environmental consultants; waste management consultants; Federal, State, and local government officials; and individuals responsible for training in the area of metal finishing waste management. Topics covered included:

- Saving money and reducing risk through pollution prevention and waste minimization
- Incorporating pollution prevention into planning electroplating and galvanizing operations
- Conducting waste minimization audits
- Developing and analyzing options for pollution prevention/waste minimization

- Innovative techniques for implementing a pollution prevention/waste minimization program.

For more information concerning this workshop, contact David Montage of the University of Nebraska at W348 Nebraska Hall, Lincoln, NE 68588-0531.

*Pollution Prevention Opportunities Checklists*

The County Sanitation Districts of Los Angeles County developed a detailed pollution prevention opportunities checklist to help companies identify and implement pollution prevention methods where possible. The County Sanitation Districts has identified specific opportunities for the metal fabricators and metal finishing industries.

*Southeast Michigan Initiative (SEMI)*

EPA and the Michigan Department of Natural Resources (MDNR) have launched a geographic initiative in the Southeast Michigan area because of the magnitude of contaminant releases and human population in the area. Eight counties within the Initiative have been identified as having major environmental problems. Several rivers in the area suffer from impaired uses, polluted airsheds, combined sewer overflows, contaminated sediments, and major toxic pollutant releases.

A Steering Committee, composed of senior managers of MDNR and EPA, meet quarterly and are responsible for making decisions concerning the overall direction of the Initiative. There are also four working committees, including: public participation; remedial action plans/sediments; pollution prevention; and compliance and enforcement.

For more information regarding SEMI contact Rufus Anderson, Assistant Deputy Director, MDNR Region 5 at (313) 953-1444 or Mardi Klevs, EPA SEMI Coordinator at (312) 353-5490.

*The Blackstone Project*

The Blackstone Project, a joint initiative by the Massachusetts Department of Environmental Protection (DEP) and the Department of Environmental Management (DEM), is intended to make environmental protection more efficient and less costly to companies. As Doug Fine, the Compliance and Enforcement Coordinator, explains, the Blackstone Project's two goals are to encourage industry

to use less toxic material in manufacturing, and to increase the efficiency of DEP's industrial inspections by conducting one-stop, facility-wide inspections. The project focused first on fabricated metal products facilities near the Blackstone River Valley and later expanded to all types of manufacturers in that region. The State of Massachusetts now conducts facility-wide inspections in a continuous effort to reduce pollution.

*The NCMS/NAMF Pollution Control Assessment Project*

The National Center for Manufacturing Sciences (NCMS) and the National Association of Metal Finishers (NAMF) worked jointly to develop the *Pollution Prevention and Control Technology for Plating Operations* publication which documents pollution prevention techniques and pollution control equipment used in plating operations. To develop this document and the associated database, NCMS and NAMF collected pollution prevention information through surveys, literature searches, and interviews with industry experts. The resulting publication illustrates pollution prevention techniques and equipment used, assesses the effectiveness of these techniques as illustrated by historical data, and indicates the types of facilities in which these techniques were employed.

*The Sustainable Industry Project*

The EPA Office of Policy, Planning, and Evaluation's Sustainable Industry Project represents a new approach to the development of environmental policy for industry. The primary goal of the Sustainable Industry Project is to develop, test, and implement industry-specific policy recommendations that will remove barriers to innovation and promote strategic environmental protection in the selected industries (i.e., photoimaging, metal finishing, and thermoset plastics). To do this, EPA gained a thorough understanding of the relevant characteristics of the industries—the industry-specific economic, institutional, cultural, technical, life-cycle, and regulatory factors that may promote or hinder environmental improvements. Further, EPA identified driving factors and barriers that influence corporate decision-making and environmental performance. Understanding the factors that influence environmental performance in a given industry provides the basis for designing policies that will encourage improved performance. Working with industries, States, non-government organizations (NGOs), and other interested parties, EPA intends to design policies that will protect the environment and human health while fostering competitive and sustainable industries.

*U.S. Bureau of Mines (USBM)*

The U.S. Bureau of Mines has developed a technique to regenerate chromium bearing solutions such as those used in chromate conversion aluminum electroplating. The process is in commercial use and a company is preparing to license the technology to manufacture and market solution treatment equipment. In related work, the Bureau worked with the specialty steel industry to reduce waste generated by pickling operations. Other USBM research includes the dewatering of sludges, extraction of metals from a variety of liquid and solid wastes, recycling of metals, and development of lead-free free-machining copper alloys.

*Wastewater Technology Center*

The Wastewater Technology Center (WTC) is an organization of scientists, chemists, technologists, and support staff dedicated to the research and development of technologies to control industrial and municipal discharges. Conducting bench-scale, pilot plant, and full-scale studies for 25 years, over 100 WTC staff have assisted industry in solving a wide variety of environmental concerns. Recently, WTC has worked closely with the Metal Finishing Task Force, a committee of Federal government, provincial government, and metal finishing industry representatives to develop a pollution prevention guide. The document is designed to assist metal finishers in establishing a pollution prevention planning process. WTC also provides assistance in interpreting and using this guide and facilitates other pollution prevention planning programs that metal finishers have or are anticipating establishing. In addition, to help metal finishers better understand and use the pollution prevention planning, WTC, in conjunction with Sheridan College, has prepared an extensive training course in pollution prevention planning in metal finishing.

*Other Initiatives*

The metal finishers and platers industry is being considered by EPA for several upcoming initiatives. Work has already begun by the NPDES and the RCRA programs. The NPDES Branch began an Industrial User initiative in May 1993 that targeted metal finishers who failed to report their compliance status with categorical pretreatment effluent standards (40 CFR 433). In addition, the RCRA program has an initiative that applies to iron and steel and metal plating/finishing industries. The State of Utah plans to inspect each of the iron and steel and metal plating/finishing industries in the State.

## VIII.B. EPA Voluntary Programs

*33/50 Program*

The "33/50 Program" is EPA's voluntary program to reduce toxic chemical releases and transfers of 17 chemicals from manufacturing facilities. Participating companies pledge to reduce their toxic chemical releases and transfers by 33 percent as of 1992 and by 50 percent as of 1995 from the 1988 baseline year. Certificates of Appreciation have been given to participants who meet their 1992 goals. The list of chemicals includes 17 high-use chemicals reported in the Toxics Release Inventory.

The number of companies that use 33/50 chemicals per industry sector ranged from a low of six in the tobacco industry to a high of 1,803 in the fabricated metal products industry. Of these companies, 187 participate in the 33/50 program. Some 33/50 chemicals that are particularly relevant to this industry include: lead and lead compounds, methyl ethyl ketone, nickel and nickel compounds, tetrachloroethylene, toluene, trichloroethane, trichlorethylene, and xylenes.

