United States
Environmental Protection
Agency

Enforcement And
Compliance Assurance
(2221A)

EPA 310-R-95-016
September 1995

EPA

Profile Of The Rubber And Plastics Industry

SECTOR NOTEBOOKS

EPA Office Of Compliance Sector Notebook Project

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

THE ADMINISTRATOR

Message from the Administrator

Over the past 25 years, our nation has made tremendous progress in protecting public health and our environment while promoting economic prosperity. Businesses as large as iron and steel plants and businesses as small as the dry cleaner on the corner have worked with EPA to find ways to operate cleaner, cheaper, and smarter. As a result, we no longer have rivers catching on fire. Our skies are clearer. American environmental technology and expertise are in demand throughout the world.

The Clinton Administration recognizes that to continue this progress, we must move beyond the pollutant-by-pollutant approaches of the past to comprehensive, facility-wide approaches for the future. Industry by industry and community by community, we must build a new generation of environmental protection.

Within the past two years, the Environmental Protection Agency undertook its Sector Notebook Project to compile, for a number of key industries, information about environmental problems and solutions, case studies and tips about complying with regulations. We called on industry leaders, state regulators, and EPA staff with many years of experience in these industries and with their unique environmental issues. Together with notebooks for 17 other industries, the notebook you hold in your hand is the result.

These notebooks will help business managers to better understand their regulatory requirements, learn more about how others in their industry have undertaken regulatory compliance and the innovative methods some have found to prevent pollution in the first instance. These notebooks will give useful information to state regulatory agencies moving toward industry-based programs. Across EPA we will use this manual to better integrate our programs and improve our compliance assistance efforts.

I encourage you to use this notebook to evaluate and improve the way that together we achieve our important environmental protection goals. I am confident that these notebooks will help us to move forward in ensuring that -- in industry after industry, community after community -- environmental protection and economic prosperity go hand in hand.

Carol M. Browner

Recycled/Recyclable • Printed with Vegetable Based Inks on Recycled Paper (20% Postconsumer)

EPA/310-R-95-016

EPA Office of Compliance Sector Notebook Project

Profile of the Rubber and Plastics 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

For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328
ISBN 0-16-048283-6

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 at the end of this document.

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 on the EPA Enviro$ense Bulletin Board and via Internet on the Enviro$ense World Wide Web. Downloading procedures are described in Appendix A of this document.

Cover photograph courtesy of The Gates Rubber Company, Denver, Colorado.

Sector Notebook Contacts

The Sector Notebooks were developed by the EPA's Office of Compliance. Particular questions regarding the Sector Notebook Project in general can be directed to:

Seth Heminway, Sector Notebook Project Coordinator
US EPA, Office of Compliance
401 M St., SW (2223-A)
Washington, DC 20460
(202) 564-7017 fax (202) 564-0050
E-mail: heminway.seth@epamail.epa.gov

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	Keith Brown	564-7124
EPA/310-R-95-009.	Motor Vehicle Assembly Industry	Suzanne Childress	564-7018
EPA/310-R-95-010.	Nonferrous Metals Industry	Jane Engert	564-5021
EPA/310-R-95-011.	Non-Fuel, Non-Metal Mining Industry	Keith Brown	564-7124
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	Maria Eisemann	564-7016
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.	Pharmaceutical 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	Suzanne Childress	564-7018
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-B-96-003.	Federal Facilities	Jim Edwards	564-2461

*Currently in DRAFT anticipated publication in September 1997

This page updated during June 1997 reprinting

RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30)

TABLE OF CONTENTS

I. INTRODUCTION TO THE SECTOR NOTEBOOK PROJECT 1

I.A. Summary of the Sector Notebook Project 1

I.B. Additional Information 2

II. INTRODUCTION TO THE RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS INDUSTRY 4

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

II.B. Characterization of the Rubber and Miscellaneous Plastics Products Industry 5

II.B.1. Industry Size and Geographic Distribution 5

II.B.2. Product Characterization 11

II.B.3. Economic Trends 13

III. INDUSTRIAL PROCESS DESCRIPTION 16

III.A. Industrial Processes in the Rubber and Miscellaneous Plastics Products Industry 16

III.B. Raw Material Inputs and Pollution Outputs in the Production Line 34

III.C. Management of Chemicals in Wastestream 45

IV. CHEMICAL RELEASE AND TRANSFER PROFILE 47

IV.A. EPA Toxic Release Inventory for the Rubber and Miscellaneous Plastics Products Industry 50

IV.B. Summary of Selected Chemicals Released 59

IV.C. Other Data Sources 65

IV.D. Comparison of Toxic Release Inventory Between Selected Industries 67

V. POLLUTION PREVENTION OPPORTUNITIES 70

V.A. Identification of Pollution Prevention Activities in Use 70

VI. SUMMARY OF APPLICABLE FEDERAL STATUTES AND REGULATIONS 80

VI.A. General Description of Major Statutes 80

VI.B. Industry Specific Regulations 92

VII. COMPLIANCE AND ENFORCEMENT PROFILE 97

VII.A. The Rubber and Miscellaneous Plastics Products Industry Compliance History 101

VII.B. Comparison of Enforcement Activity Between Selected Industries 103

VII.C. Review of Major Legal Actions 108

VII.C.1. Review of Major Cases 108

VII.C.2. Supplemental Environmental Projects (SEPs) 108

VIII. COMPLIANCE ASSURANCE ACTIVITIES AND INITIATIVES 112

VIII.A. Sector-Related Environmental Programs and Activities 112

VIII.B. EPA Voluntary Programs 113

VIII.C. Trade Association/Industry Sponsored Activity 120

VIII.C.1. Environmental Programs 121

VIII.C.2. Summary of Trade Associations 123

IX. CONTACTS/ACKNOWLEDGMENTS/RESOURCE MATERIALS/ BIBLIOGRAPHY 128

RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30) EXHIBITS INDEX

Page

Exhibit 1 Facility Size Distribution of the Plastics Products Industry 6
Exhibit 2 Geographic Distribution of the Plastics Products Industry 6
Exhibit 3 Facility Size Distribution of the Rubber Products Industry 7
Exhibit 4 Geographic Distribution of the Rubber Products Industry 8
Exhibit 5 Facility Size Distribution of the Tire Industry 9
Exhibit 6 Geographic Distribution of the Tire Industry 10
Exhibit 7 North American Tire Sales 11
Exhibit 8 Diversity of the Plastics Products Industry 12
Exhibit 9 Diversity of the Rubber Products Industry 13
Exhibit 10 Plastics Products Manufacturing Process 18
Exhibit 11 Injection Molding 20
Exhibit 12 Extrusion 21
Exhibit 13 Thermoforming 22
Exhibit 14 Transfer Molding 23
Exhibit 15 Encapsulation 24
Exhibit 16 Rubber Product Manufacturing Process 27
Exhibit 17 Processes Used to Manufacture Various Rubber Products 30
Exhibit 18 Tire Manufacturing Process 32
Exhibit 19 Tire Formation 33
Exhibit 20 Plastics Products Manufacturing Process Pollution Outputs 35
Exhibit 21 Rubber Products Manufacturing Process Pollution Outputs 39
Exhibit 22 Tire Manufacturing Process Pollution Outputs 44
Exhibit 23 Rubber & Misc. Plastics Source Reduction and Recycling Activity for SIC 30 46
Exhibit 24 Top 10 TRI Releasing Rubber and Plastics Products Manufacturing Facilities (SIC 30) 51
Exhibit 25 Top 10 TRI Releasing Rubber and Misc. Plastics Products Facilities 52
Exhibit 26 TRI Reporting Rubber and Plastics Products Manufacturing Facilities (SIC 30) by State 52

RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30) EXHIBITS INDEX (Cont'd)

Page

Exhibit 27 Releases for Rubber and Plastics Products Manufacturing (SIC 30) in TRI by Number of Facilities 54, 55, 56

Exhibit 28 Transfers for Rubber and Plastics Products Manufacturing (SIC 30) in TRI by Number of Facilities 56, 57, 58

Exhibit 29 Pollutant Releases (Short Tons/Year) 66

Exhibit 30 Summary of 1993 TRI Data: Releases and Transfers by Industry 68

Exhibit 31 Toxic Release Inventory Data for Selected Industries 69

Exhibit 32 Scrap Tire Usage 78

Exhibit 33 Five Year Enforcement and Compliance Summary for the Rubber and Plastics Industries 102

Exhibit 34 Five Year Enforcement and Compliance Summary for Selected Industries 104

Exhibit 35 One Year Enforcement and Compliance Summary for Selected Industries 105

Exhibit 36 Five Year Inspection and Enforcement Summary by Statute for Selected Industries 106

Exhibit 37 One Year Inspection and Enforcement Summary by Statute for Selected Industries 107

Exhibit 38 Supplemental Environmental Projects 110

Exhibit 39 Rubber and Misc. Plastic Producers Participating in the 33/50 Program 113-117

RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30) 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

RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30)
LIST OF ACRONYMS (CONT'D)

NO_X -	Nitrogen Oxide
NPDES -	National Pollution Discharge Elimination System (CWA)
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

RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30)

I. INTRODUCTION TO 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$ense Bulletin Board or the Enviro$ense 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$ense 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 RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS INDUSTRY

This section provides background information on the size, geographic distribution, employment, production, sales, and economic condition of the Rubber and Plastics Products industry. The type 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 rubber and miscellaneous plastics products industry, as defined by the Standard Industrial Classification (SIC) code 30, includes establishments that manufacture products from plastic resins, natural and synthetic rubber, reclaimed rubber, gutta percha, balata, and gutta siak. The production of the rubber mixture is commonly performed in facilities manufacturing rubber products and is covered under SIC 30; however, the production of plastic resins is not covered under SIC 30 because the majority of plastics product facilities manufacture products from pre-made resins purchased from plastic resin (polymer and resin) manufacturing facilities (SIC 28).

Although this SIC code covers most rubber and plastics products, some important rubber and plastics products are classified elsewhere. These products include boats, which are classified under SIC 37 (Transportation Equipment), and buttons, toys, and buckles, which are classified under SIC 39 (Miscellaneous Manufacturing Industries). Buttons, toys, and buckles are grouped according to the final product rather than by process because not all of these products are made out of rubber or plastic. The rubber and miscellaneous plastics products industry does include tire manufacture; however, because of the somewhat different processes involved, the recapping and retreading of automobile tires are classified under SIC 7534 and are not discussed in this profile.

Although SIC 30 groups rubber and plastics products together under some of the three-digit industry codes (e.g., rubber and plastic footwear under SIC 302), the majority of economic and process information separates plastic and rubber products. In addition, because tire manufacture accounts for such a large portion (almost 50 percent) of all rubber product manufacture, tire process and economic information is often discussed separately from that of

other rubber products. Therefore, for the purposes of this industry profile, plastics products, rubber products, and rubber tires are often discussed separately.

II.B. Characterization of the Rubber and Miscellaneous Plastics Products Industry

The following sections contain information about the size and distribution of rubber and miscellaneous plastics products facilities as well as information about the types of products produced by these facilities. Also included is a discussion of the current and projected economic trends for the rubber and miscellaneous plastics products 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 Bureau of the Census estimates that in 1987, 597,900 people were employed by the plastics products industry and 231,700 were employed by the rubber products industry of which the tire industry employed 65,400. The value of shipments (revenue associated with product sales) totaled $61.6 billion in 1987 for the plastics products industry and $24.8 billion for the rubber products industry of which the tire industry contributed $10.5 billion. 1992 Census Data for SIC 30 was not available at the time of this printing.

Plastic

Because of the wide range of products produced, plastics products are manufactured in all parts of the country. According to the 1987 Census of Manufacturers, the total number of plastics products establishments (with 20 or more employees) was 5,999. Of these facilities, approximately 72 percent have fewer than 50 employees and only one percent have more than 500 employees (see Exhibit 1). Although these facilities are not concentrated in any particular region, a few States account for a large percentage of the facilities. These States include California, Ohio, Texas, Illinois, New York, Pennsylvania, New Jersey, and Michigan (see Exhibit 2).

Exhibit 1

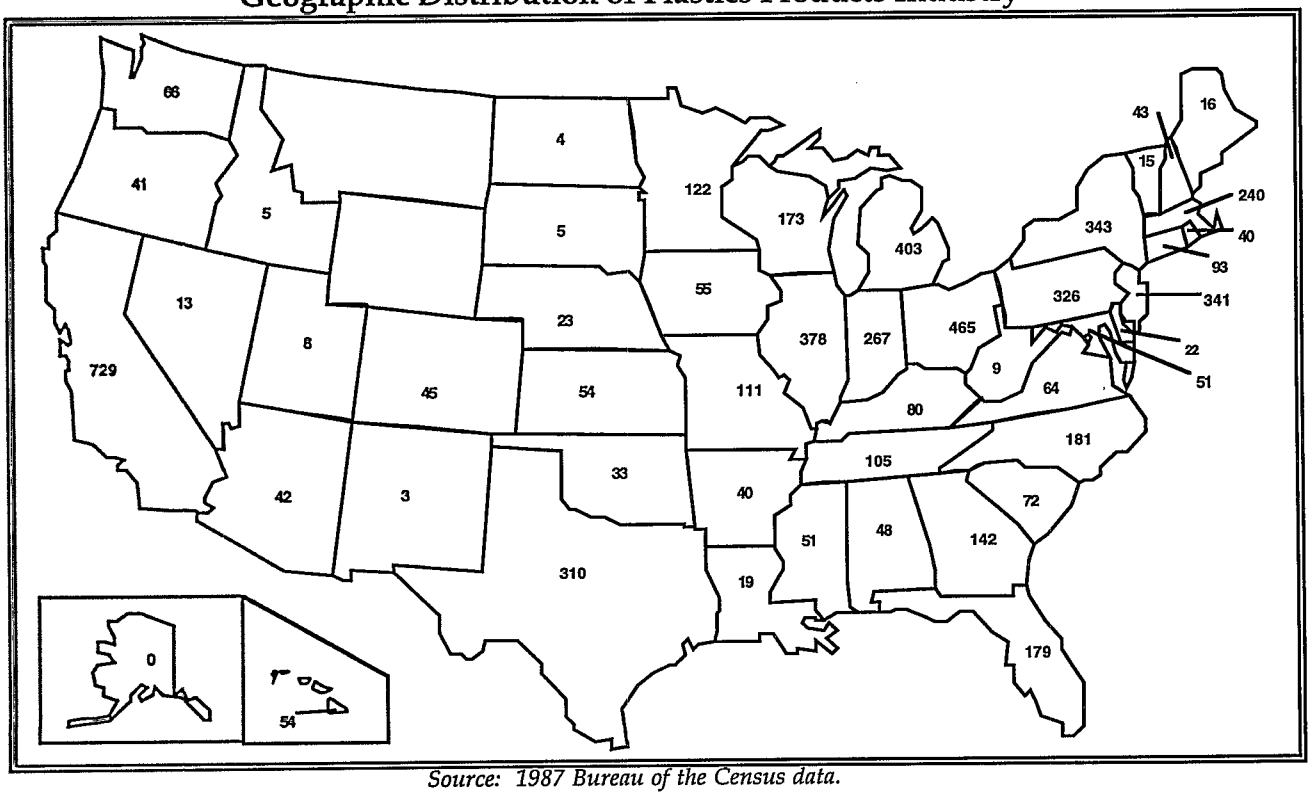
Facility Size Distribution of Plastics Products Industry

Employees per Facility	Number of Facilities	Percentage of Facilities
1 to 4	2473	20
5 to 9	1581	13
10 to 19	1991	16
20 to 49	2729	23
50 to 99	1688	14
100 to 249	1190	10
250 to 499	301	3
500 to 999	80	1
1,000 to 2,499	10	0 (0.08)
2,500 or more	1	0 (0.008)
Total	12,044	100

Source: 1987 Bureau of the Census data.

Exhibit 2

Geographic Distribution of Plastics Products Industry



Source: 1987 Bureau of the Census data.

Rubber

Like the plastic industry, the rubber industry produces a wide range of products. Rubber product manufacturing establishments are located all across the country. According to the 1987 Census of Manufacturers, the total number of establishments (with 20 or more employees) was 1,204. Of these facilities, approximately 70 percent have fewer than 50 employees, and only three percent have more than 500 employees (see Exhibit 3). Although these facilities are not concentrated in any particular region, a few States account for a large percentage of the facilities. These States include California, Ohio, North Carolina, Indiana, Michigan, Illinois, Massachusetts, and Texas (see Exhibit 4).

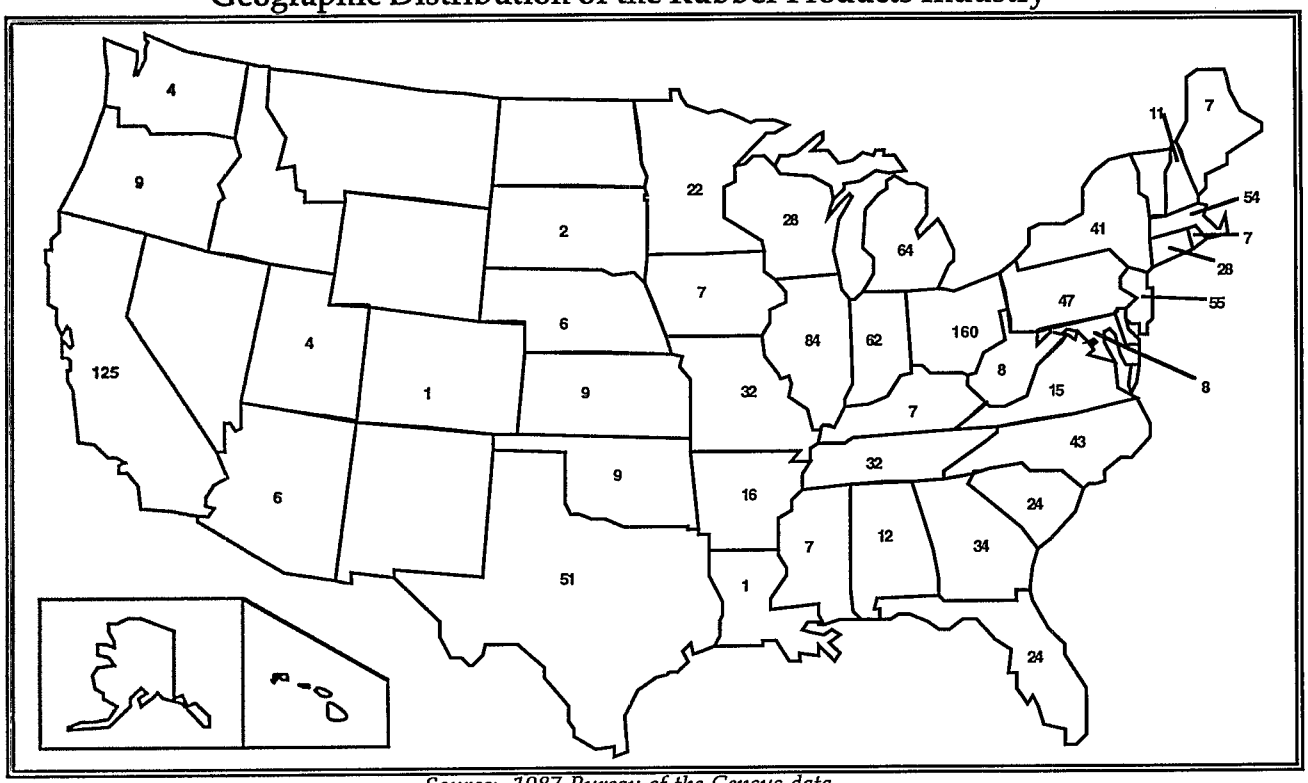
Exhibit 3

Facility Size Distribution of the Rubber Products Industry

Employees per Facility	Number of Facilities	Percentage of Facilities
1 to 4	451	19
5 to 9	335	14
10 to 19	390	16
20 to 49	505	21
50 to 99	306	13
100 to 249	228	9
250 to 499	117	5
500 to 999	36	2
1,000 to 2,499	12	1
Total	2,380	100

Source: 1987 Bureau of the Census data.