Exhibit 40 lists those companies participating in the 33/50 program that reported under SIC code 34 to TRI. Many of the participating companies listed multiple SIC codes (in no particular order), and are therefore likely to conduct operations in addition to Fabricated Metal Products industry. The table shows the number of facilities within each company that are participating in the 33/50 program; each company's total 1993 releases and transfers of 33/50 chemicals; and the percent reduction in these chemicals since 1988.

## Exhibit 40
## 33/50 Program

| Parent Facility name | Parent City | ST | SIC Codes | # of Participating Facilities | 1993 Releases and Transfers (lbs.) | % Reduction 1988 to 1993 |
|---|---|---|---|---|---|---|
| A B Chance Co. | Centralia | MO | 3644, 3613, 3423 | 1 | 59,907 | *** |
| ABC Holdings Inc. | Eufaula | AL | 2851, 3449 | 4 | 55,230 | ** |
| Acme Metals Inc. | Riverdale | IL | 3312, 3499, 3479, 3398 | 5 | 157,232 | 38 |
| Adolph Coors Company | Golden | CO | 2082, 3411, 3443 | 1 | 158,792 | 59 |
| Aero Metal Finishing Inc. | Fenton | MO | 3471 | 1 | 12,900 | 43 |
| Akzo Nobel Inc. | Chicago | IL | 3412 | 1 | 930,189 | 13 |
| Aladdin Industries Inc. | Nashville | TN | 3086, 3469, 3648 | 1 | 53,741 | 91 |
| All Metal Stamping Inc. | Abbotsford | WI | 3429, 3469, 3499 | 1 | 1,112 | 50 |
| Allied-Signal Inc. | Morristown | NJ | 3728, 3471, 3724 | 2 | 2,080,501 | 50 |
| Aluminum Company Of America | Pittsburgh | PA | 3463 | 5 | 2,403,017 | 51 |
| America's Best Quality | Milwaukee | WI | 3471 | 1 | 1,025 | 74 |
| American National Can Company | Chicago | IL | 3411 | 9 | 2,303,898 | 50 |
| Ameron Inc. Delaware | Pasadena | CA | 3272, 3317, 3443, 3479 | 1 | 184,882 | ** |
| Amsted Industries Incorporated | Chicago | IL | 3315, 3496, 3471 | 1 | 1,834,493 | 66 |
| Anderson Screw Products Inc. | Jamestown | NY | 3451 | 1 | 7,860 | 100 |
| Anomatic Corporation | Newark | OH | 3471 | 1 | 403,270 | 50 |
| Apogee Enterprises Inc. | Minneapolis | MN | 3479 | 1 | 423,862 | 15 |
| Armco Inc. | Pittsburgh | PA | 3446 | 2 | 1,849,709 | 4 |
| Asea Brown Boveri Inc. | Stamford | CT | 3443 | 2 | 501,017 | 50 |
| Asko Processing Inc. | Seattle | WA | 3479 | 2 | 36,991 | 50 |
| Atlas Die Inc. | Elkhart | IN | 3479 | 1 | 26,400 | 100 |
| Atlas Plating Inc. | Cleveland | OH | 3471 | 1 | 505 | 33 |
| Automatic Pltg Of Bridgeport | Bridgeport | CT | 3471 | 1 | 635 | *** |
| B. L. Downey Co. Inc. | Broadview | IL | 3479 | 1 | 250 | 75 |
| Baker Hughes Incorporated | Houston | TX | 3533, 3471 | 1 | 193,116 | 20 |
| Ball And Socket Mfg. Co. Inc. | Cheshire | CT | 3965, 3469, 3471 | 1 | 9,820 | ** |
| Ball Corporation | Muncie | IN | 3411 | 7 | 721,859 | 86 |
| Bausch & Lomb Incorporated | Rochester | NY | 3471, 3851, 3827 | 1 | 51,706 | * |
| Bead Industries Inc. | Bridgeport | CT | 3499, 3679, 3432 | 1 | 107,143 | *** |
| Bethlehem Steel Corporation | Bethlehem | PA | 3312, 3462 | 1 | 792,550 | 50 |
| BHP Holdings (USA) Inc. | San Francisco | CA | 3479 | 1 | 64,365 | *** |

## Exhibit 40 (cont'd)
## 33/50 Program

| Parent Facility name | Parent City | ST | SIC Codes | # of Participating Facilities | 1993 Releases and Transfers (lbs.) | % Reduction 1988 to 1993 |
|---|---|---|---|---|---|---|
| Black & Decker Corporation | Baltimore | MD | 3429 | 6 | 487,188 | 50 |
| Blaser Die Casting Co. | Seattle | WA | 3471 | 1 | 38,900 | 78 |
| Bmc Industries Inc. | Minneapolis | MN | 3479 | 1 | 207,147 | 5 |
| Brod & Mcclung-Pace Co. | Portland | OR | 3433, 3564, 3585 | 1 | 20,300 | ** |
| Brooklyn Park Oil Co. Inc. | Minneapolis | MN | 3364, 3471 | 1 | 12,606 | 13 |
| Burnham Corporation | Lancaster | PA | 3433 | 1 | 34,149 | 96 |
| C. A. Dahlin Co. | Elk Grove Village | IL | 3469 | 1 | 12,900 | *** |
| Caldwell Products Inc. | Abilene | TX | 3471 | 1 | 11,880 | 50 |
| Canon Business Machines Inc. | Costa Mesa | CA | 3479 | 1 | 5 | 95 |
| Cargill Detroit Corporation | Clawson | MI | 3462 | 1 | 717,558 | 31 |
| Channellock Inc. | Meadville | PA | 3423 | 1 | 118,913 | *** |
| Chart Industries Inc. | Willoughby | OH | 3443 | 2 | 8,260 | 79 |
| Chrysler Corporation | Highland Park | MI | 3465 | 2 | 3,623,717 | 80 |
| Cold Heading Co. | Detroit | MI | 3471 | 1 | 16,021 | 52 |
| Collis Inc. | Clinton | IA | 3496, 3471, 3499 | 1 | 63,010 | 60 |
| Commercial Enameling Co. | Huntington Park | CA | 3431 | 1 | 250 | 100 |
| Conagra Inc. | Omaha | NE | 3411 | 1 | 39,588 | 8 |
| Cooper Industries Inc. | Houston | TX | 3462, 3317 | 7 | 1,048,465 | 75 |
| Corning Inc. | Corning | NY | 3469, 3471 | 1 | 1,521,528 | 14 |
| Crenlo Inc. | Rochester | MN | 3444 | 1 | 66,945 | *** |
| Crown City Plating Co. | El Monte | CA | 3471 | 1 | 151,509 | 30 |
| Crown Cork & Seal Company | Philadelphia | PA | 2752, 3479 | 20 | 1,236,689 | 50 |
| Crown Metal Finishing Co. Inc. | Kenilworth | NJ | 3479 | 1 | 50,282 | 21 |
| Dana Corporation | Toledo | OH | 3451, 3492 | 3 | 1,652,123 | ** |
| Davis & Hemphill | Elkridge | MD | 3451 | 1 | 13,365 | * |
| Delbar Products Inc. | Perkasie | PA | 3089, 3465 | 2 | 102,983 | 50 |
| Delta Engineering & Mfg. Co. | Tualatin | OR | 3444 | 1 | 8,239 | *** |
| Disston Company | Danville | VA | 3425 | 1 | 27,000 | * |
| Duo-Fast Corp. | Franklin Park | IL | 3469 | 1 | 652,519 | 45 |
| Dynamic Metal Products Company | Manchester | CT | 3444 | 1 | 255 | *** |
| Eagle-Picher Industries Inc. | Cincinnati | OH | 3053, 3479 | 3 | 227,242 | 50 |
| Eaton Corporation | Cleveland | OH | 3462 | 4 | 450,211 | 50 |
| Ektron Industries Inc. | Aumsville | OR | 3471 | 1 | 4,354 | 50 |
| Electro-Platers Of York Inc. | Wrightsville | PA | 3471 | 1 | 29,462 | *** |
| Emerson Electric Co. | Saint Louis | MO | 3569, 3541, 3496, 3449 | 4 | 2,140,497 | 50 |
| Enamelers & Japanners Inc. | Chicago | IL | 3479 | 1 | 40,000 | * |
| Ernie Green Industries Inc. | Dayton | OH | 3465 | 3 | 329,828 | * |
| Excell Polishing & Buffing Co. | Wadsworth | OH | 3471 | 1 | 13,149 | *** |
| Federal-Mogul Corporation | Southfield | MI | 3365, 3366, 3471 | 3 | 255,996 | 50 |
| Feldkircher Wire Fabg Co. | Nashville | TN | 3471, 3496 | 1 | 750 | 18 |

## Exhibit 40 (cont'd)
## 33/50 Program

| Parent Facility name | Parent City | ST | SIC Codes | # of Participating Facilities | 1993 Releases and Transfers (lbs.) | % Reduction 1988 to 1993 |
|---|---|---|---|---|---|---|
| Fleet Design Inc. | Portland | TN | 3471 | 3 | 522 | 80 |
| Fmc Corporation | Chicago | IL | 3462, 3324, 3325 | 1 | 502,318 | 50 |
| Ford Motor Company | Dearborn | MI | 3465, 3711 | 5 | 15,368,032 | 15 |
| Foto Mark Inc. | Mendota Heights | MN | 3479 | 1 | 73,325 | 5 |
| Fulcrum II Limited Partnership | New York | NY | 3462 | 1 | 77,680 | 24 |
| G M Nameplate Inc. | Seattle | WA | 2759, 2752, 3679, 3993, 3471, 3479 | 1 | 15,405 | 50 |
| G. W. Lisk Co. Inc. | Clifton Springs | NY | 3499, 3451, 3471, 3491 | 1 | 15,548 | * |
| Gates Corporation | Denver | CO | 3429, 3451 | 1 | 478,941 | *** |
| Gayston Corporation | Springboro | OH | 3483, 3463 | 1 | 33,355 | 56 |
| Gefinor (USA) Inc. | New York | NY | 3471, 3951 | 1 | 9,088 | 50 |
| General Dynamics Corporation | St Louis | MO | 3441, 3621 | 1 | 588,246 | 84 |
| General Electric Company | Fairfield | CT | 3444, 3724 | 7 | 5,010,856 | 50 |
| General Motors Corporation | Detroit | MI | 3651, 3694, 3679, 3672, 3471 | 15 | 16,751,198 | * |
| Gillette Company | Boston | MA | 3421 | 1 | 21,497 | 99 |
| Globe Engineering Company Inc. | Wichita | KS | 3728, 3724, 3444, 3599 | 1 | 18,678 | * |
| Hager Hinge Company | Saint Louis | MO | 3429 | 2 | 97,121 | 64 |
| Halliburton Company | Dallas | TX | 3443 | 1 | 16,884 | ** |
| Hand Industries Inc. | Warsaw | IN | 3471 | 1 | 37,000 | *** |
| Handy & Harman | New York | NY | 3471, 3469 | 3 | 477,150 | 50 |
| Harrow Industries Inc. | Grand Rapids | MI | 3429 | 1 | 128,355 | * |
| Harsco Corporation | Camp Hill | PA | 3469, 3449 | 8 | 415,574 | ** |
| Henkel Corporation | Kng Of Prussa | PA | 3479 | 1 | 164,363 | 55 |
| Heresite Protective Coatings | Manitowoc | WI | 3479, 2851, 2821 | 1 | 367 | 50 |
| Hi-Shear Industries Inc. | New Hyde Park | NY | 3452, 3471, 3451, 3479 | 1 | 8,226 | 50 |
| HM Anglo-American Ltd | New York | NY | 3423 | 4 | 1,265,741 | 2 |
| Hohman Plating & Mfg. Inc. | Dayton | OH | 3471, 2851, 3479 | 1 | 13,293 | ** |
| Hoover Sys. Inc. | Dallas | TX | 2542, 3444, 3441 | 1 | 510 | 27 |
| Houston Plating Co. | South Houston | TX | 3471 | 1 | 997 | * |
| IBM | Armonk | NY | 3672, 3579, 3471 | 1 | 1,411,304 | 1 |
| Illinois Tool Works Inc. | Glenview | IL | 3469 | 3 | 673,128 | *** |
| Imagineering Enterprises Inc. | South Bend | IN | 3471 | 1 | 11,282 | *** |
| Inco United States Inc. | New York | NY | 3462, 3463 | 1 | 346,594 | 26 |