Exhibit 4
Geographic Distribution of the Rubber Products Industry



Source: 1987 Bureau of the Census data.

Tires

Labor costs currently represent about 30 percent of the cost of tire and tube production for U.S. manufacturers. To keep these labor costs as low as possible, tire manufacturing plants are located primarily in southern States where labor rates are lower than the national average.

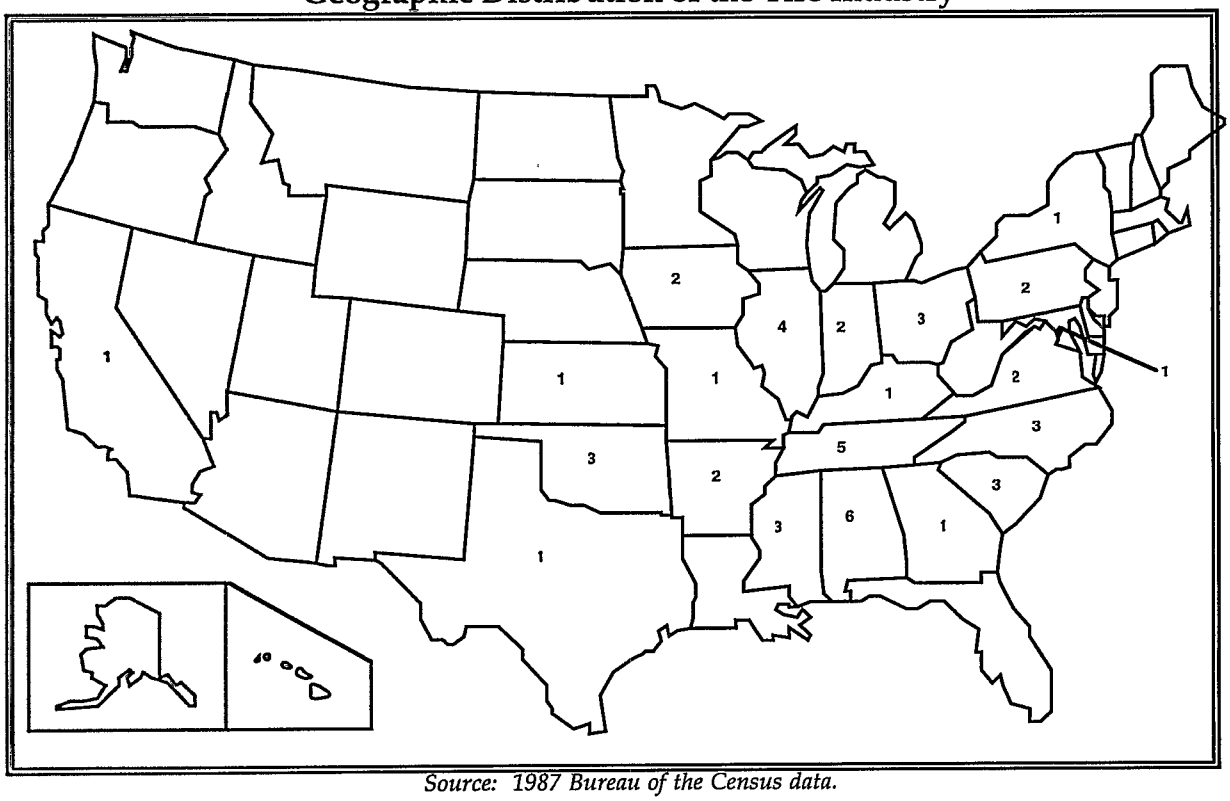
Exhibit 5
Facility Size Distribution of the Tire Industry

Employees per Facility	Number of Facilities	Percentage of Facilities
1 to 4	31	19
5 to 9	17	10
10 to 19	18	11
20 to 49	19	12
50 to 99	8	5
100 to 249	20	12
250 to 499	13	8
500 to 999	9	6
1,000 to 2,499	23	14
2,500 or more	5	3
Total	163	100

Source: 1987 Bureau of the Census data.

There are 47 tire manufacturing plants in the United States. These plants are located in 20 states. States that account for a large percentage of facilities include Alabama, Illinois and Tennessee.

Exhibit 6
Geographic Distribution of the Tire Industry

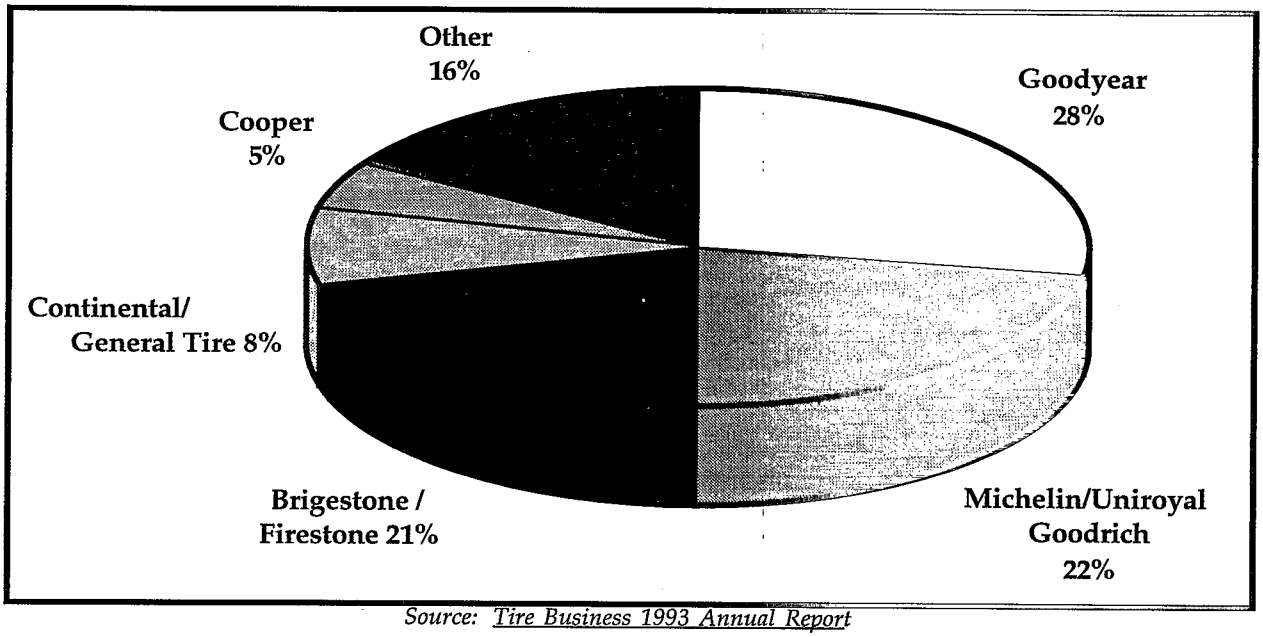


Source: 1987 Bureau of the Census data.

The two largest producers of tires, Goodyear and Michelin, accounted for approximately 55 percent of tire production in 1992. The five largest producers, Goodyear, Michelin, Bridgestone/Firestone, Continental/General Tire, and Cooper, accounted for 84 percent of production, while the eight largest companies produced 97 percent of the domestic product (see Exhibit 7).

Exhibit 7

North American Tire Sales



Source: Tire Business 1993 Annual Report

II.B.2. Product Characterization

The Bureau of the Census' SIC 30 divides the rubber and miscellaneous plastics products into industry groups according to the type of product manufactured. The following is a list of all the three digit industry groups under SIC 30:

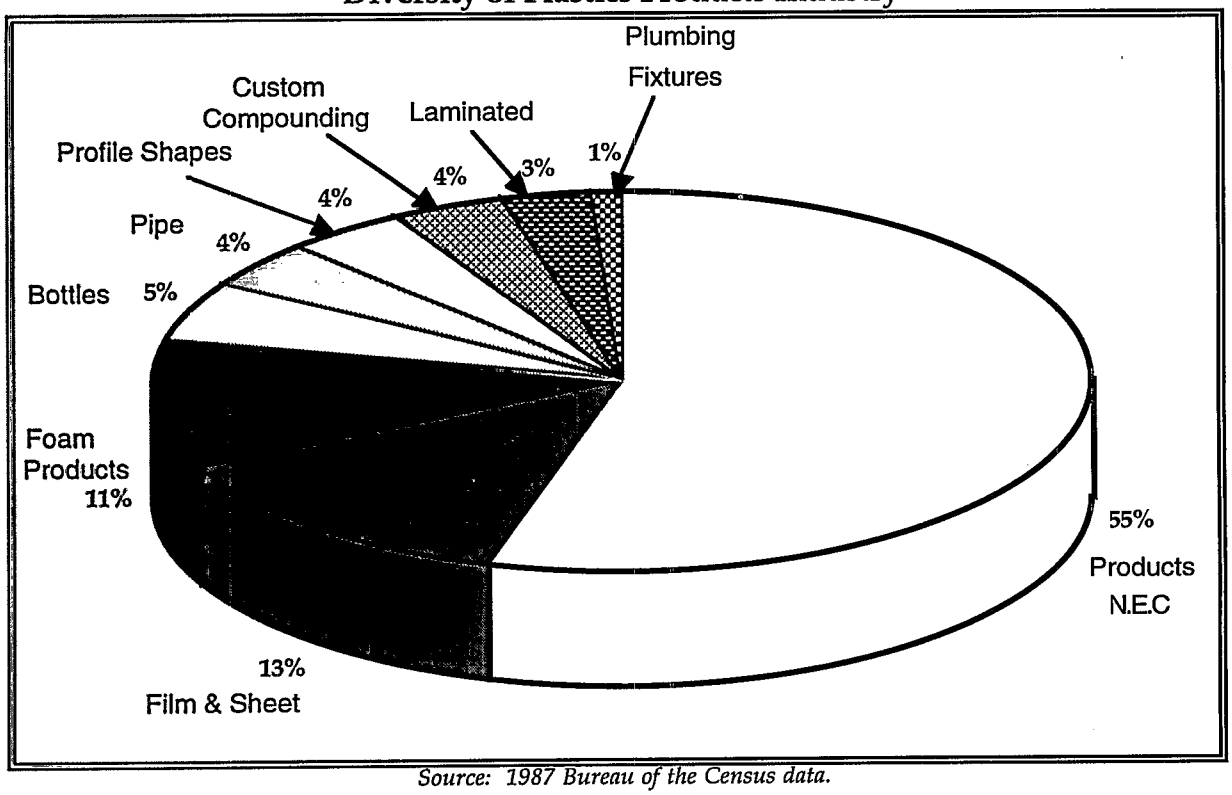
SIC 301 - Tires and Inner Tubes
SIC 302 - Rubber and Plastic Footwear
SIC 305 - Gaskets, Packing, and Sealing Devices and Rubber and Plastic Hose and Belting
SIC 306 - Fabricated Rubber Products, Not Elsewhere Classified
SIC 308 - Miscellaneous Plastics products

Several of these three digit classifications group rubber and plastics products. However, the four digit classifications clearly segregate the two industries. The following are four digit SIC code breakdowns of the plastic and rubber products industries. In the plastic industry, Plastics products, Not Elsewhere Classified (NEC) (SIC 3089) account for approximately 55 percent of all plastic product production. Unsupported Plastic Film and Sheet (SIC 3081) account for approximately 13 percent; Plastic Foam Products (SIC 3086) account for approximately 11 percent; Plastic Bottles (SIC 3085) account for approximately five percent; Plastic Pipe (SIC 3084), Unsupported Plastic Profile Shapes (SIC 3082), and Custom Compounding of

Purchased Plastic Resins (SIC 3087) account for approximately four percent each; Laminated Plastic Plate, Sheet, and Profile Shapes (SIC 3083) account for approximately three percent; and Plastic Plumbing Fixtures (SIC 3088) for approximately one percent (see Exhibit 8).

Exhibit 8

Diversity of Plastics Products Industry

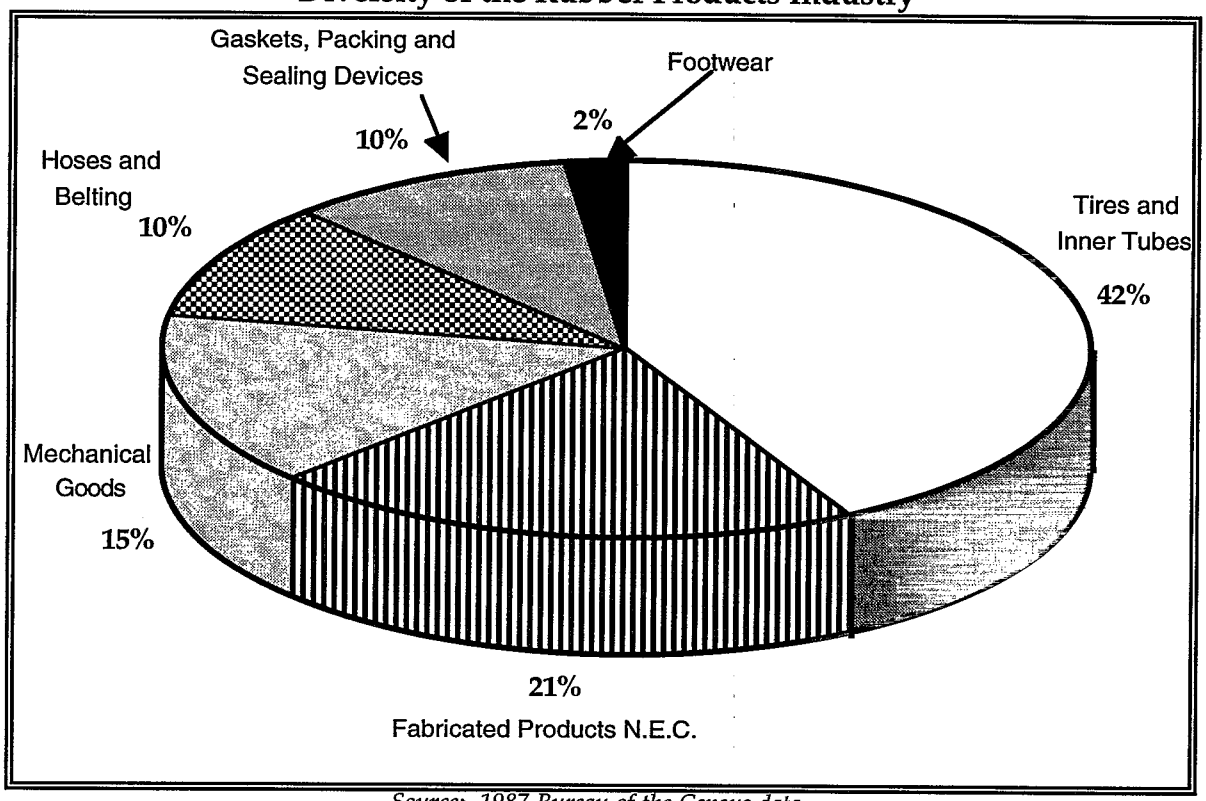


Source: 1987 Bureau of the Census data.

In the rubber industry, Tire and Inner Tube (SIC 3011) manufacture accounts for approximately 42 percent of all rubber product production. Fabricated Rubber Products Not Elsewhere Classified (SIC 3069) account for approximately 21 percent; Molded, Extruded, and Lathe-Cut Mechanical Rubber Goods (SIC 3061) account for approximately 15 percent; Rubber and Plastic Hose and Belting (SIC 3052), and Gaskets, Packing, and Sealing Devices (SIC 3053) account for approximately 10 percent; and Rubber and Plastic Footwear (SIC 3021) account for two percent (see Exhibit 9).

Exhibit 9

Diversity of the Rubber Products Industry



Source: 1987 Bureau of the Census data.

II.B.3. Economic Trends

Plastic

Consumption of plastics products is highest in the electronics, health care, construction, transportation, automotive, and food packaging industries. According to the 1994 U.S. Industrial Outlook, shipments of miscellaneous plastics products are expected to grow by five percent in 1994, largely as a result of stronger consumer confidence and spending, and expected increases in demand from the electronics and health care sectors. Highest growth is expected to be for molded and extruded products.

In 1992, U.S. exports of plastics products (approximately $4.5 billion) slightly exceeded imports (approximately $4.3 billion). The bulk of U.S. imports in 1993 came from Canada, Taiwan, China, and Japan. The value of the total trade turnover (sum of imports plus exports) amounted to approximately 13.5 percent of total industry shipments, domestic and foreign, in 1993. U.S. plastics products exports compete favorably against lower cost producers in many

third-country markets. [Note: This data excludes the bottles and plumbing equipment/parts sectors of the industry.]

Rubber

The value of all products and services sold in the rubber products industry is forecasted to grow three percent in 1994, largely reflecting expected increases in the tire manufacturing sector's use of fabricated rubber products, as well as higher consumer spending. Higher than average growth is expected for automobiles (i.e., hoses, belts, etc.).

Trading patterns reflect the U.S. rubber industry's position as a moderately competitive producer; the U.S. is both a major exporter to industrialized nations and an importer of lower-cost products from industrializing countries. Imports continue to make inroads in the domestic market and stand at a nearly 2:1 ratio to exports. Two-way trade relative to total industry shipments remains stable, at about one-fifth of total industry shipments.

Tires

The tire industry shows signs of stabilizing after undergoing a period characterized by massive restructuring, the effects of recession in the domestic market, and consistently high levels of imports. With tire durability pushed to what many consider the practical limit, industry strategy has shifted to servicing the fast-growing emerging markets for high-performance, light truck, and recreational vehicle (RV) tires.

The tire industry grew at an average rate of 2.5 percent until 1990, at which point there was a slight decrease in growth. Industry shipments reached record levels in 1994, with higher than average growth expected for the high-performance, truck, and light truck tires and little or no growth projected for passenger tires installed on new cars.