## Exhibit 40 (cont'd)
## 33/50 Program

| Parent Facility name | Parent City | ST | SIC Codes | # of Participating Facilities | 1993 Releases and Transfers (lbs.) | % Reduction 1988 to 1993 |
|---|---|---|---|---|---|---|
| Indal Ltd | Weston, Ontario, Canada | | 3442 | 3 | 303,909 | * |
| Indianhead Plating Inc. | Chippewa Falls | WI | 3471 | 1 | 14,005 | *** |
| Industrial Hard Chrome Ltd. | Geneva | IL | 3471 | 2 | 13,213 | * |
| Ingersoll-Rand Company | Woodcliff Lake | NJ | 3429 | 4 | 96,553 | 60 |
| Interlake Corporation | Lisle | IL | 3441 | 1 | 159,932 | 37 |
| International Paper Company | Purchase | NY | 8731, 3471, 3544 | 1 | 2,784,831 | 50 |
| ITT Corporation | New York | NY | 3471, 3479, 3498 | 3 | 735,332 | 7 |
| Jacobson Mfg Co. Inc. | Kenilworth | NJ | 3452 | 1 | 12 | * |
| Jefferson City Mfg. Co. Inc. | Jefferson City | MO | 3363, 3451, 3469 | 1 | 4,850 | ** |
| Jor-Mac Company Inc. | Grafton | WI | 3499, 3479 | 1 | 4,995 | *** |
| Jordan-Edmiston Group Inc. | New York | NY | 3421 | 1 | 332,930 | 27 |
| Kaspar Electroplating Corp | Shiner | TX | 3471 | 1 | 56 | * |
| Kelso Asi Partners L P | New York | NY | 3585, 3433, 3564 | 1 | 355,557 | 43 |
| Kennedy Mfg. Co. | Van Wert | OH | 3469 | 2 | 69,756 | 80 |
| Kitzinger Cooperage Corp | Saint Francis | WI | 3412, 5085, 5805 | 1 | 84 | 50 |
| Lacks Enterprises Inc. | Grand Rapids | MI | 3089, 3471 | 3 | 867,354 | 27 |
| Lawrence Brothers Inc. | Sterling | IL | 3429 | 1 | 6,827 | 50 |
| Leco Corporation | Saint Joseph | MI | 3826, 3471, 3229 | 1 | 6,800 | 14 |
| Litton Industries Inc. | Beverly Hills | CA | 3731, 3441, 3443 | 1 | 332,264 | ** |
| Lord Corporation | Erie | PA | 3069, 3471 | 2 | 1,111,309 | 58 |
| Lorin Ind. | Muskegon | MI | 3471, 3354 | 1 | 25,500 | 50 |
| LTV Steel Co. Inc. | Cleveland | OH | 3471 | 1 | 612,924 | 60 |
| Luke Engineering & Mfg Corp | Wadsworth | OH | 3471 | 1 | 6,600 | ** |
| Macklanburg-Duncan Co. | Oklahoma City | OK | 3429 | 1 | 23,376 | *** |
| Marmon Group, Inc. | Chicago | IL | 3451 | 5 | 1,092,218 | 1 |
| Martin Marietta Corporation | Bethesda | MD | 3769, 3499, 3479, 3471 | 1 | 223,286 | 73 |
| Masco Industries Inc. | Taylor | MI | 3398, 3471 | 13 | 488,484 | *** |
| Mascotech | Taylor | MI | 3465 | 9 | 3,163,830 | 35 |
| Matec Corporation | Hopkinton | MA | 3479, 2899, 3489 | 1 | 21,800 | * |
| Meaden Screw Products Company | Burr Ridge | IL | 3451 | 1 | 12,860 | 40 |
| Mechanical Galv-Plating Corp | Sidney | OH | 3479 | 1 | 3,448 | *** |
| Meco Inc. | Paris | IL | 3443 | 1 | 51,864 | *** |
| Metallics Inc. | Onalaska | WI | 3479 | 1 | 27,720 | 50 |
| Metromedia Company | E Rutherford | NJ | 3451, 3499 | 1 | 295,322 | * |
| Midwest Plating Company Inc. | Grand Rapids | MI | 3471 | 1 | 520 | 50 |

## Exhibit 40 (cont'd)
## 33/50 Program

| Parent Facility name | Parent City | ST | SIC Codes | # of Participating Facilities | 1993 Releases and Transfers (lbs.) | % Reduction 1988 to 1993 |
|---|---|---|---|---|---|---|
| Miller Smith Mfg. Co. | Spring Lake | MI | 3471 | 1 | 17,247 | *** |
| Modern Metal Products Co. | Loves Park | IL | 3471 | 1 | 163 | 71 |
| Modern Welding Company | Owensboro | KY | 3441, 3443 | 1 | 5 | * |
| Modine Manufacturing Company | Racine | WI | 3443, 3714 | 4 | 488,996 | 50 |
| Morgan Stanley Leveraged Fund | New York | NY | 3724, 3471 | 2 | 2,166,420 | 13 |
| Napco Inc. | Valencia | PA | 3499, 3444, 3446, 3442, 3479 | 1 | 41,037 | 60 |
| Nashua Corp. | Nashua | NH | 2672, 3572, 3577, 2869, 2821, 3479 | 2 | 1,818,504 | ** |
| National Forge Company | Irvine | PA | 3462 | 1 | 3,100 | * |
| National Semiconductor Corp. | Santa Clara | CA | 3679, 3674, 3471 | 1 | 23,173 | 6 |
| New Dimension Plating Inc. | Hutchinson | MN | 3471 | 1 | 17,300 | 35 |
| Newell Co. | Freeport | IL | 3471, 3496 | 5 | 324,283 | 23 |
| Norandal USA | Brentwood | TN | 3353, 3479 | 1 | 627,740 | 6 |
| North American Investment Prop | Hawthorne | NY | 3443 | 1 | 11,755 | 70 |
| Northland Stainless Inc. | Tomahawk | WI | 3443 | 1 | 7,570 | *** |
| Norton Company | Worcester | MA | 3425 | 1 | 40,831 | 63 |
| Oak Industries Inc. | Waltham | MA | 3451, 3471, 3398 | 1 | 34,128 | 16 |
| Oberg Industries Inc. | Freeport | PA | 3469, 3471, 3089 | 1 | 18,435 | 85 |
| Oregon Sand Blasting & Coating | Tualatin | OR | 3479 | 1 | 14,660 | * |
| Owens-Illinois Inc. | Toledo | OH | 3469 | 2 | 412,573 | *** |
| Pace Industries Inc. | New York | NY | 3639, 3444, 3469 | 1 | 14,530 | ** |
| Parker Hannifin Corporation | Cleveland | OH | 3451, 3492, 3494 | 9 | 244,966 | 50 |
| Pechiney Corporation | Greenwich | CT | 3479, 3724 | 1 | 216,177 | *** |
| Penn Engineering & Mfg | Danboro | PA | 3452 | 1 | 111,897 | 100 |
| Philip Morris Companies Inc. | New York | NY | 3479, 3468 | 1 | 259,053 | ** |
| Photocircuits Corporation | Glen Cove | NY | 3672, 3471 | 1 | 292,178 | 92 |
| PMF Ind. Inc. | Williamsport | PA | 3499, 3471 | 1 | 13,015 | 34 |
| Precision Plating Inc. | Minneapolis | MN | 3471 | 1 | 10,155 | *** |
| Precision Products Group Inc. | Rockford | IL | 3398, 3469, 3495, 3493, 3499 | 1 | 149,834 | *** |
| Premark International Inc. | Deerfield | IL | 3556, 3325, 3444 | 2 | 140,313 | *** |
| Process Engineering Co. Inc. | Jackson | MS | 3471 | 1 | 10,305 | 50 |
| Production Paint Finishers | Bradford | OH | 3479 | 1 | 11,584 | 60 |
| Prospect Purchasing Co. Inc. | N Brunswick | NJ | 3412 | 1 | 47,275 | 50 |

## Exhibit 40 (cont'd)
## 33/50 Program

| Parent Facility name | Parent City | ST | SIC Codes | # of Participating Facilities | 1993 Releases and Transfers (lbs.) | % Reduction 1988 to 1993 |
|---|---|---|---|---|---|---|
| Protective Coatings Inc. | Kent | WA | 3471, 3479 | 1 | 41,137 | *** |
| Providence Metallizing Co. Inc. | Pawtucket | RI | 3479, 3471 | 1 | 35,347 | 70 |
| Quality Rolling & Deburring Co. | Thomaston | CT | 3471 | 1 | 287,324 | *** |
| R P Adams Company Inc. | Tonawanda | NY | 3469 | 1 | 20 | *** |
| Raytheon Company | Lexington | MA | 3672, 3471, 3674 | 1 | 706,045 | 50 |
| Rehrig International Inc. | Richmond | VA | 3471 | 1 | 2,261 | *** |
| Reilly Plating Co. | Nanticoke | PA | 3471 | 1 | 750 | 2 |
| Reliance Finishing Co. | Grand Rapids | MI | 3479 | 1 | 11,400 | ** |
| Reynolds Metals Company | Richmond | VA | 3479 | 1 | 2,055,294 | 38 |
| S. K. Williams Co. | Wauwatosa | WI | 3471 | 1 | 126 | * |
| Schuller Corporation | Denver | CO | 3444 | 1 | 24,694 | *** |
| Seneca Foods Corporation | Pittsford | NY | 3411 | 1 | 19,717 | 50 |
| Siebe Industries Inc. | Richmond | VA | 3400, 3471 | 2 | 849,335 | 2 |
| Skills Inc. | Seattle | WA | 3479 | 1 | 7,650 | *** |
| Smith Everett Investment Co. | Milwaukee | WI | 3444 | 1 | 240,445 | 89 |
| Smith System Manufacturing Co. | Plano | TX | 3444, 2531 | 1 | 499 | * |
| Sommer Metalcraft Corp | Crawfordsville | IN | 3471 | 1 | 1,500 | * |
| Sonoco Products Company | Hartsville | SC | 2655, 3469 | 2 | 621,380 | 1 |
| Southline Metal Products Co. | Houston | TX | 3412 | 1 | 77,552 | *** |
| Spx Corporation | Muskegon | MI | 3479 | 1 | 554,822 | 2 |
| Stanley Works | New Britain | CT | 3471 | 10 | 508,199 | 50 |
| Sunset Fireplace Fixtures | City Of Industry | CA | 3429 | 1 | 12,800 | 25 |
| Super Radiator Coils Ltd | Minneapolis | MN | 3400 | 1 | 139,235 | 82 |
| Superior Plating Inc. | Minneapolis | MN | 3471 | 1 | 39,406 | *** |
| Surftech Finishes Company | Kent | WA | 3471 | 1 | 20,270 | * |
| Swva Inc. | Huntington | WV | 3441 | 1 | 43,405 | 27 |
| Tawas Plating Company | Tawas City | MI | 3471 | 1 | 3,265 | 50 |
| Tech Industries Inc. | Woonsocket | RI | 3089, 3471 | 1 | 27,003 | 64 |
| Techmetals Inc. | Dayton | OH | 3471 | 1 | 10,645 | 50 |
| Tektronix Inc. | Beaverton | OR | 3663, 3444 | 1 | 12,393 | * |
| Tenneco Inc. | Houston | TX | 3441 | 1 | 1,272,423 | 8 |
| Texas Instruments Incorporated | Dallas | TX | 3822, 2812, 3356, 3471, 3714, 3341 | 1 | 344,225 | 25 |
| Therma-Tru Corp | Sylvania | OH | 3442, 3089 | 1 | 17,255 | 41 |
| Thiokol Corporation | Ogden | UT | 3452 | 2 | 1,001,162 | 40 |
| Thomas Steel Strip Corp | Warren | OH | 3471, 3316 | 1 | 6,839 | 50 |
| Trinova Corporation | Maumee | OH | 3451, 3498 | 1 | 488,879 | 50 |
| U T I Corporation | Collegeville | PA | 3469 | 1 | 473,872 | 50 |
| United States Can Company Del | Hinsdale | IL | 3412, 3411 | 1 | 5,299 | * |
| United Technologies Corp | Hartford | CT | 3086, 3471 | 2 | 2,393,252 | 50 |
| US Can Corporation (Del) | Oak Brook | IL | 3411 | 7 | 573,088 | 37 |

**Exhibit 40 (cont'd)**
**33/50 Program**

| Parent Facility name | Parent City | ST | SIC Codes | # of Participating Facilities | 1993 Releases and Transfers (lbs.) | % Reduction 1988 to 1993 |
|---|---|---|---|---|---|---|
| Valley Plating Works | Los Angeles | CA | 3471 | 1 | 130 | 75 |
| Valley Technologies Inc. | Valley Park | MO | 3398, 3463 | 1 | 0 | ** |
| Van Der Horst Usa Corporation | Terrell | TX | 3471 | 1 | 20,623 | ** |
| Veba Corporation | Houston | TX | 3471, 3599 | 1 | 24,254 | 10 |
| W W Custom Clad Inc. | Canajoharie | NY | 3471 | 1 | 8,595 | 50 |
| W. J. Roscoe Co. | Akron | OH | 2851, 2891, 2517, 3479 | 1 | 40,051 | 50 |
| Walter Industries Inc. | Tampa | FL | 3321, 3479 | 1 | 859,751 | *** |
| Warner-Lambert Company | Morris Plains | NJ | 3421 | 1 | 146,333 | 40 |
| Weiss-Aug Co. Inc. | East Hanover | NJ | 3465, 3469 | 1 | 15,834 | ** |
| Wheeling-Pittsburgh Corp | Wheeling | WV | 3479 | 1 | 560,055 | 66 |
| Whirlpool Corporation | Benton Harbor | MI | 3450, 3471, 3490 | 1 | 1,540,866 | 50 |
| Whyco Chromium Company Inc. | Thomaston | CT | 3471 | 1 | 88,737 | 50 |
| Winona Corporation | Winona Lake | IN | 3479 | 1 | 47,260 | 50 |
| Wisconsin Tool & Stamping Co. | Schiller Park | IL | 3469 | 1 | 42,000 | ** |
| WNA Inc. | Wilmington | DE | 3449 | 2 | 248,148 | *** |
| Worldwide Cryogenics Holdings | Minneapolis | MN | 3443 | 1 | 133,810 | * |
| Wright Products Corp | Minneapolis | MN | 3429 | 1 | 45,287 | *** |
| York Metal Finishing Co. | Philadelphia | PA | 3471 | 1 | 5 | * |
| Zippo Manufacturing Company | Bradford | PA | 3421 | 2 | 189,929 | 50 |