Imports continued to outpace exports in the tire industry at a ratio of nearly 2:1 in 1993. However, since 1989, a steady growth of exports has slowly cut into this negative net trade position. The foreign trade sector of the industry is stable, as evidenced by several consecutive years when the ratio of combined exports and imports to overall industry shipments remained relatively constant. Canada is now the U.S.' largest trading partner, absorbing 40 percent of total U.S. exports, while supplying approximately 30 percent of imports in 1992. The two other top recipients of U.S. exports are

Mexico and Japan, while Japan, South Korea, and Canada, produce the majority of tires imported by the United States.

During the 1980's, corporate restructuring and mergers and acquisitions resulted in the globalization of the tire industry. Almost one-half of domestic production capacity is now owned by foreign-based tire manufacturers, mainly European and Japanese. Among the advantages realized by the surviving companies are increased resources for research and development, and economies of scale across procurement, manufacturing, distribution, and service.

All four of the major tire producers in the U.S. are involved in the production of the synthetic rubber used in tire production, and two of these producers own and operate natural rubber plantations. More than 80 percent of the sales revenue of the four major producers (both foreign and domestic) is derived from tires and related transportation products such as rubber belts and hoses.

III. INDUSTRIAL PROCESS DESCRIPTION

This section describes the major industrial processes within the Rubber and Miscellaneous Plastics 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.

This section specifically contains a description of commonly used production processes, 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, provide 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 Rubber and Miscellaneous Plastics Products Industry

The production of plastics products, both solid and foam, is a relatively diverse industry. Simpler processes consist of: (1) imparting the appropriate characteristics to the plastic resin with chemical additives; (2) converting plastic materials in the form of pellets, granules, powders, sheets, fluids or preforms into either intermediate or final formed plastic shapes or parts via molding operations; and (3) finishing the product (see Exhibit 10).

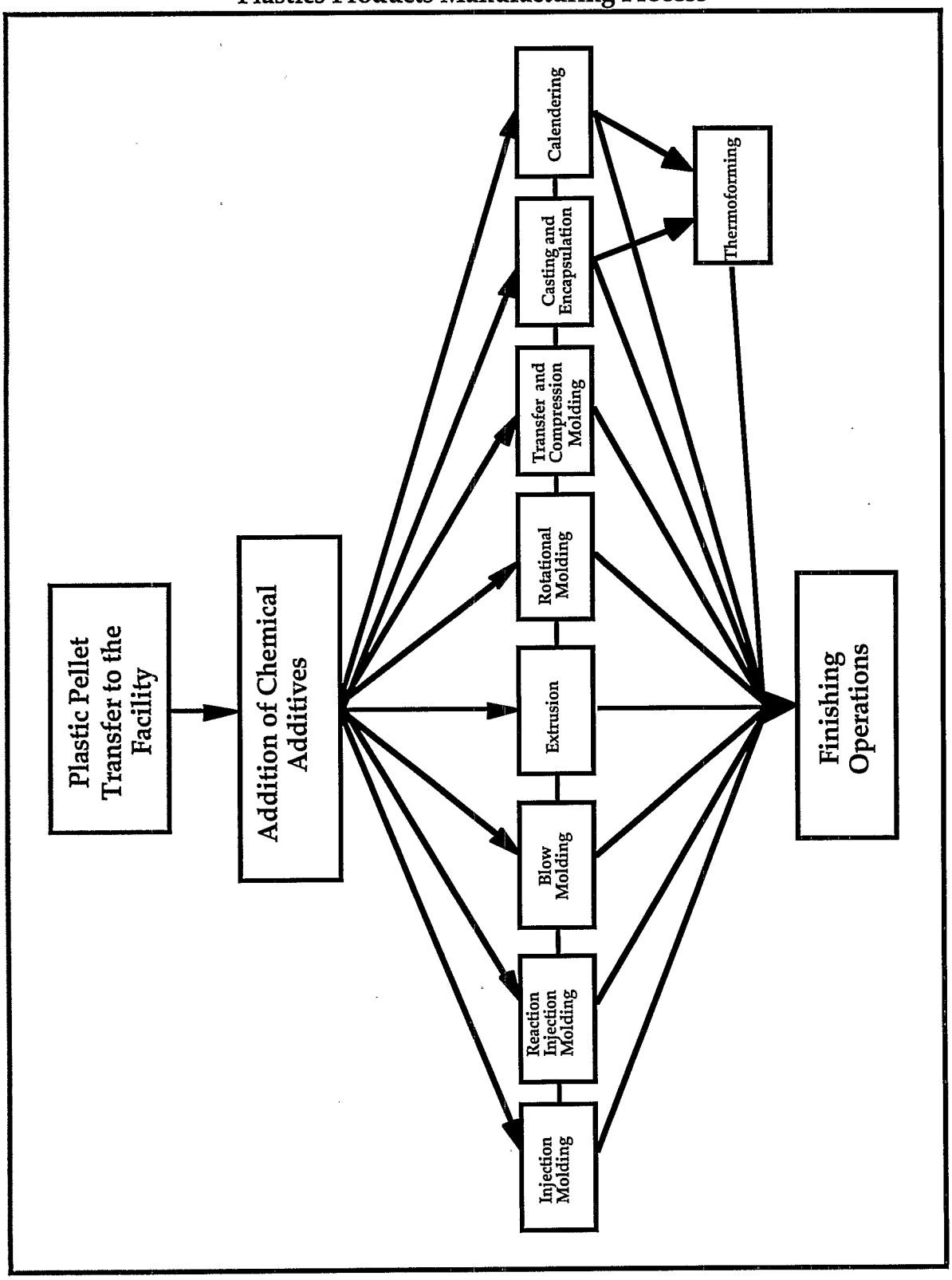
There are also several methods of reacting plastic resin and catalyst materials to form a thermoset plastic material into its final shape. (see Exhibit 11).

Plastic

Additives are often mixed with the plastic materials to give the final product certain characteristics (some of these additives can also be applied to the shaped product during the finishing process). These plastic additives and their functions, in terms of their effect on the final product, are listed below.

- **Additive Lubricants** assist in easing the flow of the plastic in the molding and extruding processes by lubricating the metal surfaces that come into contact with the plastic.
- **Antioxidants** inhibit the oxidation of plastic materials that are exposed to oxygen or air at normal or high temperatures.
- **Antistats** impart a minimal to moderate degree of electrical conductivity to the plastic compound, preventing electrostatic charge accumulation on the finished product.
- **Blowing Agents (foaming agents)** produce a cellular structure within the plastic mass and can include compressed gases that expand upon pressure release, soluble solids that leach out and leave pores, or liquids that change to gases and in the process develop cells.
- **Colorants** impart color to the plastic resin.
- **Flame Retardants** reduce the tendency of the plastic product to burn.
- **Heat Stabilizers** assist in maintaining the chemical and physical properties of the plastic by protecting it from the effects of heat such as color changes, undesirable surface changes, and decreases in electrical and mechanical properties.
- **Impact Modifiers** prevent brittleness and increase the resistance of the plastic to cracking.
- **Organic Peroxides** initiate or control the rate of polymerization in thermosets and many thermoplastics.
- **Plasticizers** increase the plastic product's flexibility and workability.
- **Ultraviolet Stabilizers (UV light absorbers)** absorb or screen out ultra-violet radiation thereby preventing the premature degradation of the plastic product.

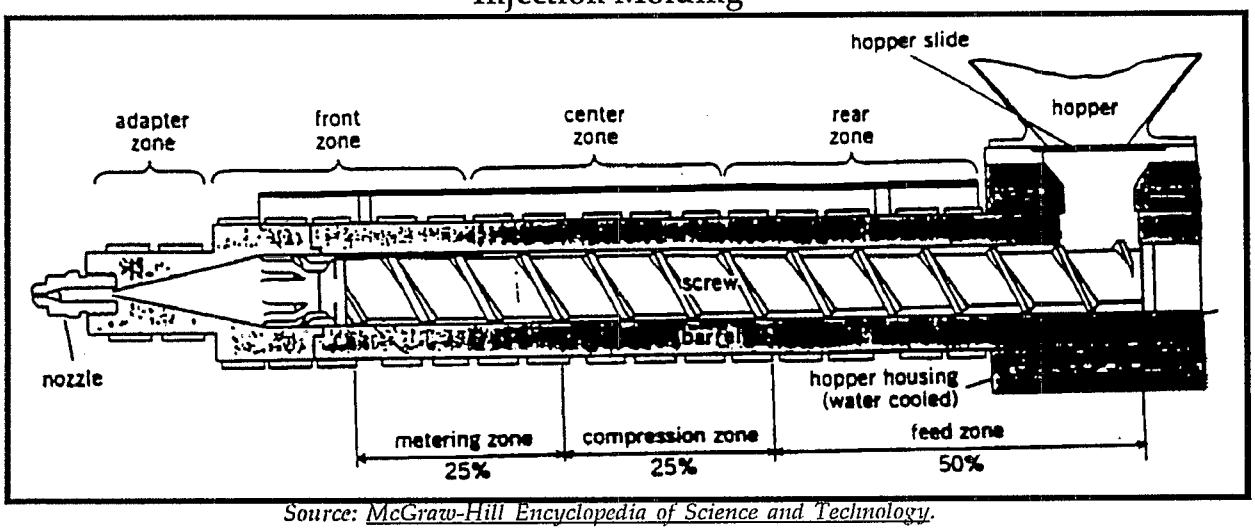
Exhibit 10
Plastics Products Manufacturing Process



After adding the necessary additives to the plastic pellets, granules, powders, etc., the plastic mixture is formed into intermediate or final plastics products. A variety of molding processes are used to form solid plastics products. These processes include injection molding, reaction injection molding, extrusion, blow molding, thermoforming, rotational molding, compression molding, transfer molding, casting, encapsulation, and calendering. Foamed plastics products are made using slightly different processes then those used to make solid plastics products. The choice of which plastic forming process to use is influenced by economic considerations, the number and size of finished parts, the adaptability of particular plastic to a process (various plastic will mold, process, etc., differently) and the complexity of the post-forming operations. Below are brief descriptions of the most common molding and forming processes for creating solid plastics products.

Injection Molding: In the injection molding process, plastic granules or pellets are heated and homogenized in a cylinder until they are fluid enough to be injected (by pressure) into a relatively cold mold where the plastic takes the shape of the mold as it solidifies. Advantages of this process include speed of production, minimal post-molding requirements, and simultaneous multi-part molding. The reciprocating screw injection machine is the dominate technology used in injection molding. The screw acts as both a material plasticizer and an injection ram. The buildup of viscous plastic at the nozzle end of a cylinder forces the screw backwards as it rotates. When an appropriate charge is accumulated, rotation stops and the screw moves forward, thereby becoming an injection ram, forcing the melt (liquefied plastic) into the mold. The screw remains forward until the melt solidifies and then returns to repeat the cycle (see Exhibit 11).

Exhibit 11
Injection Molding

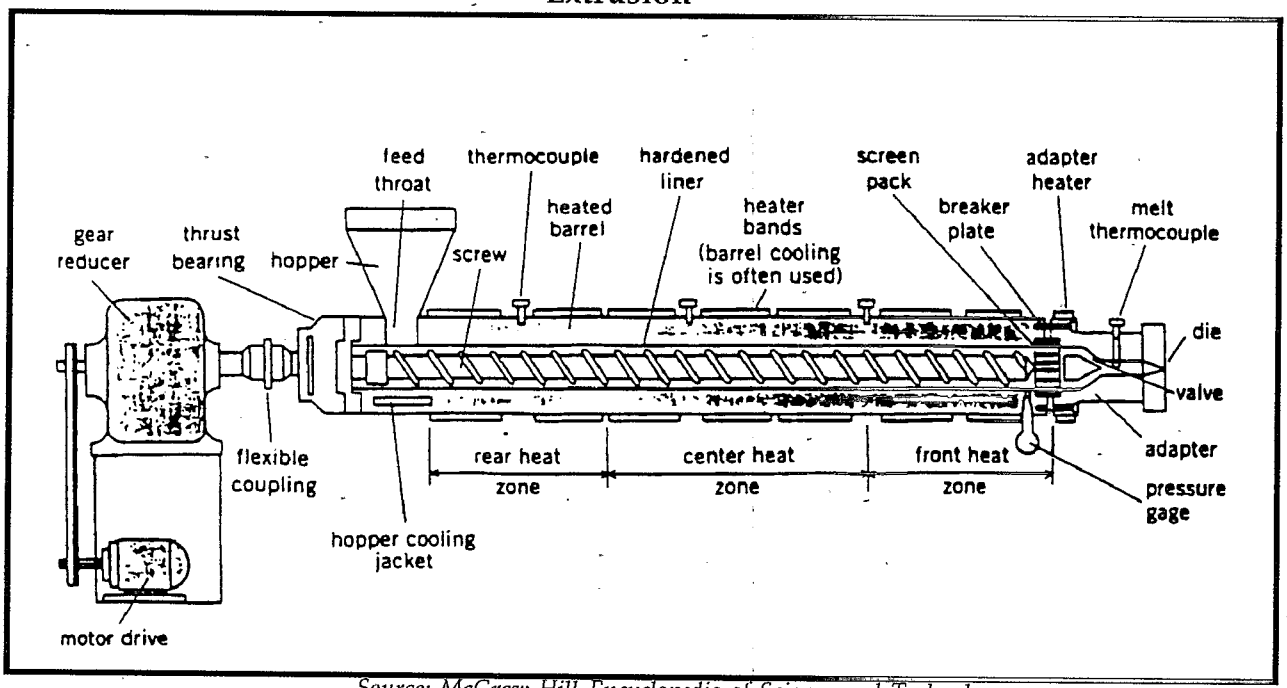


Source: McGraw-Hill Encyclopedia of Science and Technology.

Reaction Injection Molding: In the reaction injection molding process, two liquid plastic components, polyols and isocyanates, are mixed at relatively low temperatures (75 - 140 degrees F) in a chamber and then injected into a closed mold. Reaction Injection Molding requires far less energy than other injection molding systems because an exothermic reaction occurs when the two liquids are mixed. Reaction injection molding is a relatively new processing method that is quickly becoming common in the industry.

Extrusion: In the extrusion process, plastic pellets or granules are fluidized, homogenized, and formed continuously as the extrusion machine feeds them through a die (see Exhibit 12). The result is a very long plastic shape such as a tube, pipe, sheet, or coated wire. Extruding is often combined with post extruding processes such as blowing, thermoforming, or punching. Extrusion molding has an extremely high rate of output, for example, pipe can be formed at a rate of 2000 lb/hr (900 kg/hr).

Exhibit 12
Extrusion

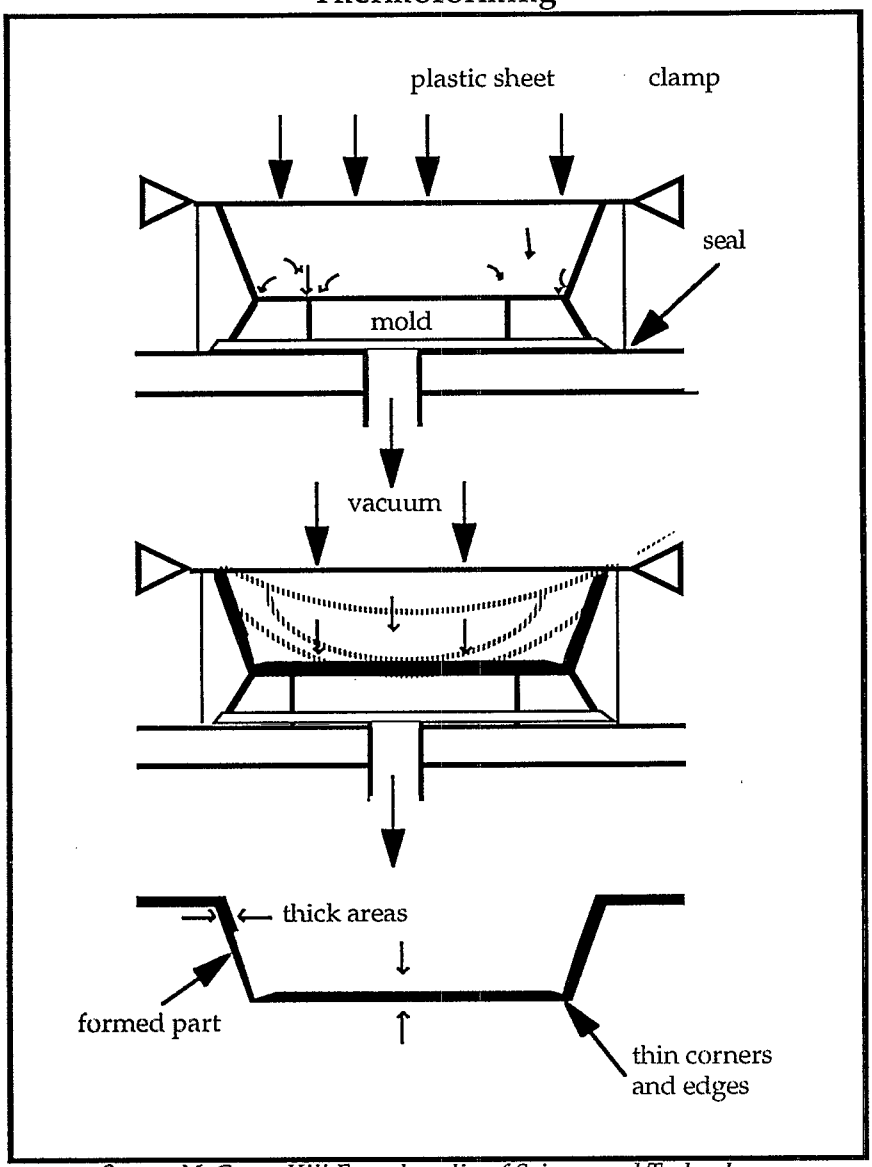


Source: McGraw-Hill Encyclopedia of Science and Technology.

Blow Molding: Blow molding describes any forming process in which air is used to stretch and form plastic materials. In one method of blow molding, a tube is formed (usually by extrusion molding) and then made into a free-blown hollow object by injecting air or gas into the tube. Blow molding can also consist of putting a thermoplastic material in the rough shape of the desired finished product into a mold and then blowing air into the plastic until it takes the shape of the mold, similar to blowing up a balloon.

Thermoforming: In the thermoforming process heat and pressure are applied to plastic sheets which are then placed over molds and formed into various shapes. The pressure can be in the form of air, compression, or a vacuum (see Exhibit 13). This process is popular because compression is relatively inexpensive.