*** = not quantifiable against 1988 data.**
**** = use reduction goal only.**
***** = no numerical goal.**

*Environmental Leadership Program*

The Environmental Leadership Program (ELP) is a national initiative piloted by EPA and State agencies in which facilities have volunteered to demonstrate innovative approaches to environmental management and compliance. EPA has selected 12 pilot projects at industrial facilities and Federal installations which will demonstrate the principles of the ELP program. These principles include: environmental management systems, multimedia compliance assurance, third-party verification of compliance, public measures of accountability, community involvement, and mentoring programs. In return for participating, pilot participants receive public recognition and are given a period of time to correct any violations discovered during these experimental projects. At present, no metal finishing or fabricating facilities are carrying out ELP pilot projects. (Contact: Tai-ming Chang, ELP Director, (202) 564-5081 or Robert Fentress, (202) 564-7023)

**Gillette ELP Project**

The objective of the Gillette Environmental Leadership Program is the development and implementation of a third party compliance and management systems audit and verification process. The project will involve the development of environmental compliance and environmental management systems audit protocol criteria that can be adopted and easily implemented by other facilities to assess compliance with relevant regulations. The three Gillette facilities that are participating are: South Boston Manufacturing Center, blade and razor manufacturing; North Chicago Manufacturing Center, batch chemical manufacturing; and Santa Monica, CA, stationary products manufacturing. (Contact: Scott Throwe, (202) 564-7013).

*Project XL*

Project XL was initiated in March 1995 as a part of President Clinton's *Reinventing Environmental Regulation* initiative. The projects seek to achieve cost effective environmental benefits by allowing participants to replace or modify existing regulatory requirements on the condition that they produce greater environmental benefits. EPA and program participants will negotiate and sign a Final Project Agreement, detailing specific objectives that the regulated entity shall satisfy. In exchange, EPA will allow the participant a certain degree of regulatory flexibility and may seek changes in underlying regulations or statutes. Participants are encouraged to seek stakeholder support from local governments, businesses, and environmental groups. EPA hopes to implement fifty pilot projects in four categories including facilities, sectors, communities, and government agencies regulated by EPA. Applications will be accepted on a rolling basis and projects will move to implementation within six months of their selection. For additional information regarding XL Projects, including application procedures and criteria, see the May 23, 1995 Federal Register Notice. Contact Jon Kessler, Office of Policy Analysis, (202) 260-4034.

*Green Lights Program*

EPA's Green Lights program was initiated in 1991 and has the goal of preventing pollution by encouraging U.S. institutions to use energy-efficient lighting technologies. The program has over 1,500 participants which include major corporations; small and medium sized businesses; Federal, State and local governments; non-profit groups; schools; universities; and health care facilities. Each

participant is required to survey their facilities and upgrade lighting wherever it is profitable. EPA provides technical assistance to the participants through a decision support software package, workshops and manuals, and a financing registry. EPA's Office of Air and Radiation is responsible for operating the Green Lights Program. (Contact: Susan Bullard, (202) 233-9065 or the Green Light/Energy Star Hotline at (202) 775-6650)

*WasteWi$e Program*

The WasteWi$e Program was started in 1994 by EPA's Office of Solid Waste and Emergency Response. The program is aimed at reducing municipal solid wastes by promoting waste minimization, recycling collection, and the manufacturing and purchase of recycled products. As of 1994, the program had about 300 companies as members, including a number of major corporations. Members agree to identify and implement actions to reduce their solid wastes and must provide EPA with their waste reduction goals along with yearly progress reports. EPA in turn provides technical assistance to member companies and allows the use of the WasteWi$e logo for promotional purposes. (Contact: Lynda Wynn, (202) 260-0700 or the WasteWi$e Hotline at (800) 372-9473)

*Climate Wise Recognition Program*

The Climate Change Action Plan was initiated in response to the U.S. commitment to reduce greenhouse gas emissions in accordance with the Climate Change Convention of the 1990 Earth Summit. As part of the Climate Change Action Plan, the Climate Wise Recognition Program is a partnership initiative run jointly by EPA and the Department of Energy. The program is designed to reduce greenhouse gas emissions by encouraging reductions across all sectors of the economy, encouraging participation in the full range of Climate Change Action Plan initiatives, and fostering innovation. Participants in the program are required to identify and commit to actions that reduce greenhouse gas emissions. The program, in turn, gives organizations early recognition for their reduction commitments; provides technical assistance through consulting services, workshops, and guides; and provides access to the program's centralized information system. At EPA, the program is operated by the Air and Energy Policy Division within the Office of Policy Planning and Evaluation. (Contact: Pamela Herman, (202) 260-4407)

*NICE*$^3$

The U.S. Department of Energy and EPA's Office of Pollution Prevention are jointly administering a grant program called The National Industrial Competitiveness through Energy, Environment, and Economics (NICE$^{3)}$. By providing grants of up to 50 percent of the total project cost, the program encourages industry to reduce industrial waste at its source and become more energy-efficient and cost-competitive through waste minimization efforts. Grants are used by industry to design, test, demonstrate, and assess the feasibility of new processes and/or equipment with the potential to reduce pollution and increase energy efficiency. The program is open to all industries; however, priority is given to proposals from participants in the pulp and paper, chemicals, primary metals, and petroleum and coal products sectors. (Contact: DOE's Golden Field Office, (303) 275-4729)

## VIII.C. Trade Association/Industry Sponsored Activity

Associations, universities, and the industry are currently working with EPA to make the Agency aware of issues that relate to metal fabricating and finishing industries. As a result of these relationships and overall interest in achieving compliance and reducing pollution, additional research relating to process techniques and pollution prevention alternatives is being conducted. Various workshops and training opportunities have resulted from these efforts. A summary of some trade association and industry activities is presented below, along with some associations related to this industry.

### VIII.C.1. Environmental Programs

Several trade and professional associations are working with EPA to make the Agency aware of issues that relate to metal fabricating industries. For example, the Copper and Brass Fabricators Council (CBFC) has been assisting EPA's Office of Solid Waste regarding recycling issues as it develops or redrafts RCRA regulations. CBFC is communicating its experiences with metal fabricating to EPA, in terms of materials used and possible recycling options, in hopes that future regulations might complement the industry's processes.

Additionally, several organizations have sponsored workshops focusing on waste minimization and pollution prevention in several fabricated metal related industries. Three workshops, the Hazardous Waste Management for Small Business Workshop, the Environmentally Conscious Painting Workshop, and the Pollution Prevention Workshop for the Electroplating Industry, are discussed below.

*Hazardous Waste Management for Small Business Workshop*

The University of Northern Iowa, with support from EPA, Des Moines Area Community College, Northeast Iowa Community College, Scott Community College, and Indiana Hills Community College, sponsored a *Hazardous Waste Management for Small Business* workshop. This workshop was geared towards small businesses and was intended to provide practical answers to environmental regulatory questions. Small businesses covered by the workshop include: manufacturers, vehicle maintenance and repair shops, printers, machine shops, and other businesses that generate potentially hazardous waste. Topics covered include: hazardous waste determination, waste generator categories, management of specific common waste streams, including used oil and solvents, and pollution prevention. (Contact: Duane McDonald, (319) 273-6899)

*Environmentally Conscious Painting Workshop*

Kansas State University, NIST/Mid-America Manufacturing Technology Center, Kansas Department of Health & Environment, EPA Region 7, Allied Signal, Inc., Kansas City Plant, and the U.S. Department of Energy sponsored the *Environmentally Conscious Painting* workshop. This workshop covered topics such as upcoming regulations and the current regulatory climate, methods to cost-effectively reduce painting wastes and emissions, and alternative painting processes. (Contact: the Kansas State University Division of Continuing Education, (913) 532-5566)

*Pollution Prevention Workshop for the Electroplating Industry*

Kansas State University Engineering Extension, EPA Region 7, Kansas Department of Health and Environment, and the University of Kansas sponsored the *Pollution Prevention Workshop for the Electroplating Industry*. The workshop described simple techniques for waste reduction in the electroplating industry, including: plating, rinsing processes and wastewater, wastewater management options, metals

recovery options, waste treatment and management, and product substitutions and plating alternatives. (Contact: the Kansas State University Division of Continuing Education, (800) 432-8222)

## VIII.C.2. Summary of Trade Associations

Various trade associations represent the interests of metal fabricator workers and the industry itself. Some of these organizations are discussed in greater detail below.

| | |
|---|---|
| American Electroplaters and Surface Finishers Society (AESF)<br>12644 Research Parkway<br>Orlando, FL 32826<br>Phone: (407) 281-6441<br>Fax: (407) 281-6446 | Members: 10,000<br>Staff: 21<br>Budget: 2,000,000<br>Contact: Ted Witt, Executive Director |

Founded in 1909, AESF is an international professional society of scientists, technicians, job shop operators, and others interested in research in electroplating, surface finishing, and allied arts. AESF offers classroom training courses, home study courses, cooperative programs, and a voluntary certification program. In addition, it bestows awards, conducts research programs, and provides an insurance program for job shop owners. AESF also publishes *Plating and Surface Finishing* (monthly), *AESF Shop Guide*, books, symposia proceedings, research reports, and training booklets with slide presentations; and makes available films and videotapes.

| | |
|---|---|
| ASM International (ASM)<br>9639 Kinsman<br>Materials Park, OH 44073<br>Phone: (216) 338-5151 | Members: 54,000<br>Staff: 145<br>Budget: $19,500,000<br>Contact: Edward L. Langer |

Founded in 1920, ASM represents metallurgists; materials engineers; executives in materials producing and consuming industries; and teachers and students. This association disseminates technical information about the manufacture, use, and treatment of engineered materials. It offers in-plant, home study, and intensive courses through the Materials Engineering Institute; conducts conferences, seminars, and lectures; presents awards to teachers of materials science and for achievements in the field; and grants scholarships and fellowships. Additionally, it maintains a library of 10,000 volumes on metals and other materials.

| | |
|---|---|
| Copper and Brass Fabricators Council (CBFC)<br>1050 17th Street, NW, Suite 440<br>Washington, DC 20036<br>Phone: (202) 833-8575 | Contact: Joseph L. Mayer |

Founded in 1966, CBFC represents copper and brass fabricators. Its activities involve foreign trade in copper and brass fabricated products, and Federal regulatory matters including legislation, regulations, rules, controls, stockpiling, and other similar measures affecting domestic fabricators of copper and brass products. CBFC holds an annual convention.

| | |
|---|---|
| Metal Construction Association (MCA)<br>1101 14th Street, NW, Suite 1100<br>Washington, DC 20005<br>Phone: (202) 371-1243<br>Fax: (202) 371-1090 | Members: 100<br>Staff: 5<br>Contact: David W. Barrack |

Founded in 1983, MCA represents individuals engaged in the manufacture, design, engineering, sale, or installation of metal used in construction, and others interested in the metal construction industry. It promotes the use of metal in all construction applications. Additionally, MCA represents all sectors of the metal construction industry; fosters better trade practices and improved communication within the industry; serves as liaison between members and other industry organizations. The association collects and disseminates information; maintains the Merit Award Program to acknowledge outstanding buildings, products, and systems in the industry; plans programs in institutional advertising, voluntary standards, and statistics; proposed educational programs including structure erection, estimating, and bookkeeping; compiles statistics; and bestows scholarships. MCA also prepares and distributes two publications: the *Metal Construction Association-Membership Directory* (annually) and the *Metal Construction Association-Newsletter* (quarterly). Its newsletter includes technical articles, meeting reviews, committee reports, minutes, and a calendar of events. MCA holds a semiannual meeting and Metalcon International Trade Show and an annual meeting.

| | |
|---|---|
| Metal Fabricating Institute (FMI)<br>PO Box 1178<br>Rockford, IL 61105<br>Phone: (815) 965-4031 | Staff: 4<br>Contact: Ronald L. Fowler |

Founded in 1968, MFI conducts technical seminars for structural and sheet metal fabricators to update management on the latest manufacturing techniques. MFI also presents a Fabricating Engineer of the Year Award. In addition, it publishes *Metal Fabricating News* (bimonthly), which contains a calendar of events, new products and literature, book reviews, and a buyers guide. The association also holds a semiannual conference in West Lafayette, Indiana.

| | |
|---|---|
| Metal Finishers Suppliers Association (MFSA)<br>801 North Cass, Ste. 300<br>Westmont, IL 60559<br>Phone: (708) 887-0797 | Members: 180 Companies<br>Staff: 2-4<br>Budget: $400,000<br>Contact: Richard Crain |

Incorporated in 1951, MFSA is the only trade association representing companies that supply chemicals and equipment to the metal finishing industry. MFSA works closely with organizations that represent the metal finishing industry, such as AESF (see above) and the National Association of Metal Finishers (see below), and is involved in several joint programs, including an annual conference. In addition, MFSA publishes a monthly newsletter and has published a dozen technical papers to inform and assist its members.

| | |
|---|---|
| National Association of Metal Finishers (NAMF)<br>401 N. Michigan Avenue<br>Chicago, IL 60611-4267<br>Phone: (312) 644-6610 | Members: 940<br>Staff: 6<br>Budget: $750,000<br>Contact: Brad Parcells |

Founded in 1955, NAMF represents management executives of firms engaged in plating, hard chroming, galvanizing, electroforming, metalizing, organic coating, phosphating, rust proofing, polishing, buffing, anodizing, and other forms of metal finishing. NAMF is concerned primarily with management education, development of finishing standards, and legislative issues. In addition, it publishes *Finishers' Management*, a trade magazine of the plating and finishing industry. NAMF also produces *Finishing Line* (monthly), *Legislative Line* (bi-monthly), and *NAMF Regulatory Compliance Manual*. NAMF holds an annual trade show.