Exhibit 13
Thermoforming



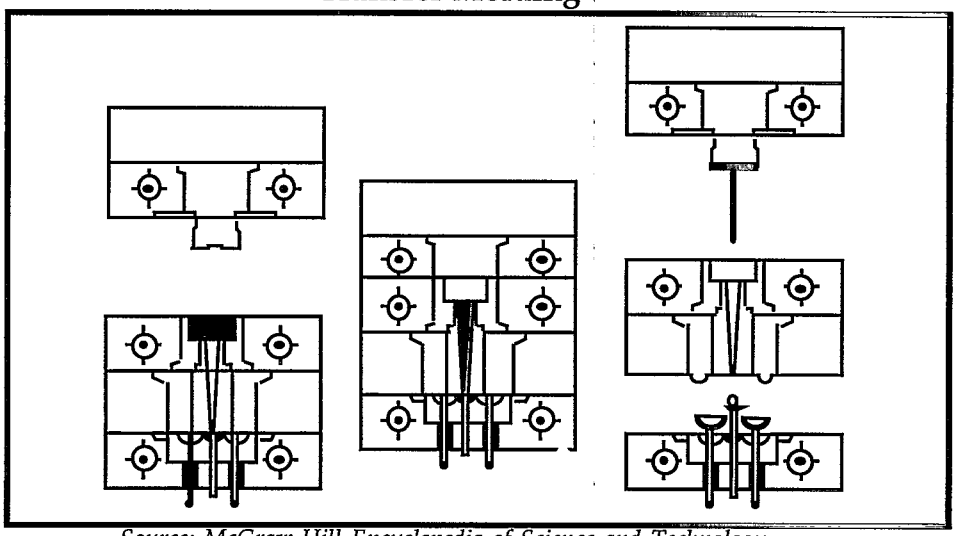
Source: McGraw-Hill Encyclopedia of Science and Technology.

Rotational Molding: In the rotational molding process, finely ground plastic powders are heated in a rotating mold to the point of either melting and/or fusion. The inner surface of the rotating mold is then evenly coated by the melted resin. The final product is hollow and produced scrap free.

Compression and Transfer Molding: In the compression molding process, plastic powder or a preformed plastic part is plugged into a mold cavity and compressed with pressure and heat until it takes

the shape of the cavity. Transfer molding is similar, except that the plastic is liquefied in one chamber and then injected into a closed mold cavity by means of a hydraulically operated plunger (see Exhibit 14). Transfer molding was developed to facilitate the molding of intricate plastics products which contain small deep holes or metal inserts because compression molding often ruins the position of the pins which form the holes and the metal inserts.

Exhibit 14
Transfer Molding



Source: McGraw-Hill Encyclopedia of Science and Technology.

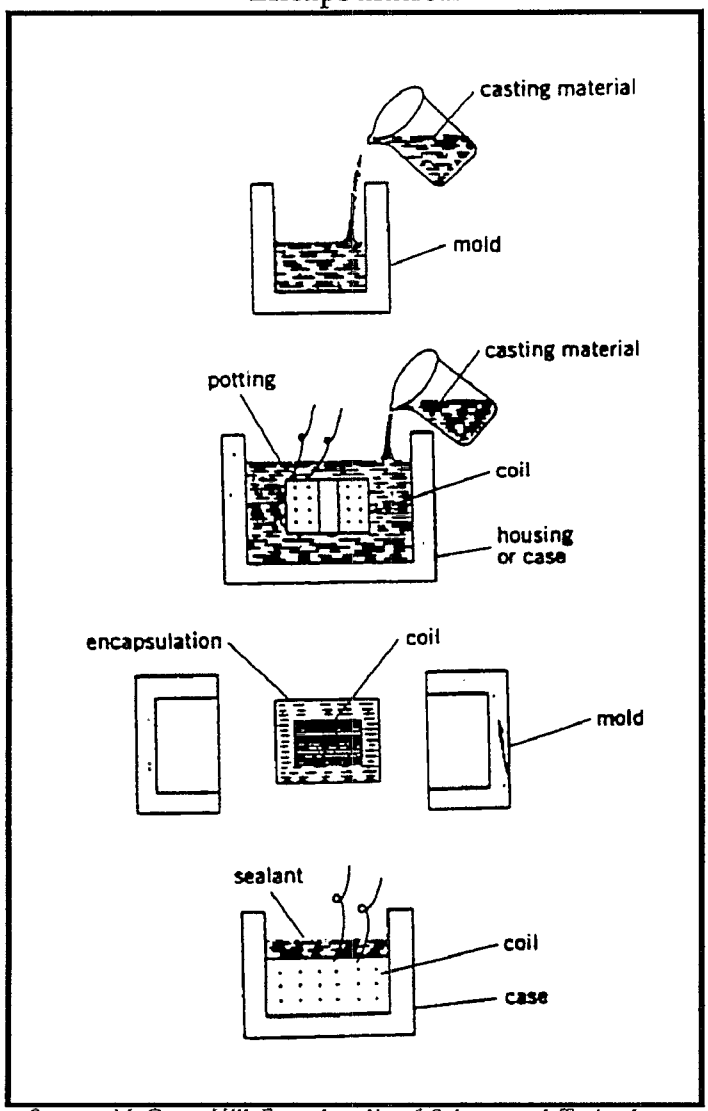
Casting and Encapsulation: In the casting process, liquid plastic is poured into a mold until it hardens and takes the shape of the mold. In the encapsulation or potting process, an object is encased in plastic and then hardened by fusion or a chemical reaction (see Exhibit 15).

Calendering: In the calendering process, plastic parts are squeezed between two rolls to form a thin, continuous film.

The manufacture of foamed plastics products involves slightly different forming processes than those described above. The three types of foam plastic are blown, syntactic, and structural. Blown foam is an expanded matrix, similar to a natural sponge; syntactic foam is the encapsulation of hollow organic or inorganic micro spheres in the plastic matrix; and structural foam is a foamed core surrounded by a solid outer skin. All three types of foam plastic can be produced using processes such as injection, extrusion, and compression molding to create foam products in many of the same shapes as solid plastics products. The difference is that creating

foam products requires processes such as the addition of chemical blowing agents, different mixing processes which add air to the plastic matrix, or a unique injection molding process used to make structural plastic.

Exhibit 15
Encapsulation



Source: McGraw-Hill Encyclopedia of Science and Technology.

The following are some basic processes which occur in conjunction with the standard molding and forming operations to produce blown foam plastic and syntactic foam plastic:

- Gas which is under pressure is injected into the melt and then expands during pressure relief;
- A low-boiling liquid (e.g., HCFC's or hydrocarbons) is incorporated into the plastic compound and volatilized through the exothermic heat of reaction;
- Non-chemical gas-liberating agents (adsorbed gas on finely divided carbon) are added to the resin mix and released during heating;
- Air is dispersed by mechanical means within the polymer (similar to whipping cream); or
- The external application of heat causes the expansion of small beads of thermoplastic resin containing a blowing agent.

Structural foam plastic is made by injection molding liquid resins that contain chemical blowing agents. Less mixture is injected into the mold than is needed to mold a solid plastic part. At first the injection pressure is very high, causing the blowing agent mixture to solidify against the mold without undergoing expansion. As the outer skin is formed, the pressure is reduced and the remaining resin expands to fill the remainder of the mold. Structural foam plastic parts have a high strength-to-weight ratio and often have three to four times greater rigidity than solid plastic molded parts of equal weight that are made of the same material.

After the solid or foam plastic shape is created, post forming operations such as welding, adhesive bonding, machining, applying of additives, and surface decorating (painting and metalizing) are employed to finish the product.

To produce a thermoset plastic material, liquid resins are combined with a catalyst. Resins used for thermoset plastic products include urethane resins, epoxy resins, polyester resins, and acrylic resins. Fillers are often added to the resin-catalyst mixture prior to molding to increase product strength and performance and to reduce cost. Most thermoset plastic products contain large amounts of fillers (up to 70% by weight). Commonly used fillers include mineral fibers, clay, glass fibers, wood fibers, and carbon black. After the thermoset material is created, a final or intermediate product can be molded.

Various molding options may be employed to create the intermediate or final thermoset product. These processes include

vacuum molding, press molding, rotational molding, hand lamination, casting and encapsulation, spray-up lamination, resin transfer molding, filament winding, injection molding; reaction injection molding, and pultrusion.

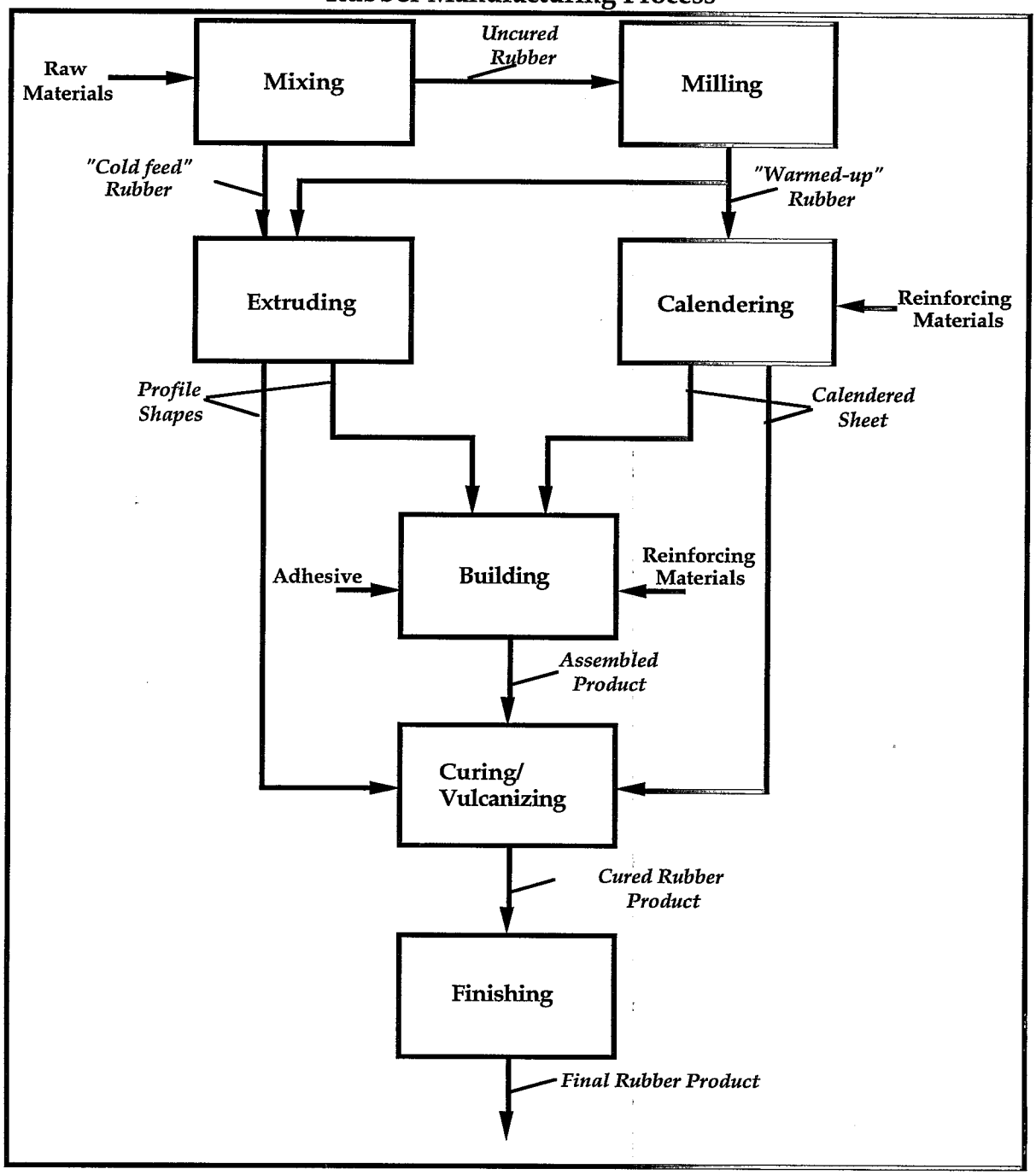
Rubber

Rubber product manufacture is as diverse as the number of rubber products produced. Even with this diversity, several basic, common processes are identifiable. This profile will focus on these basic processes: (1) mixing; (2) milling; (3) extruding; (4) calendering; (5) building; (6) vulcanizing; and (7) finishing (see Exhibit 16).

The rubber product manufacturing process begins with the production of a rubber mix from polymers (i.e., raw and/or synthetic rubber), carbon black (the primary filler used in making a rubber mixture), oils, and miscellaneous chemicals. The miscellaneous chemicals include processing aids, vulcanizing agents, activators, accelerators, age resistors, fillers, softeners, and specialty materials. The following is a list of these miscellaneous chemicals and the functions they perform:

- **Processing Aids** modify the rubber during the mixing or processing steps, or aid in a specific manner during the extrusion, calendering, or molding operations.
- **Vulcanizing Agents** create cross links between polymer chains.
- **Activators,** in combination with vulcanizing agents, reduce the curing time by increasing the rate of vulcanization.
- **Accelerators** form chemical complexes with activators and thus aid in obtaining the maximum benefits from the acceleration system by increasing vulcanization rates and improving the final product's properties.
- **Age Resistors** slow down the deterioration of the rubber products that occurs through reactions with materials that may cause rubber failure (i.e., oxygen, ozone, light, heat, radiation, etc.).
- **Fillers** reinforce or modify the physical properties of the rubber, impart certain processing properties, and reduce costs by decreasing the quantity of more expensive materials needed for the rubber matrix.

Exhibit 16
Rubber Manufacturing Process



- **Softeners** either aid in mixing, promote greater elasticity, produce tack, or extend (replace) a portion of the rubber hydrocarbon (without a loss in physical properties).

- **Specialty Materials** include retarders, colorants, blowing agents, dusting agents, odorants, etc. Specialty materials are used for specific purposes, and are not required in the majority of rubber compounds.

Rubber mixes differ depending upon the desired characteristics of the product being manufactured. Production of the rubber mixture involves weighing and loading the appropriate ingredients into an internal mixer known as a "Banbury" mixer which is used to combine these ingredients. The area where the chemicals are weighed and added to the banbury is called the compounding area. The polymers and miscellaneous chemicals are manually introduced into the mixer hopper, while carbon black and oils are often injected directly into the mixing chamber from bulk storage systems. The mixer creates a homogeneous mass of rubber using two rotors which shear materials against the walls of the machine's body. This mechanical action also adds considerable heat to the rubber.

The mixed rubber mass is discharged to a mill or other piece of equipment which forms it into a long strip or sheet. The hot, tacky rubber then passes through a water-based "anti-tack" solution which prevents the rubber sheets from sticking together as they cool to ambient temperature. The rubber sheets are placed directly onto a long conveyor belt which, through the application of cool air or cool water, lowers the temperature of the rubber sheets. The process of rubber mixing includes all of these steps - Banbury mixing, milling (or other means of sheeting), anti-tack coating, and cooling.

After cooling, the sheets of rubber are sent through another mill. These mills are used to "warm up" the rubber for further processing on extruders and calenders. Some extruders can be "cold fed" rubber sheets, making this milling step unnecessary.

Extruders transform the rubber into various shapes or profiles by forcing it through dies via a rotating screw. Extruding heats the rubber and the rubber remains hot until it enters a water bath or spray conveyor where cooling takes place. Calenders receive hot strips of rubber from mills and squeeze them into reinforcing fibers or cloth-like fiber matrices, thus forming thin sheets of rubber coated materials. Calenders are also used to produce non-reinforced, thickness controlled sheets of rubber.

Extruded and calendered rubber components are combined (layered, built-up) with wire, polyester, aramid, and other reinforcing materials to produce various rubber products. Adhesives, called

cements, are sometimes used to enhance the bonding of the various product layers. This assembling, reinforcing, pre-curing, and bonding process is referred to as building.

All rubber products undergo vulcanization (curing). Vulcanization is accomplished in heated compression molds, steam heated pressure vessels (autoclaves), hot air and microwave ovens, or various molten and fluidized bed units. During the curing process, the polymer chains in the rubber matrix cross-link to form a final product of durable, elastic, thermoset rubber. Increasing the number of cross-links in the rubber matrix gives rubber its elastic quality. One way to visualize this is to think of a bundle of wiggling snakes in constant motion. If the bundle is pulled at both ends and the snakes are not entangled, then the bundle comes apart. The more entangled the snakes are (like the rubber matrix after vulcanization), the greater the tendency for them to bounce back to their original shape.

Finishing operations may include grinding, printing, washing, wiping, and buffing.

As initially indicated, due to the diversity of products and facilities, not all of the processes shown in Exhibit 16 are necessary for every product. For example, many plants do not mix rubber but purchase uncured rubber from other facilities.

Exhibit 17 illustrates the processes used to manufacture the following rubber products:

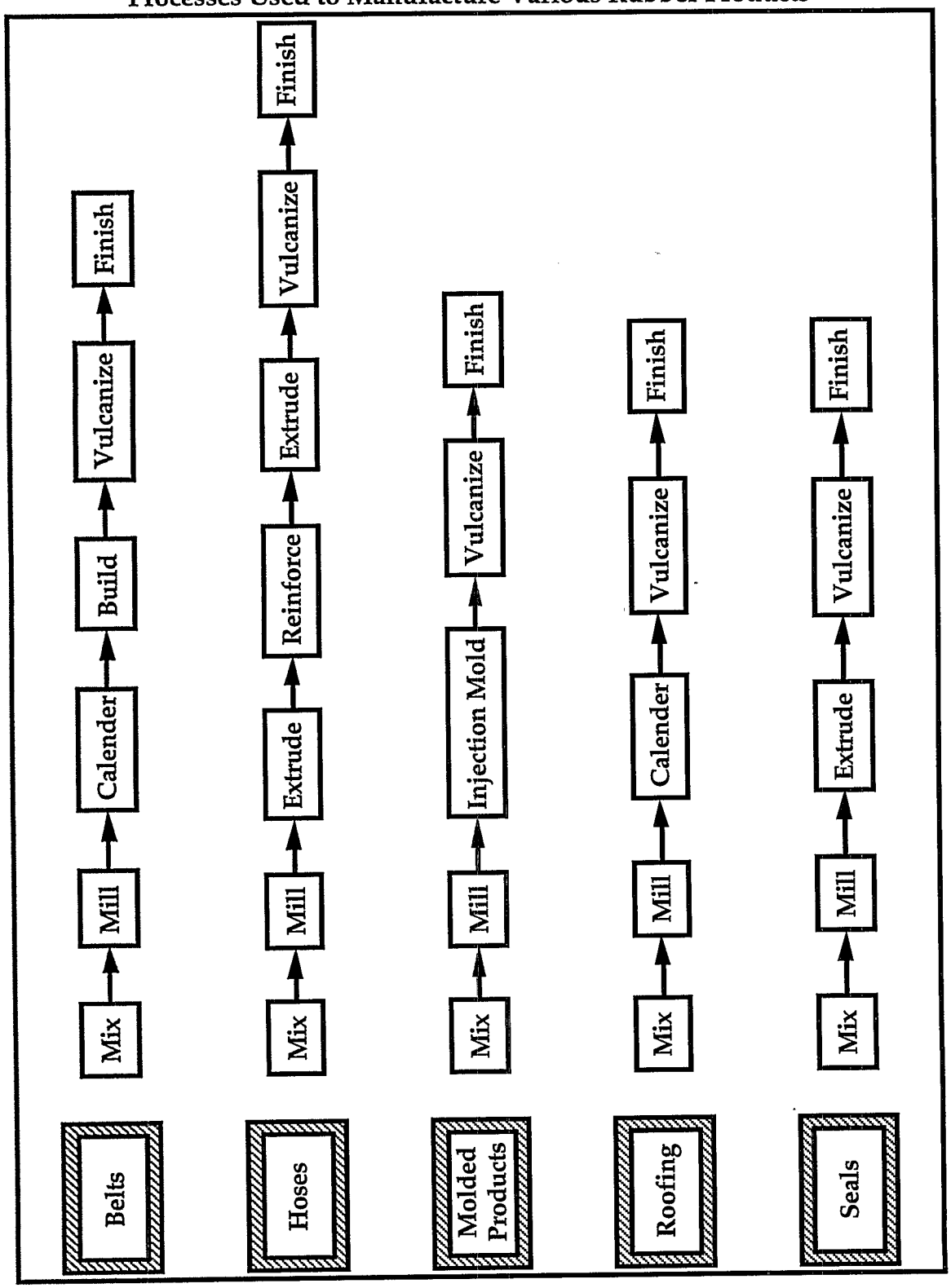
Belts - A typical belt plant will not have an extruder but will use many layers of calendered material assembled on a lathe type builder to produce a rubber cylinder from which individual belts can be cut.