| | |
|---|---|
| Precision Metalforming Association (PMA)<br>27027 Chardon Road<br>Richmond Heights, OH 44143<br>Phone: (216) 585-8800<br>Fax: (216) 585-3126 | Members: 1,000<br>Staff: 20<br>Budget: $3,000,000<br>Contact: Jon E. Jenson |

Founded in 1942, PMA represents manufacturers of metal stampings, precision metal fabrications, and metal spinnings, and their suppliers. PMA provides information and technical services to members. It also presents numerous awards and publishes *Metalforming*, a monthly magazine that addresses: materials and equipment, electronics in metal forming and assembly, taxes, legal issues, and management.

| | |
|---|---|
| Society for Mining, Metallurgy, and Exploration, Inc. (SME)<br>PO Box 625005<br>Littleton, CO 80162<br>Phone: (303) 973-9550 | Members: 20,000<br>Staff: 31<br>Budget: $3,700,000<br>Contact: Gary D. Howell |

Founded in 1871, SME represents individuals engaged in the finding, exploitation, treatment, and marketing of all classes of minerals (metal ores, industrial minerals, and solid fuel) except petroleum. Additionally, it offers specialized education programs; and compiles enrollment and graduation statistics from schools offering engineering degrees in mining, mineral, mineral processing/metallurgical, geological, geophysical technology.

| | |
|---|---|
| United Steelworkers of America (USWA)<br>5 Gateway Center<br>Pittsburgh, PA 15222<br>Phone: (412) 562-2400<br>Fax: (412) 562-2445 | Members: 675,000<br>Staff: 475<br>Contact: George Becker |

Founded in 1936, this association has absorbed numerous associations for steel workers. Currently, this agency publishes *Steelabor* ten times a year. This news magazine reports on legislation and regulation affecting the union, union activities at the national and chapter levels, economic developments, pension news, and information on safety and health. USWA also publishes the *Steelworker Old Time*, quarterly; and holds a biennial convention.

## IX. Contacts/Acknowledgments/Resource Materials/Bibliography and Other References

### General Profile

*Construction Materials*, DOC, U.S. Industrial Outlook 1994.

*Industry Profile for the Metal Finishing Industry*, *Meridian Research Inc.*, U.S. EPA/OPPT, June 24, 1994.

*1987 Census of Manufacturers Industry Series 34A: Metal Cans, Cutlery, Handtools*, U.S. Department of Commerce, Bureau of the Census, April 1990. (MC87-I-34A)

*1987 Census of Manufacturers Industry Series 34B: Heating Apparatus and Plumbing Fixtures*, Bureau of the Census, April 1990. (MC87-I-34B)

*1987 Census of Manufacturers Industry Series 34C: Fabricated Structural Metal Products*, Bureau of the Census, April 1990. (MC87-I-34C)

*1987 Census of Manufacturers Industry Series 34D: Screw Machine Products*, Bureau of the Census, April 1990. (MC87-I-34D)

### Process Description

*Emissions From Metal Finishing Operations, Draft Report,* U.S. EPA, Office of Research and Development, March 31, 1995.

*Hot Dip Galvanized Coatings*, American Society for Metals Committee on Hot Dip Galvanized Coatings, Metals Handbook, 9th Edition, Volume 5.

*Machining,* American Society for Metals, Metals Handbook: 9th Edition, Volume 16, 1989.

*McGraw Hill Encyclopedia of Science and Technology*, Volume 6, 1987.

*Metals Handbook, Ninth Edition; Volume 5, Surface Cleaning, Finishing, and Coating,* 1982, American Society for Metals.

*Properties and Selection: Stainless Steels, Tool Materials and Special Purpose Materials*, American Society for Metals, Metals Handbook, 9th Edition, Volume 3, 1980.

*Selection of Cleaning Process Metals,* American Society for Metals Committee on Selection of Cleaning Process, Handbook, 9th Edition.

*Surface Cleaning, Finishing, and Coating*, American Society for Metals, Metals Handbook: 9th Edition, Volume 5, 1982.

## Regulatory Profile

*U.S. EPA OPPTS Title III Section 313 Release Reporting Guidance: Estimating Chemical Releases from Electroplating Operations*, 1988.

*Guidance Manual for Electroplating and Metal Finishing Pretreatment Standards*, U.S. EPA/Effluent Guidelines Division and Permits Division, 1984.

*Listing of Hazardous Waste (40 CFR 261.31 and 261.32): Identification and Listing of Hazardous Waste Under RCRA, Subtitle C, Section 3001,* U.S. EPA, May 1980.

## Pollution Prevention

*Guides to Pollution Prevention: The Metal Finishing Industry,* U.S. EPA, ORD, October 1992.

*Minnesota Technical Assistance Program Checklists for Identifying Waste Reduction Opportunities*.

*Pollution Prevention In Metal Manufacturing: Saving Money Through Pollution Prevention*, U.S. EPA, OSW, October 1989.

*Pollution Prevention Options In Metal Fabricated Products Industries: A Bibliographic Report*, U.S. EPA, OPPT, January 1992.

*Sustainable Industry: Promoting Strategic Environmental Protection in the Industrial Sector, Phase 1 Report*, U.S. EPA, OPPE, June 1994.

*Toxic Chemical Release Inventory: Clarification and Guidance for the Metal Fabrication Industry*, U.S. EPA, OTS, 1990.

## Contacts*

| Name | Organization | Telephone |
|---|---|---|
| Paul Beatty | U.S. EPA Region VII | (913) 551-5089 |
| Bob Benson | U.S. EPA, Office of Policy, Planning and Evaluation | (202) 260-8668 |
| Marty Borruso | American Electroplaters and Surface Finishers Society | (718) 720-6646 |
| Jim Callier | U.S. EPA Region VII | (913) 551-7646 |
| Doug Fine | Massachusetts Department of Environmental Protection | (617) 556-1049 |
| Marilyn Goode | U.S. EPA Office of Solid Waste | (202) 260-6299 |
| Kris Goschen | U.S. EPA Region VII, Southeast Michigan Initiative | (913) 551-5078 |
| Mardi Klevs | U.S. EPA SEMI Coordinator | (312) 353-5490 |
| Larry Lins | U.S. EPA Region V | (216) 835-5200 |
| John Robison | U.S. EPA, Office of Pollution Prevention and Toxics | (202) 260-3590 |
| William Saas | Taskem, Inc., Metal Finishers Suppliers' Association | (216) 351-1500 |
| Paul Shapiro | U.S. EPA, Office of Research and Development | (202) 260-4969 |
| William Sonntag | National Association of Metal Finishers, American Electroplaters and Surface Finishers Society | (202) 965-5190 |

* Many of the contacts listed above provided valuable information and comments during the development of this doucment. EPA appreciated this support and acknowledges that the indivduals listed do not necessarily endorse all statements made within this notebook.