Hoses - A hose plant will use an extruder to produce a tube which is reinforced with cord or wire and covered with a layer of rubber applied by an extruder. The same extruder may be used to produce the initial tube and then to extrude the final "cover" layer onto the reinforced tube.

Molded Products - A molded products plant will use extruded material to feed compression molds, or may cut strips directly from the mixing process to feed the molds.

Roofing - Roofing manufacturers will process rubber through mills and calenders to produce the necessary sheeting.

Exhibit 17
Processes Used to Manufacture Various Rubber Products



Sealing - Sealing, gasket like materials, will use extrusion and continuous vulcanization in hot air ovens.

Tires

The tire manufacturing process is similar to that of other rubber products. The main difference between the rubber product manufacturing process and the tire manufacturing process is that the building process is generally more complex because there are many rubber components.

The tire production process in its most basic form consists of: (1) compounding and mixing elastomers, carbon blacks, pigments, and other chemicals such as vulcanizing agents, accelerators, plasticizers, and initiators; (2) extruding the rubber mixture between pairs of large rollers to prepare it for the feed mill, where it is slit into strips to take the shape of the tread and sidewall materials; (3) processing fabrics and coating them with rubber in a calendering operation; (4) processing bead wires and coating them with rubber in an extruding process; (5) cutting and cooling the various extruded and calendered outputs; (6) assembling all of the components (bead wires, coated fabrics, treads, etc.) on a tire-building machine; (7) lubricating the green tire (green tire spraying) (8) vulcanizing and molding the tire with heat and pressure; and (9) finishing the product (see Exhibit 18).

The main component of tire-building is the drum which is a collapsible cylinder shaped like a wide drum that can be turned and controlled by the tire builder. The building process begins when carcass plies, also known as rubberized fabric, are placed on a drum one at a time, after which the cemented beads (rubber coated wires) are added and the plies are turned up around them. Narrow strips of fabric are then cemented on for additional strength. At this stage the belts, tread, and sidewall rubber are wrapped around the drum over the fabric. The drum is then collapsed and the uncured (green) tire is coated with a lubricant (green tire spray) and loaded into an automatic tire press to be molded and cured. Prior to curing, the tire looks like a barrel that is open at both ends. The curing process converts the rubber, fabric, and wires into a tough, highly elastic product while also bonding the various parts of the tire into one single unit (see Exhibit 19). After curing, the tire is cooled by mounting it on a rim and deflating it to reduce internal stress. Finishing the tire involves trimming, buffing, balancing, and quality control inspection.

Exhibit 18
Tire Manufacturing Process

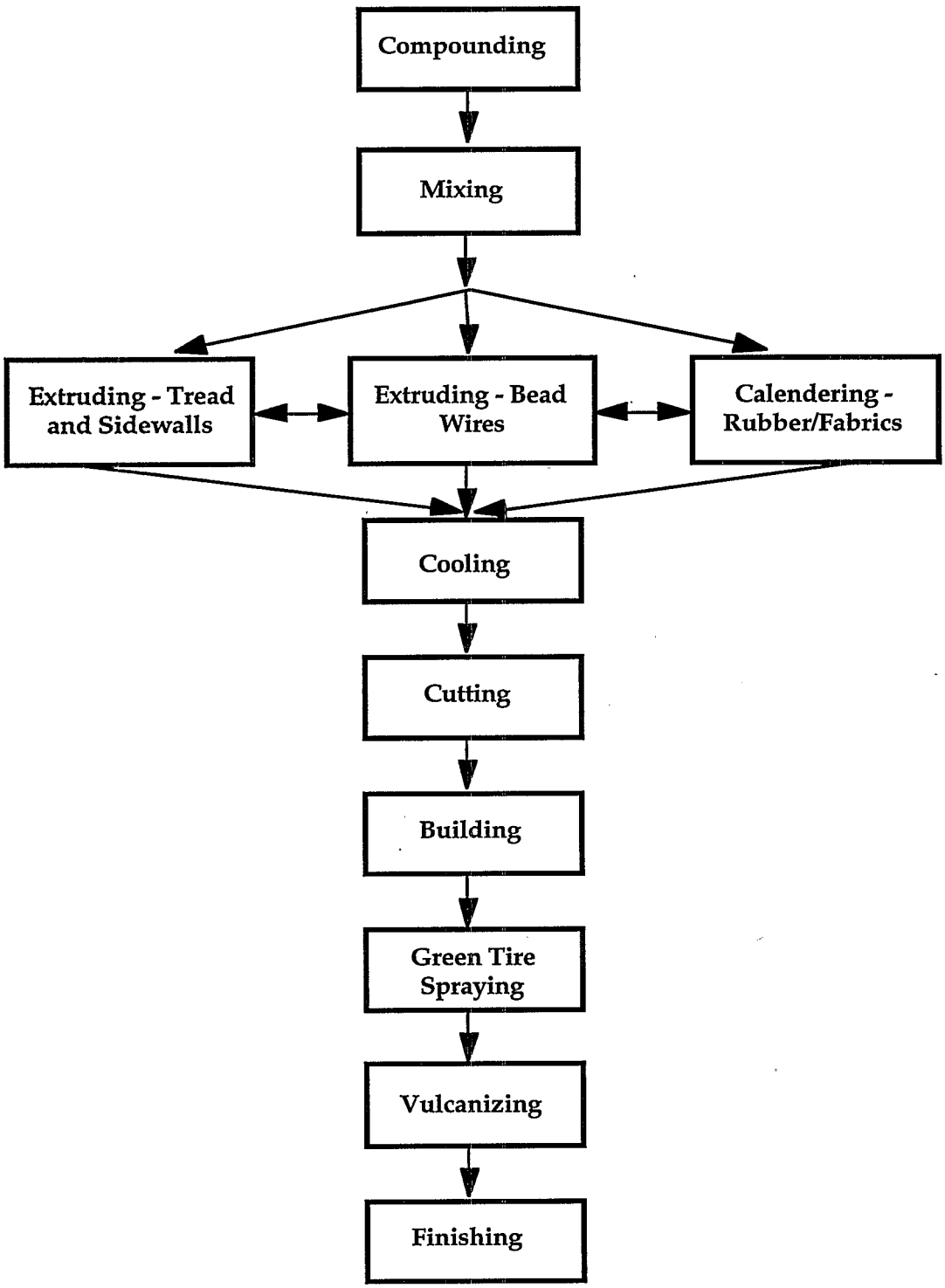
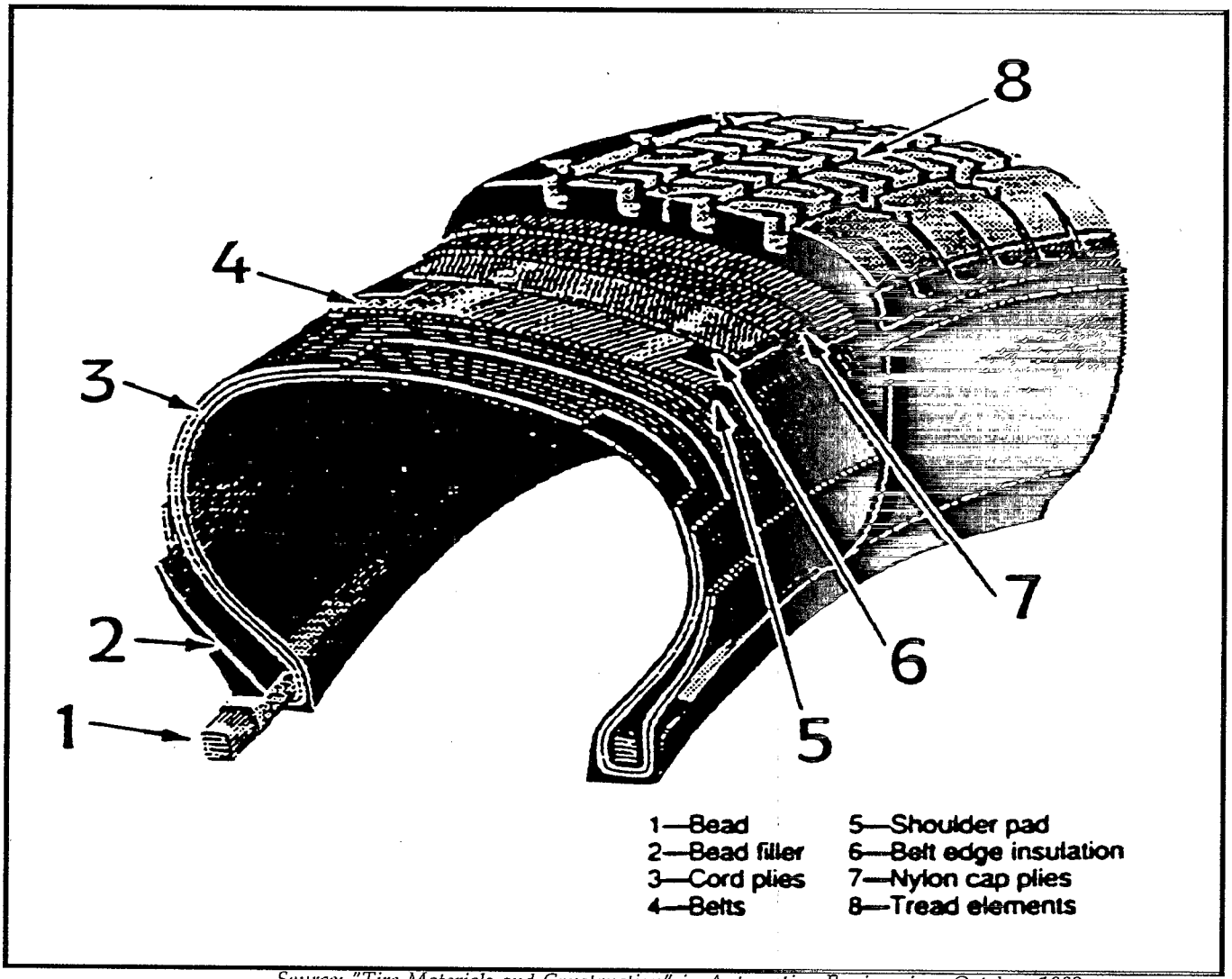


Exhibit 19
Tire Formation



Source: "Tire Materials and Construction" in Automotive Engineering, October, 1992.

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

Plastic

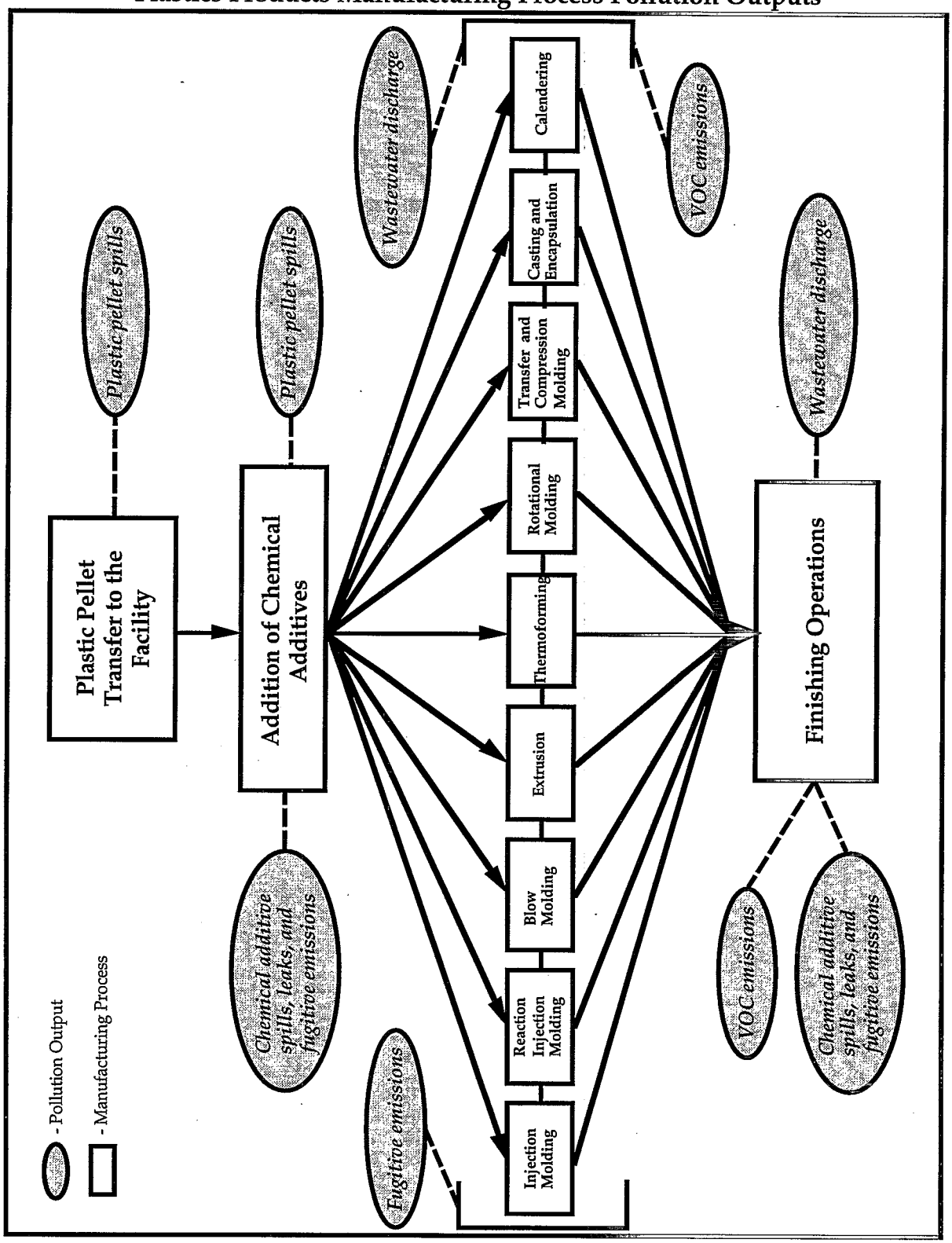
There are four general types of pollution and resource material outputs that can occur at one or more stages of the plastics product manufacturing process. In addition, there are some plastics products disposal concerns. Manufacturing outputs include spills, leaks, and fugitive emissions of chemicals during the application of additives prior to molding or during finishing; waste water discharges during cooling and heating, cleaning, and finishing operations; plastic pellet releases to the environment prior to molding; and fugitive emissions from molding and extruding machines (see Exhibit 20). Each of these is discussed below.

Chemicals

One concern during the plastic product manufacturing process is the potential release of the additive chemicals prior to molding and during the finishing process. Releases could be in the form of spills during weighing, mixing, and general handling of the chemicals, in the form of leaks from chemical containers and molding machines, or in the form of fugitive dust emissions from open chemical containers. It should be noted that not all plastic product manufacturers use additives because many purchased pellets already contain the necessary additives, making this pollution output irrelevant for many facilities. The chemicals used in the plastic product manufacturing process are usually added in such small amounts that most manufacturers do not consider them to be a problem; however, some of the additives could be toxic and therefore even small amounts could present significant problems. According to a National Enforcement Investigations Center (NEIC) inspector, the plastic industry is currently looking into the characteristics of the additives and their releases for possible environmental or worker safety issues. The following is a list of some of the typical chemicals used as additives in the plastics products manufacturing process:

- **Lubricants** - stearic acid, waxes, fatty acid esters, and fatty acid amines
- **Antioxidants** - alkylated phenols, amines, organic phosphites and phosphates, and esters
- **Antistats** - quaternary ammonium compounds, anionics, and amines

Exhibits 20
Plastics Products Manufacturing Process Pollution Outputs



- **Blowing/foaming agents** - azodicarbonamide, modified azos, OBSH, and HTBA
- **Colorants** - titanium dioxide, iron oxides, anthraquinones, and carbon black
- **Flame Retardants** - antimony trioxide, chlorinated paraffins, and bromophenols
- **Heat Stabilizers** - lead, barium-cadmium, tin, and calcium-zinc
- **Organic Peroxides** - MEK peroxide, benzoyl peroxide, alkyl peroxide, and peresters
- **Plasticizers** - adipates, azelates, trimellitates, and DOP/DIOP/DIDP
- **Ultraviolet Stabilizers** (UV light absorbers) - benzophenones, benzotriazole, and salicylates.

Waste Water

Contaminated waste water is another concern in the plastic product industry. EPA estimates that of the 10,260 plastic molding and forming plants in the U.S. (this figure includes establishments with less than 20 employees), 1,898 plants have 2,587 processes that use water (i.e., they are wet). The 1,898 wet plants have an estimated 810 wet processes with direct discharge, 1,145 processes with indirect discharge, and 632 wet processes with no discharge.

Water used in the plastic molding and forming processes falls into three main categories: (1) water to cool or heat the plastics products; (2) water to clean the surface of both the plastics products and the equipment used in production; (3) and water to finish the plastics products.

Cooling and heating water usually comes into contact with raw materials or plastics products during molding and forming operations for the purpose of heat transfer. The only pollutant found in some waste water discharged by contact cooling and heating in a treatable concentration is bis(2-ethylhexyl) phthalate (BEHP) and it is toxic. Many facilities do not process materials containing BEHP making this pollutant output irrelevant for many manufactures.

Cleaning water includes water that is used to clean the surface of the plastic product or the molding equipment that is or has been in

contact with the formed plastic product. The types of pollutants found in cleaning water in treatable concentrations are biochemical oxygen demand (BOD5), oil and grease, total suspended solids (TSS), chemical oxygen demand (COD), total organic carbon (TOC), total phenols, phenol, and zinc.

Finishing water consists of water used to carry away waste plastic material or to lubricate the product during the finishing operation. TSS, bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, and dimethyl phthalate are the pollutants identified in finishing water in treatable concentrations.

Of the pollutants found in all three types of process water, BOD5, oil and grease, TSS, and pH are considered conventional pollutants, TOC and COD are considered non-conventional pollutants, and bis (2-ethylhexyl) phthalate, di-n-butyl phthalate, dimethyl phthalate, phenol, and zinc are considered priority toxic pollutants.

Pellet Release

The third concern in the plastic product manufacturing industry is the release of plastic pellets into the environment. Plastic pellets and granules used to mold intermediate and final plastics products are often lost to floor sweepings during transport or while being loaded into molding machines, and may end up in waste water. Although they are inert, plastic pellets are an environmental concern because of the harm they can cause if runoff carries them to wetlands, estuaries, or oceans where they may be ingested by seabirds and other marine species. EPA storm water regulations classify plastic pellets as "significant materials," and therefore the discovery of a single pellet in storm water runoff is subject to Federal regulatory action.

Fugitive Emissions

Fugitive emissions from the molding processes may be an environmental concern because of the many additives, including cadmium and lead, which can be released during the application of high heat and pressure. Trade association officials (i.e., American Plastic Council and the Society of the Plastic Industry), are currently researching the composition of these emissions and their possible effects on worker safety and air quality.

Disposal

Plastics products also pose disposal concerns. Discarded plastics products and packaging make up a growing portion of municipal and solid waste. Because only a small percentage of plastic is recycled (less than one percent), virtually all disposed plastics products are put into landfills or incinerated. By the year 2000, the amount of disposed plastic will increase by 50 percent from present levels. Current estimates show that plastic constitutes 14 to 21 percent of the waste stream by volume and seven percent of the waste stream by weight. Because of its resistance to degradation, improper plastic disposal can have a particularly serious effect in the marine environment in terms of ecological risks and aesthetics.

In terms of landfill disposal, the slow degradation of plastic is not a significant factor in landfill capacity; research has shown that other constituents (e.g., paper, wood, food wastes) also degrade very slowly. However, the additives contained in plastic, such as colorants, stabilizers, and plasticizers, may include toxic constituents such as lead and cadmium which can leach out into the environment as the plastic degrades. Plastic contribute 28 percent of all cadmium found in municipal solid waste and approximately two percent of all lead. Data are too limited to determine whether these and other plastic additives contribute significantly to the leachate produced in municipal solid waste landfills. Plastic that contains heavy metal-based additives may also contribute to the metal content of incinerator ash.

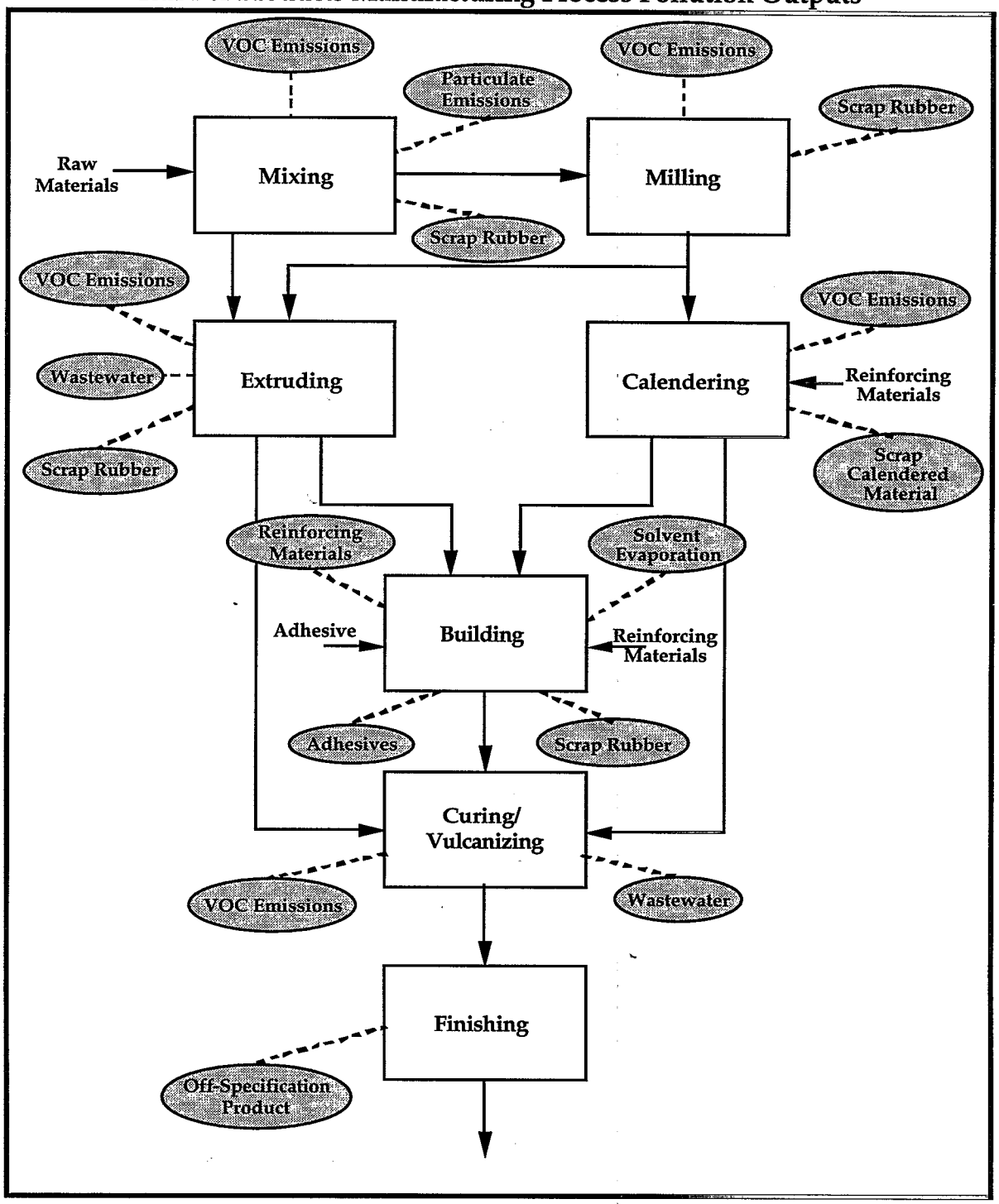
Rubber

In the rubber product manufacturing industry, the primary environmental concerns are fugitive emissions, solid wastes, waste water, and hazardous wastes. Each of these is discussed below.

Fugitive and VOC Emissions

The compounding area, where dry chemicals are weighed and put into containers prior to mixing, can be a source of fugitive emissions, and possibly spills and leaks. Because additives must be pre-weighed, in some facilities the chemicals sit in big open bins on the scales or waiting to get on the scales, thus increasing the potential for significant fugitive dust emissions. Most mixing facilities have eliminated this problem by purchasing their chemicals in small, pre-weighed, sealed polyethylene bags. The sealed bag is put directly into the banbury mixer thus eliminating a formerly dusty operation. If chemicals are not in pre-weighed bags,

Exhibit 21
Rubber Products Manufacturing Process Pollution Outputs



fugitive emissions are also produced as the chemicals are loaded into the mixer. Emissions from the internal mixers are typically controlled by baghouses. Exhausts from the collection hoods are

ducted to the baghouses for control of particulate and possibly particle-bound semi-volatiles and metals. The following is a list of the major chemicals used in the rubber compounding and mixing processes which can constitute these fugitive emissions:

- **Processing Aids** - zinc compounds
- **Accelerators** - zinc compounds, ethylene thiourea, and diethanolamie
- **Activators** - nickel compounds, hydroquinone, phenol, alphanaphthylamine, and p-phenylenediamine
- **Age Restorers** - selenium compounds, zinc compounds, and lead compounds
- **Initiator** - benzoyl peroxide
- **Accelerator Activators** - zinc compounds, lead compounds, and ammonia
- **Plasticizers** - dibutyl phthalate, dioctylphthalate, and bis(2-ethylhexyl adipate)
- **Miscellaneous Ingredients** - titanium dioxide, cadmium compounds, organic dyes, and antimony compounds.

VOC emissions are also an environmental concern in the rubber product manufacturing process. A 1994 RMA Emissions Factors study analyzed data on VOC emissions resulting from the mixing, milling, extruding, calendering, vulcanizing, and grinding processes. Although the findings showed extremely low VOC emissions for each pound of rubber process, large facilities processing great quantities of rubber face the potential of significant VOC emissions. For example, a facility must process 100,000 pounds of rubber to produce 10 pounds of VOCs during the mixing process. These emissions may add up, however, at large tire facilities producing 50,000 tires a day. The following are the finalized RMA VOC emissions factors for the various processes:

- **Mixing:** 1×10^{-4} lb VOC/lb rubber mixed (uncontrolled, i.e., before the control device)
- **Milling:** 8×10^{-5} lb VOC/lb rubber processed
- **Extruding:** 1×10^{-5} lb VOC/lb rubber processed
- **Calendering:** 3×10^{-5} lb VOC/lb rubber processed

- **Vulcanizing**: 4×10^{-4} lb VOC/lb rubber processed
- **Grinding (during finishing)**: 6×10^{-3} lb VOC/lb rubber removed (controlled, i.e., after the control device).

The RMA VOC emissions factors have been sent to EPA for review and possible inclusion in AP-42.

Solvent evaporation is another source of VOC emissions. Solvents are used in various capacities during the rubber product manufacturing process. For example, solvents are used to degrease equipment and tools and as a type of adhesive during building. Typically, releases of solvents occur either when the spent solvent solutions are disposed as hazardous wastes or when degreasing solvents are allowed to volatilize. In some facilities, mold release compounds, sprayed onto the cavities of compression molds, produce significant fugitive emissions. Solvents are becoming less of an issue as water, silicon, and non-solvent based release compounds are now common.

Solid Waste

Solid wastes are also an issue at rubber product manufacturing facilities. Surface grinding activities that generate dust and rubber particles are typically controlled by a primary cyclone and a secondary baghouse or electrostatic precipitator. This baghouse-captured particulate matter (chemicals, ground rubber, etc.) from compounding areas, banburys, and grinders is a source of solid waste. Used lubricating, hydraulic, and process oils are also prevalent at most manufacturing facilities.

Scorched rubber from mixing, milling, calendering, and extruding is a major solid waste source within the rubber product manufacturing facilities, as is waste rubber produced during rubber molding operations. Waste rubber can be classified into three categories: (1) uncured rubber waste; (2) cured rubber waste; (3) off-specification products. Currently, much of the uncured rubber waste is recycled at the facility. Cured rubber waste is either recycled at the facility or sold to other companies who use it to make products such as mud flaps and playground mats. Off-specification products can be sold to other companies who make products from shredded or scrap rubber or it can be disposed. These practices are discussed further in the section on pollution prevention.

Waste Water

Waste water from cooling, heating, vulcanizing, and cleaning operations is an environmental concern at many facilities. Contaminants can be added to waste water in direct contact cooling applications such as extruder cooling conveyors and from direct contact steam used in vulcanizing operations. The residual in adhesive dispensing containers and contaminated adhesives can also be sources of contaminated waste water.

Zinc is of particular concern as a constituent of storm water for the facilities involved in manufacturing and processing rubber products. A study by the RMA identified several processes through which zinc might be introduced into storm water. Inadequate housekeeping is considered to be the primary source of zinc. Inefficient, overloaded, or malfunctioning dust collectors and baghouses are another source of zinc. Facilities that grind rubber usually create dust. This dust, composed partially of zinc, can go untreated (no dust collector) and be released into the atmosphere through ventilation fans. The ventilation fans, which are typically located in the ceilings, deposit the dust on the roof where it is exposed to rain and hence to storm water. Some facilities use zinc stearate slurry to prevent sticking between rubber products and have indicated that the slurry frequently drips to the floor and eventually drains to a storm water outlet.

Like plastic products, the leaching potential of rubber products disposed in landfills poses a potential environmental concern. This is a concern for rubber product manufacturing facilities which may have to dispose of scrap rubber that they are unable to sell. The RMA assessed the levels of chemicals, if any, leached from waste rubber products using EPA's June 13, 1986 proposed Toxicity Characterization Leaching Procedure (TCLP). TCLP tests were performed on 16 types of rubber products to assess the leaching potential of over 40 different chemicals which included volatile organics, semi-volatile organics and metals. Results of the TCLP study indicate that none of the rubber products tested, cured or uncured, exceeded proposed TCLP regulatory levels. Most compounds detected were found at trace levels (near method detection limits) from ten to one hundred times less than proposed TCLP regulatory limits. The TCLP regulatory levels adopted after June 13, 1986 were even less stringent than the original proposal.

Tires

The resource material and pollution outputs from the tire manufacturing process include all of the outputs discussed above in the rubber product manufacturing process. There is however an emphasis on the VOC emissions which result from cementing and spraying operations (see Exhibit 22) and on scrap tire disposal.

VOC Emissions

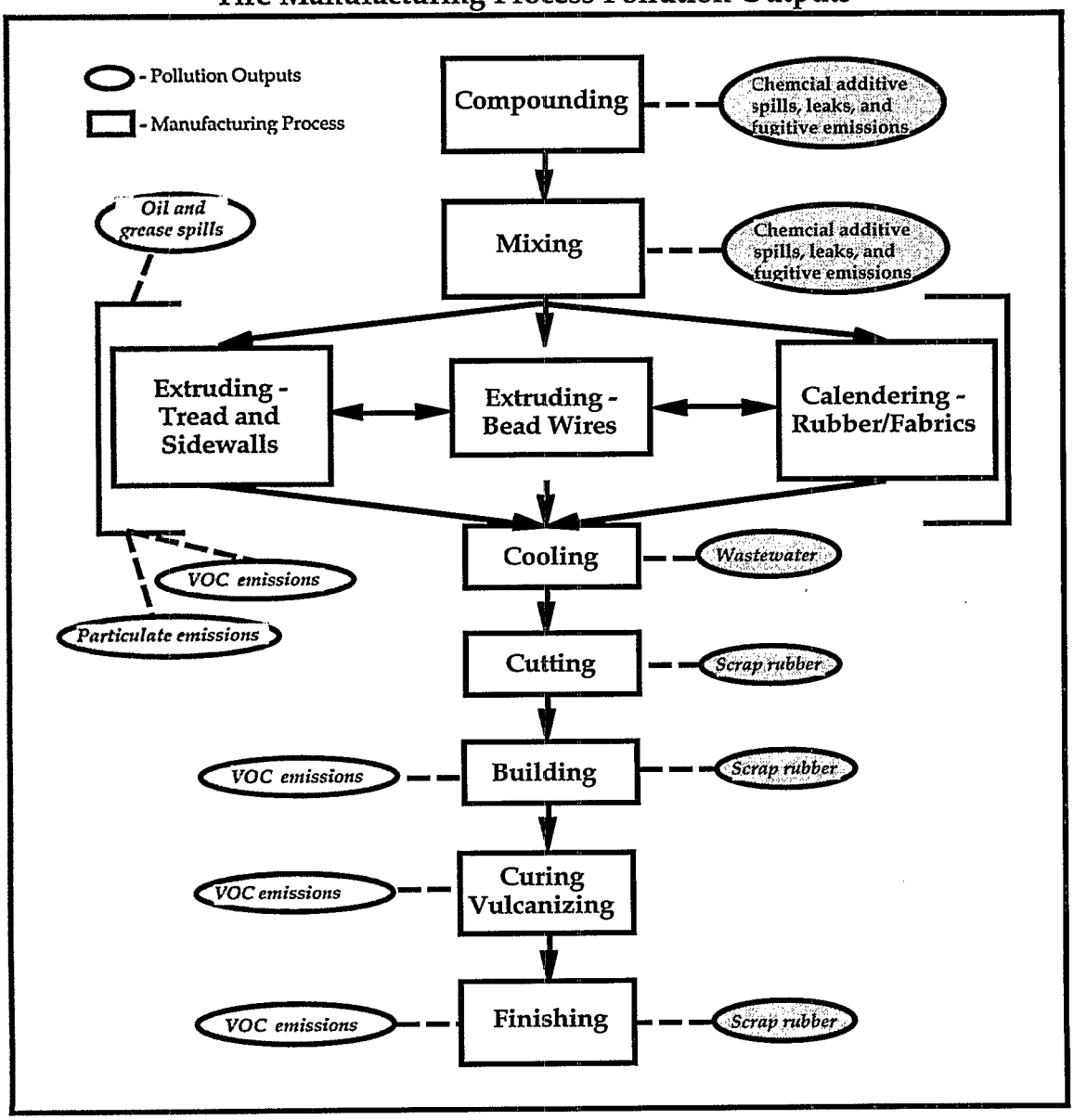
VOC emissions from the rubber tire manufacturing process are caused by solvent application to the different tire components before, during, and after the building process (these VOC emissions can also result from the manufacture of other rubber products that require cementing or gluing). The principal VOC emitting processes affected by NSPS regulations are undertread cementing operations, sidewall cementing operations, tread end cementing operations, bead cementing operations, green tire spraying operations, Michelin-B operations, and Michelin-C automatic operations. Michelin-B and -C operations are confidential and cannot be revealed to the public. They are however known and regulated by EPA. All cementing operations refer to the system used to apply cement to any part of the tire. The green tire spraying operation refers to the system used to apply a mold release agent and lubricant to the inside and/or outside of green tires to facilitate the curing process and to prevent rubber from sticking to the curing press. VOC-emissions also occur in limited amounts from operations where rubber is heated. Such operations include mixing, milling, extruding, calendering, vulcanizing, and grinding.

Scrap Tires

Probably the biggest environmental concern with respect to rubber tires is the disposal of scrap tires. In 1992, it was estimated that the U.S. had approximately two billion scrap tires, with annual additions of 200 to 250 million tires. These tires pose three environmental threats. The first being that tire piles are a fire hazard and burn with an intense heat which gives off dense black smoke. These fires are extremely difficult to extinguish in part because tire casings form natural air pockets that supply the oxygen which feeds the flames. The second threat is that the tires trap rain water which serves as a nesting ground for various insects such as mosquitoes, and in areas where there are scrap tire piles there tend to be severe insect problems. The third and most important environmental threat associated with scrap tires is that discarded tires are bulky, virtually indestructible, and when buried tend to

work their way back to the surface as casings compressed by the dirt slowly spring back into shape and "float" the tire upward. This problem has led to either extremely high tipping fees for scrap tires in landfills - at least twice the fee for municipal solid waste - or total bans on whole tires in landfills. As discussed above, the RMA has conducted testing to verify that tires are not hazardous wastes based on TCLP analysis. The many efforts underway to address this problem are discussed in the pollution prevention section of this profile.

Exhibits 22
Tire Manufacturing Process Pollution Outputs



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 23 shows that the rubber and miscellaneous plastics industry managed about .53 billion 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, 31 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 70 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 (23.8 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 has decreased and the

portions treated or managed through energy recovery on-site have increased between 1992 and 1995 (projected).

Exhibit 23
Rubber & Misc. Plastics
Source Reduction and Recycling Activity for SIC 30

A	B	C	D	E	F	G	H	I	J
			On-Site			Off-Site			
Year	Production Related Waste Volume (10^6lbs.)*	% Reported as Released and Transferred	% Recycled	% Energy Recovery	% Treated	% Recycled	% Energy Recovery	% Treated	Remaining Releases and Disposal
1992	543	31%	55.04%	2.97%	11.61%	3.05%	1.63%	0.94%	32.52%
1993	534	31%	55.91%	2.83%	11.00%	3.19%	1.95%	1.26%	23.87%
1994	414	—	44.27%	2.94%	15.49%	5.16%	2.49%	1.74%	27.91%
1995	307	—	27.35%	6.02%	20.92%	5.89%	2.66%	2.34%	34.82%

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% 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 Rubber and Miscellaneous Plastics Products Industry

The following section provides TRI data for those facilities categorized under SIC 30, the rubber and miscellaneous plastics products industry. According to the TRI data, the manufacture of rubber and miscellaneous plastics products results primarily in the release of solvents. The commonly released solvents include acetone, toluene, methyl ethyl ketone, 1,1,1-trichloroethane, and dichloromethane. According to the Toxic Release Inventory (TRI) Public Release Data for 1993, the rubber and miscellaneous plastics products industry released over 118 million pounds of pollutants and transferred over 44 million pounds of pollutants. Of pollutants released, approximately 69 percent were released as point source air emissions, approximately 30.5 percent were released as fugitive air emissions, approximately 0.2 percent were released to water, and approximately 0.3 percent were disposed of on land.

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 24. Exhibit 25 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 25 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.

The rubber and miscellaneous plastics products industry air releases can be traced primarily to the mixing component preparation and building/assembly stages of the rubber manufacturing process and to the solvent cleaning and finishing stages of the plastics products manufacturing process. Major pollutants released to air include toluene, dichloromethane, methylene chloride, and carbon disulfide. Releases of pollutants to water and transfers of pollutants to POTWs arise primarily from the cleaning and cooling of machinery in both the rubber and plastic manufacturing processes and from the cooling and heating of rubber during the rubber

products manufacturing process. Major pollutants released to water include zinc compounds, sulfuric acid, and ammonia, and ammonium sulfate. Major pollutants transferred to POTWs include acetone, methanol, and zinc compounds, and ammonium sulfate. Releases of pollutants to land arise from the use of various chemicals in the rubber and plastic mixing processes. Major releases of pollutants to land include barium compounds, antimony compounds, zinc compounds, and styrene.

The rubber and miscellaneous plastics products industry releases and transfers a number of metals in large quantities (i.e., transfers as high as millions of pounds and releases as high as hundreds of thousands of pounds). These metals include zinc compounds, copper, lead, and lead compounds. Both zinc and lead are used in the rubber mixing process as vulcanizing agents, accelerator activators, and processing aids (zinc only). Lead and zinc can be released during mixing operation as spills, leaks, and fugitive emissions in the form of dust and particulates (which can and often are captured by filters). Exhibit 27 and 28 present releases and transfers for SIC 30 TRI reporting facilities.

Exhibit 24
Top 10 TRI Releasing Rubber and Plastics Products Manufacturing Facilities (SIC 30)

Rank	Total TRI Releases in Pounds	Facility Name	City	State
1	5,425,721	Westinghouse Electric Corp.	Hampton	SC
2	3,603,789	Teepak Inc.	Danville	IL
3	2,901,978	Goodyear Tire & Rubber Co.	Lincoln	NE
4	2,586,030	Flexel Indiana Inc.	Covington	IN
5	2,559,756	O'Sullivan Corp.	Winchester	VA
6	2,129,000	Viskase Corp.	Loudon	TN
7	1,363,500	Viskase Corp.	Osceola	AR
8	1,359,629	Hickory Springs Mfg. Co.	Conover	NC
9	1,293,243	E. R. Carpenter Co. Inc.. Tupelo	Verona	MS
10	1,265,488	Foamex L.P. Great Western Carpet Cushion	Orange	CA

Source: US 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 25
Top 10 TRI Releasing Rubber and Misc. Plastics Products Facilities

SIC Codes	Total TRI Releases in Pounds	Facility Name	City	State
3083	5,425,721	Westinghouse Electric Corp.	Hampton	SC
3089	3,603,789	Teepak Inc.	Danville	IL
3052	2,901,978	Goodyear Tire & Rubber Co.	Lincoln	NE
3089	2,586,030	Flexel Indiana Inc.	Convington	IN
3081, 3083	2,559,756	O'Sullivan Corp.	Winchester	VA
3089	2,129,000	Viskase Corp.	Loudon	TN
2899, 3081, 2822	1,473,670	3M	Decatur	AL
3089	1,363,500	Viskase Corp.	Oseola	AR
3086	1,359,629	Hickory Spring Mfg. Co. Foam Plant	Conover	NC
3081, 3083, 2671, 2297	1,333,229	IPC Corinth Div.	Corinth	MS

Source: US 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 26
TRI Reporting Rubber and Plastics Products Manufacturing Facilities (SIC 30) by State

State	Number of Facilities
AL	31
AR	30
AZ	13
CA	100
CO	15
CT	21
DE	11
FL	38
GA	57
IA	28
ID	2
IL	86
IN	118
KS	18
KY	31

State	Number of Facilities
NC	101
ND	2
NE	10
NH	11
NJ	42
NM	3
NV	4
NY	33
OH	171
OK	13
OR	17
PA	76
PR	4
RI	9
SC	44

Exhibit 26 (cont'd)
TRI Reporting Rubber and Plastics Products Manufacturing Facilities (SIC 30) by State

State	Number of Facilities
LA	6
MA	44
MD	9
ME	5
MI	81
MN	36
MO	41
MS	31

State	Number of Facilities
SD	4
TN	74
TX	110
UT	6
VA	35
VT	4
WA	16
WI	53
WV	17

Source: US EPA, Toxics Release Inventory Database, 1993.

Exhibit 27
Releases for Rubber and Plastics Products Manufacturing (SIC 30) 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 Release per Facility
Styrene	461	4755176	7692418	250	0	40057	12487901	27089
Zinc Compounds	370	44973	44157	14578	0	93945	197653	534
Acetone	329	6479638	5821271	353	0	184	12301446	37390
Toluene	219	3785915	11297325	2279	0	0	15085519	68884
Methyl Ethyl Ketone	199	2793949	7482034	0	0	0	10275983	51638
1,1,1-Trichloroethane	193	5374360	5647721	7	0	0	11022088	57109
Dichloromethane	160	8144323	13955176	450	0	9753	22109702	138186
Di(2-Ethylhexyl) Phthalate	151	91271	122847	95	0	92220	306433	2029
Methylenebis (Phenylisocyanate)	139	8978	10312	0	0	992	20282	146
Antimony Compounds	127	8144	9895	1953	0	9810	29802	235
Barium Compounds	119	72062	7778	1060	0	109945	190845	1604
Xylene (Mixed Isomers)	99	417496	3406217	10	0	0	3823723	38623
Lead Compounds	91	5278	8328	1014	0	4682	19302	212
Toluenediisocyanate (Mixed Isomers)	74	5847	15492	0	0	0	21339	288
Sulfuric Acid	65	1043	2590	7005	5	2000	12643	195
Chromium Compounds	63	2258	3395	10	0	707	6370	101
Methyl Isobutyl Ketone	63	167312	1894129	0	0	0	2061441	32721
Methanol	60	324667	5964005	0	0	0	6288672	104811
Glycol Ethers	51	95289	649213	5	0	750	745257	14613
Bis(2-Ethylhexyl) Adipate	50	18402	72313	10	0	9374	100099	2002
Trichlorofluoromethane	41	1008351	465928	0	0	0	1474279	35958
Decabromodiphenyl Oxide	39	3815	19389	357	0	0	23561	604
Hydrochloric Acid	35	2207	62715	0	0	250	65172	1862
Formaldehyde	33	32787	114922	90	0	0	147799	4479
N-Butyl Alcohol	33	80646	627028	0	0	0	707674	21445
Phenol	33	59278	662329	132	0	4	721743	21871
Methyl Methacrylate	29	52402	255715	0	0	2250	310367	10702
Cobalt Compounds	28	453	506	280	0	5	1244	44
Ethylene Glycol	28	22121	402124	2700	0	0	426945	15248
Toluene-2,4-Diisocyanate	27	2165	3405	0	0	0	5570	206
Trichloroethylene	26	738682	336336	10	0	0	1075028	41347
Butyl Benzyl Phthalate	25	13603	1930	203	0	0	15736	629
Cadmium Compounds	24	573	525	15	0	1100	2213	92
Ammonia	23	312606	230462	6037	0	0	549105	23874
Toluene-2,6-Diisocyanate	23	1449	2369	0	0	0	3818	166
Dimethyl Phthalate	22	5861	10186	5	0	0	16052	730
Diethanolamine	20	1584	1496	0	0	0	3080	154
Lead	18	272	1213	12	0	5	1502	83
Dibutyl Phthalate	17	314	9400	7	0	0	9721	572
Manganese Compounds	17	281	1024	16	0	250	1571	92
Chlorine	16	42439	34255	484	0	0	77178	4824
Tetrachloroethylene	16	46975	368793	0	0	0	415768	25986

Source: US EPA, Toxics Release Inventory Database, 1993.

Exhibit 27 (cont'd)
Releases for Rubber and Plastics Products Manufacturing (SIC 30) 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 Release per Facility
Ethylbenzene	14	4752	200554	250	0	0	205556	14683
Copper Compounds	13	156	50	6	0	0	212	16
Isopropyl Alcohol (Manufacturing)	13	47381	207141	0	0	0	254522	19579
Nickel Compounds	13	286	960	5	0	0	1251	96
Phosphoric Acid	12	5404	1205	0	0	0	6609	551
Zinc (Fume Or Dust)	12	500	504	5	0	4169	5178	432
Freon 113	11	229347	389191	0	0	0	618538	56231
Nitric Acid	11	1477	1164	0	0	0	2641	240
Chromium	10	25	5	0	0	5	35	4
4,4'-Methylenebis (2-Chloroaniline)	10	10	5	0	0	0	15	2
Antimony	9	5	250	0	0	5	260	29
Copper	9	171	799	0	0	0	970	108
Carbon Disulfide	8	451497	12136818	18273	0	0	12606588	1575824
Barium	7	4193	2007	0	0	0	6200	886
Dichlorodifluoromethane	7	72623	42675	0	0	0	115298	16471
Benzoyl Peroxide	6	252	0	0	0	0	252	42
Cumene Hydroperoxide	6	23422	903	0	0	0	24325	4054
Cyclohexane	6	61564	66357	0	0	0	127921	21320
Diethyl Phthalate	6	11457	23745	18	0	0	35220	5870
Ethylene Thiourea	6	0	260	0	0	0	260	43
Nickel	6	120	179	0	0	5	304	51
4,4'-Methylenedianiline	6	255	311	0	0	0	566	94
Manganese	5	82	215	0	0	0	297	59
Phthalic Anhydride	5	298	489	0	0	0	787	157
Propylene Oxide	5	7076	44815	0	0	0	51891	10378
Vinyl Acetate	5	8977	6643	0	0	0	15620	3124
Acrylic Acid	4	0	6506	1	0	0	6507	1627
Acrylonitrile	4	0	1850	0	0	6332	8182	2046
Aluminum Oxide (Fibrous Form)	4	1005	732	159	0	0	1896	474
Ammonium Sulfate (Solution)	4	0	0	250000	0	0	250000	62500
Arsenic Compounds	4	5	5	0	0	0	10	3
Chloroprene	4	0	0	0	0	3018	3018	755
Ethylene Oxide	4	14717	58889	0	0	0	73606	18402
1,2,4-Trimethylbenzene	4	5757	40835	0	0	0	46592	
1,4-Dioxane	4	920	10341	0	0	0	11261	2815
Cresol (Mixed Isomers)	3	5389	1118	1	0	0	6508	2169
Maleic Anhydride	3	250	258	0	0	0	508	169
Selenium Compounds	3	0	2	0	0	0	2	1
2-Methoxyethanol	3	8152	250318	0	0	0	258470	86157
4,4'-Isopropylidenediphenol	3	212	45	0	0	0	257	86
Asbestos (Friable)	2	0	0	0	0	0	0	0
Chloroethane	2	140680	201840	0	0	0	342520	171260

Source: US EPA, Toxics Release Inventory Database, 1993.

Exhibit 27 (cont'd)
Releases for Rubber and Plastics Products Manufacturing (SIC 30) 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
Chloroform	2	11825	5829	0	0	0	17654	8827
Cobalt	2	0	0	0	0	5	5	3
Acetaldehyde	1	0	114	0	0	0	114	114
Aluminum (Fume Or Dust)	1	0	0	0	0	0	0	0
Ammonium Nitrate (Solution)	1	0	0	0	0	0	0	0
Butyl Acrylate	1	0	0	0	0	0	0	0
Cadmium	1	5	0	0	0	0	5	5
Chloromethane	1	95980	0	0	0	0	95980	95980
Cumene	1	250	250	0	0	0	500	500
Cyanide Compounds	1	0	0		0	0	0	0
Dichlorvos	1	250	250			250	750	750
M-Xylene	1	0	31000	0	0	1700	32700	32700
Michler's Ketone	1	100	1442	0	0	0	1542	1542
Naphthalene	1	250	0	0	0	0	250	250
Vinylidene Chloride	1	0	1525	1	0	1	1527	1527
1,2-Dichloroethane	1	0	250	0	0	0	250	250
1,3-Butadiene	1	0	0	0	0	0	0	0
Total	**1579**	**36242322**	**81459310**	**308146**	**5**	**393773**	**118,403,556**	**74,986**

Source: US EPA, Toxics Release Inventory Database, 1993

Exhibit 28
Transfers for Rubber and Plastics Products Manufacturing (SIC 30) 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
Styrene	461	6412	912615	86676	84467	540858	1631033	3538
Zinc Compounds	370	48197	5313559	1330657	450403	64930	7208206	19482
Acetone	329	163425	62738	1021491	178209	1669477	3106290	9442
Toluene	219	6166	24650	337563	413312	2672384	3455230	15777
Methyl Ethyl Ketone	199	12	9481	1517588	454307	3024993	5007954	25166
1,1,1-Trichloroethane	193	250	8081	356140	254839	380732	1000042	5182
Dichloromethane	160	753	23838	1061649	219538	238847	1544625	9654
Di(2-Ethylhexyl) Phthalate	151	13806	819005	2219672	203704	84937	3341124	22127
Methylenebis (Phenylisocyanate)	139	0	50991	78361	25255	14927	169534	1220
Antimony Compounds	127	2362	307512	61111	8576	7085	386646	3044
Barium Compounds	119	2021	609352	57595	33789	44543	747300	6280
Xylene (Mixed Isomers)	99	9	250	234297	63807	549669	848032	8566
Lead Compounds	91	1258	100404	1441782	22879	1977	1568300	17234
Toluenediisocyanate (Mixed Isomers)	74	5	5524	3335	293268	417	302549	4089
Sulfuric Acid	65	61066	5900	123620	22650		213236	3281
Chromium Compounds	63	293	88952	5735	329484		424464	6738
Methyl Isobutyl Ketone	63	589	1005	126226	41739	393497	563056	8937
Methanol	60	174509	255	95817	88988	367353	726922	12115
Glycol Ethers	51	19935	68165	73819	17486	47661	227066	4452

Source: US EPA, Toxics Release Inventory Database, 1993

Exhibit 28 (cont'd)
Transfers for Rubber and Plastics Products Manufacturing (SIC 30) 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
Bis(2-Ethylhexyl) Adipate	50	1255	58390	146605	632	108276	315158	6303
Trichlorofluoromethane	41	250	552	2498	3277	18920	25497	622
Decabromodiphenyl Oxide	39	515	332723	6905	8067	2729	350939	8998
Hydrochloric Acid	35	14926	100		268		15294	437
Formaldehyde	33	25727	9735	365	11194	3488	50509	1531
N-Butyl Alcohol	33	5	105	2053	12209	101677	116049	3517
Phenol	33	59	260711		38458	13963	313191	9491
Methyl Methacrylate	29	15002	33335		7238	44159	99734	3439
Cobalt Compounds	28	22	40697	2700	4385		47804	1707
Ethylene Glycol	28	12047	5778	4146395	137387	1030	4302637	153666
Toluene-2,4-Diisocyanate	27	0		49588	54488	1960	106036	3927
Trichloroethylene	26	10	5430	70433	36970	27640	140483	5403
Butyl Benzyl Phthalate	25	935	4778	1108	180	15283	22284	891
Cadmium Compounds	24	36	10043	3022	667	14	13782	574
Ammonia	23	28069	2600		180		30849	1341
Toluene-2,6-Diisocyanate	23	0		12397			12397	539
Dimethyl Phthalate	22	7893	3267	250	1635	1590	14635	665
Diethanolamine	20	0			497	51	548	27
Lead	18	67	12167	1183359	27499	1800	1224892	68050
Dibutyl Phthalate	17	5498	42354	12044	22860	11000	93756	5515
Manganese Compounds	17	271	17219	281	5		17776	1046
Chlorine	16	32800					32800	2050
Tetrachloroethylene	16	0		33955	13840	1850	49645	3103
Ethylbenzene	14	251	0		998	71764	73013	5215
Copper Compounds	13	331	47972	505	115960		164768	12674
Isopropyl Alcohol (Manufacturing)	13	0	5	3760		42047	45812	
Nickel Compounds	13	271	22882	43	179905		203101	15623
Phosphoric Acid	12	0	0		28180		28180	2348
Zinc (Fume Or Dust)	12	1774	73419	1610			76803	6400
Freon 113	11	0		218046	17751		235797	21436
Nitric Acid	11	5	41		21		67	6
Chromium	10	0	56721	267963	119		324803	32480
4,4'-Methylenebis (2-Chloroaniline)	10	5	750			1589	2344	234
Antimony	9	22	8063	7656	250	1924	17915	1991
Copper	9	5	21780	292083	125		313993	34888
Carbon Disulfide	8	201233	250		250		201733	25217
Barium	7	0	6018	5			6023	860
Dichlorodifluoromethane	7	0					0	0
Benzoyl Peroxide	6	0	5000				5000	833
Cumene Hydroperoxide	6	0	10609				10609	1768
Cyclohexane	6	250	250		5187	18368	24055	4009
Diethyl Phthalate	6	45954	11650	69000	22267		148871	24812
Ethylene Thiourea	6	5	1010	2054	5585		8654	1442
Nickel	6	5	10650	85382			96037	16006
4,4'-Methylenedianiline	6	0			3890		3890	648
Manganese	5	5	9634	36964			46603	9321
Phthalic Anhydride	5	0	4900			630	5530	1106
Propylene Oxide	5	0			250		250	50

Source: US EPA, Toxics Release Inventory Database, 1993

Exhibit 28 (cont'd)
Transfers for Rubber and Plastics Products Manufacturing (SIC 30) 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
Vinyl Acetate	5	0	1638		6880	5681	14199	2840
Acrylic Acid	4	0	0				0	0
Acrylonitrile	4	0	6332			1268	7600	1900
Aluminum Oxide (Fibrous Form)	4	0	3591				3591	898
Ammonium Sulfate (Solution)	4	2630872					2630872	657718
Arsenic Compounds	4	5	5	15	5		30	8
Chloroprene	4	0	5045				5045	1261
Ethylene Oxide	4	750					750	188
1,2,4-Trimethylbenzene	4	0		10161			10161	2540
1,4-Dioxane	4	113353		2270		2215	117838	29460
Cresol (Mixed Isomers)	3	4	1320		2700	962	5986	1995
Maleic Anhydride	3	0	1600				1600	533
Selenium Compounds	3	5	834		0		839	280
2-Methoxyethanol	3	0				14883	14883	4961
4,4'-Isopropylidenediphenol	3	0	234		9		243	81
Asbestos (Friable)	2	0	135704				135704	67852
Chloroethane	2	0					0	0
Chloroform	2	0			169675		169675	84838
Cobalt	2	5					5	3
Acetaldehyde	1	115					115	115
Aluminum (Fume Or Dust)	1	0	250	250			500	500
Ammonium Nitrate (Solution)	1	0					0	0
Butyl Acrylate	1	0				600	600	600
Cadmium	1	0					0	0
Chloromethane	1	0					0	0
Cumene	1	0	1136				1136	1136
Cyanide Compounds	1	0					0	0
Dichlorvos	1						0	0
M-Xylene	1	0				1700	1700	1700
Michler's Ketone	1	0				216	216	216
Naphthalene	1	0		5		5	10	10
Vinylidene Chloride	1	0					0	0
1,2-Dichloroethane	1	0					0	0
1,3-Butadiene	1	5410	2863				8273	8273
Total	**1579**	**3,647,090**	**9,704,417**	**16,904,864**	**4,148,643**	**10,623,569**	**45,043,726**	**28,537**

Source: US 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 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.

---

[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 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.

The top ten chemicals released by the rubber and miscellaneous plastics products industry in 1993 were:

1,1,1-Trichloroethane
Acetone
Carbon Disulfide
Dichloromethane
Methanol
Methyl Ethyl Ketone
Methyl Isobutyl Ketone.
Styrene
Toluene
Xylene (Mixed Isomers)

Summaries of some of the health and environmental impacts of several of these chemicals are discussed below.

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 photo-oxidation and slowly diffuses to the upper atmosphere where photo-degradation 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.

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. 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.

Dichlorodifluoromethane

Toxicity. Ordinary occupational and ambient exposure to dichlorodifluoromethane (CFC-12 or Freon 12) causes neither eye nor respiratory irritation. Short-term moderate to high inhalation exposure to CFC-12 is linked to irregular heart beat and central nervous system effects, such as dizziness, decreased coordination, amnesia, apprehension, tingling, and unconsciousness. Attendant lack of oxygen at high concentrations may also produce tremors, convulsions, and cerebral edema. Inhalation of highly-concentrated vapors, such as through accidental exposure to concentrated refrigerant, can cause death through cardiovascular collapse and/or severe damage to the respiratory tract. Long-term exposure to CFC-12 is reported to cause heart palpitations and lightheadedness.

The most significant toxic effect associated with CFC-12 is its role as a potent ozone-depletor. Stratospheric ozone depletion causes an increase in the levels of ultraviolet solar radiation reaching the earth's surface, which in turn is linked to increased incidence of skin cancers, immune system suppression, cataracts, and disruptions in terrestrial and aquatic ecosystems. In addition, increased UV-B radiation is expected to increase photochemical smog, aggravating related health problems in urban and industrialized areas.

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

Environmental Fate. All of the CFC-12 produced is eventually lost as air emissions and builds up in the atmosphere. If released on land, dichlorodifluoromethane leaches into the ground and volatilizes from the soil surface. No degradative processes are known to occur in the soil. Dichlorodifluoromethane is also stable in water and the only removal process is volatilization. Dichlorodifluoromethane is extremely stable in the lower atmosphere and disperses over the globe and diffuses slowly into the stratosphere where it is lost by photolysis. In this process, chlorine atoms are released that degrade stratospheric ozone.

Methanol

Toxicity. Methanol is readily absorbed from the gastrointestinal tract and the respiratory tract, and is toxic to humans in moderate to high doses. In the body, methanol is converted into formaldehyde and formic acid. Methanol is excreted as formic acid. Observed toxic effects at high dose levels generally include central nervous system damage and blindness. Long-term exposure to high levels of methanol via inhalation cause liver and blood damage in animals.

Ecologically, methanol is expected to have low toxicity to aquatic organisms. Concentrations lethal to half the organisms of a test population are expected to exceed 1 mg methanol per liter water. Methanol is not likely to persist in water or to bioaccumulate in aquatic organisms.

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

Environmental Fate. Liquid methanol is likely to evaporate when left exposed. Methanol reacts in air to produce formaldehyde which contributes to the formation of air pollutants. In the atmosphere it can react with other atmospheric chemicals or be washed out by rain. Methanol is readily degraded by microorganisms in soils and surface waters.

Physical Properties. Methanol is highly flammable.

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 volatilized, 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.

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 29 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 29
Pollutant Releases (Short Tons/Years)

Industry	SIC Codes Used for AIRS Search	CO	NO_2	PM_{10}	PT	SO_2	VOC
U.S. Total	All Sources	97,208,000	23,402,000	45,489,000	7,836,000	21,888,000	23,312,000
Metal Mining	1011, 1021, 1031, 1041, 1044, 1051, 1061, 1081, 1094, 1099	5,391	28,583	39,359	140,052	84,222	1,283
Nonmetal Mining	1411, 1420, 1422, 1423, 1429, 1442, 1446, 1452, 1453, 1454, 1455, 1459, 1472, 1473, 1474, 1475, 1476, 1477, 1479, 1481, 1490, 1492, 1496, 1499	4,525	28,804	59,305	167,948	24,129	1,736
Lumber and Wood Products	2411, 2421, 2426, 2429, 2435, 2436, 2439, 2491, 2493	123,756	42,658	14,135	63,761	9,149	41,423
Wood Furniture and Fixtures	2511, 2517, 2521, 2541	2,069	2,981	2,165	3,178	1,606	59,426
Pulp and Paper	2611, 2621, 2631	624,291	394,448	35,579	113,571	341,002	96,875
Printing	2711, 2721, 2731, 2732, 2741, 2751, 2752, 2753, 2754, 2759, 2761, 2771, 2782, 2789	8,463	4,915	399	1,031	1,728	101,537
Inorganic Chemicals	2812, 2813, 2816, 2819	166,147	108,575	4,107	39,082	182,189	52,091
Organic Chemicals	2861, 2865, 2869	146,947	236,826	26,493	44,860	132,459	201,888
Petroleum Refining	2911	419,311	380,641	18,787	36,877	648,153	309,058
Rubber and Misc. Plastic Products	**3011, 3021, 3052, 3053, 3061, 3069, 3079, 3081, 3082, 3083, 3084, 3085, 3086, 3087, 3088, 3089**	**2,090**	**11,914**	**2,407**	**5,355**	**29,364**	**140,741**
Stone, Clay, Glass, and Concrete	3211, 3221, 3229, 3231, 3241, 3251, 3253, 3255, 3259, 3261, 3262, 3264, 3269, 3271, 3272, 3273, 3274, 3275, 3281, 3291, 3292, 3293, 3295, 3296	58,043	338,482	74,623	171,853	339,216	30,262
Iron and Steel	3312, 3313	1,518,642	138,985	42,368	83,017	238,268	82,292
Nonferrous Metals	3331, 3334, 3339, 3341, 3351, 3353, 3354, 3355, 3356, 3357, 3361, 3362, 3363, 3364, 3365, 3366, 3369	448,758	55,658	20,074	22,490	373,007	27,375
Fabricated Metals	3411, 3412, 3421, 3423, 3425, 3429, 3431, 3432, 3433, 3441, 3442, 3443, 3444, 3446, 3448, 3449, 3451, 3452, 3462, 3463, 3465, 3466, 3469, 3471	3,851	16,424	1,185	3,136	4,019	102,186
Electronics	3671, 3672, 3674	367	1,129	207	293	453	4,854
Motor Vehicles, Bodies, Parts, and Accessories	3711, 3713, 3714	35,303	23,725	2,406	12,853	25,462	101,275
Dry Cleaning	7216	101	179	3	28	152	7,310

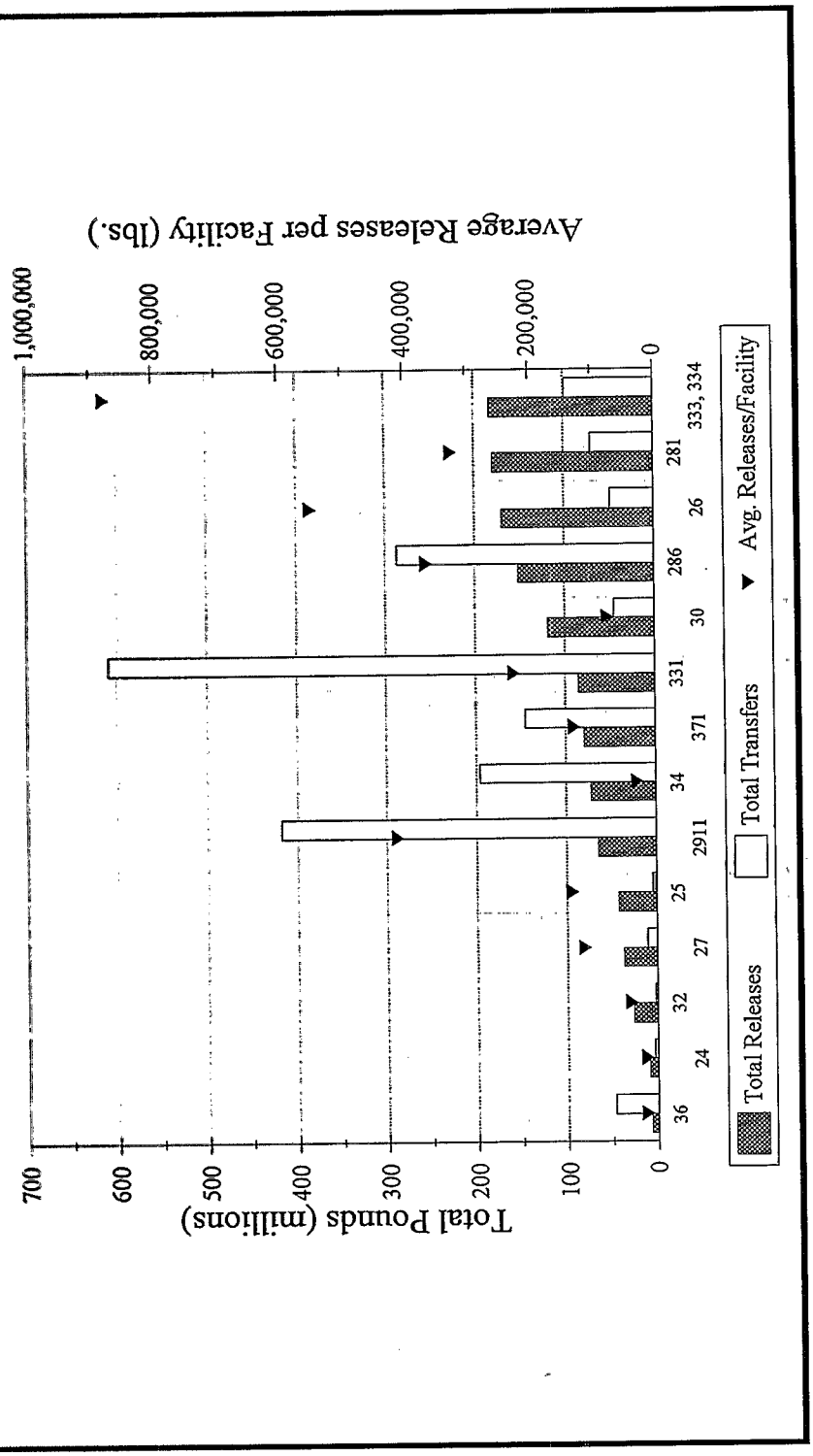
Source U.S. EPA Office of Air and Radiation, AIRS Database, May 1995.

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 30 is a graphical representation of a summary of the 1993 TRI data for the Rubber and Miscellaneous Plastics 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 31 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 the Rubber and Miscellaneous Plastics Products Industry, the 1993 TRI data presented here covers 1,579 facilities. These facilities listed SIC 30, the Rubber and Miscellaneous Plastics Products industry, as a primary SIC code.

Exhibit 30: Summary of 1993 TRI Data: Releases and Transfers by Industry



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 Accecessories	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 31
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
Electronic Equipment	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 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 substitutes for toxic chemicals. Some smaller facilities are able to 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 Rubber and Miscellaneous Plastics 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

Plastic

In the plastic industry, there are substantial pollution prevention options for most environmental concerns including chemical spills, waste water (including solvents in waste water), plastic pellet loss, and plastic product disposal. According to an NEIC inspector, pollution prevention for leaks and spills of chemical additives during compounding or finishing operations is as simple as covering the chemical containers as often as possible and training employees to properly handle and dispose of chemicals.

Waste Water

The pollution prevention options for process waste water from the plastic manufacturing industry are slightly more complex. As discussed earlier, waste water can be divided into three categories: contact cooling and heating water; cleaning water; and finishing water. The technologies identified by EPA as appropriate for contact cooling and heating water are good housekeeping practices and the activated carbon process. The activated carbon process uses activated (powered or granulated) carbon to remove soluble organics from air and water. The organics are removed as they became physically/chemically attached to the carbon (i.e. adsorbed to the carbon surface). EPA analysis indicates that only one pollutant of concern, bis(2-ethylhexyl)phthalate, is present in contact cooling and heating water in treatable concentrations, and the only technology identified to control bis(2-ethylhexyl)phthalate is the activated carbon process. To maintain low concentrations of other pollutants currently discharged in contact cooling and heating water, EPA advises the application of good housekeeping practices. For example, routine segregation of raw materials and lubricating oils from the cooling and heating water will keep pollutants not actually generated during the plastic molding and forming operation out of the cooling and heating water.

In cleaning water, the data indicate that there are three conventional pollutants (BOD5, oil and grease, and TSS), three non conventional (COD, TOC, and total phenols), and two priority pollutants (phenol and zinc) present in treatable concentrations. For the cleaning water category, EPA proposes pollution prevention technologies based on in-process controls. One control is recycling process water through a sedimentation tank designed to remove the suspended solids so the process water can be reused. The other control is end-of-pipe treatment of the discharge from the recycle unit.

In finishing water, the data indicate that the only pollutants present in treatable concentrations are total suspended solids (TSS) and three phalates. The only pollution prevention technology EPA has identified for the removal of TSS is a settling unit, and the only technology identified for removal of phthalates present in finishing water is an activated carbon process.

Pellet Release

The issue of plastic resin pellet loss to the environment during the manufacturing process is being addressed by most manufacturers through participation in "Operation Clean Sweep" (OCS). All participating facilities take measures to ensure spill minimization, prompt and thorough cleanup of spills, and proper pellet disposal. Such measures include employee education, extra conscientious sweeping efforts, enhanced pellet capture methods, and disposal precautions. Currently, the Society of the Plastic Industry is in the process of putting labels on all hoppers and cars used to transport the pellets to remind employees of the importance of not spilling the pellets.

Disposal

Plastics products disposal, as discussed earlier, is a concern because plastics make up a significant portion of the nation's waste stream. The most common pollution prevention method currently employed is recycling. Both single plastic resins and mixtures of plastic resins can be recycled, but the end products from mixtures are often lower in quality than those from just one type of resin. Therefore, the success of plastic recycling will depend on the development of technologies to separate mixed plastic into single resins, and on increasing the markets for products made of mixed plastic resins. Although recycling is the most common method of plastic waste pollution prevention, at present, less than one percent of all plastics products are recycled. Only a few plastic consumer items such as soft drink bottles and milk jugs are being recycled on a wide scale in the U.S., and the recycling of food containers and cups is just getting started. Enhancing the degradation of plastic has been offered as a solution to both the waste stream and marine environmental problems; however, EPA believes source reduction and recycling will provide the most significant results in reducing the impact of plastic in the environment. EPA is conducting a study of substitutes for lead- and cadmium-based additives as a possible pollution prevention action for metal leaching at landfills and metal releases from incinerator ash.

Rubber

As discussed, pollution outputs from the rubber products industry occur at many stages of the manufacturing process. Most facilities are reducing these outputs by employing the many reasonable and effective pollution prevention options that exist.

Chemicals

The compounding and mixing area of a rubber products manufacturing facility, where dry chemicals are weighed, put into small containers, and loaded into the rubber mixer, can be a significant source of particulate emissions. Some mixing facilities have practically eliminated particulate emissions by purchasing their chemicals in small pre-weighed, sealed polyethylene bags. The sealed bags are put directly into the banbury mixer and the bag itself becomes part of the rubber matrix, thus eliminating this formerly dusty operation. For facilities not purchasing their chemicals in pre-weighed bags, a variety of other pollution prevention options exist. The following pollution prevention methods have been used by various facilities:

- **Careful Transportation Mechanisms** - Receiving chemicals in closed docks in sealed containers or in bulk rail or truck shipments with a minimal history of spills. Storing chemical piles inside the facility to ensure that any fugitive emissions can be contained within the facility.

- **Sealed Containers** - Providing sealed containers for all open materials. Sealed containers should have air space between the chemical and the container cover to minimize "puffing" losses when the container is opened. Similarly, placing secondary containment mechanisms around all storage containers provides further protection from spills and leaks.

- **Automatic Dispensing** - Utilizing automatic dispensing and weighing equipment whenever possible. Automatic dispensing minimizes waste due to spills from manual dispensing and provides quality control.

- **Reduced Toxic Chemical Usage** - Reducing the use of toxic chemicals via reformulation. For example, one manufacturer claims to have reduced zinc waste simply by reducing the amount of zinc added to the compound master batch. He kept reducing the amount of zinc added until the quality of the product suffered. The manufacturer then assumed that the last zinc level at which no decrease in product quality was discovered was the best "waste minimized" operating level. Since manufacturers may use several hundred compounding formulae on a regular basis, formulae review may not only reduce waste production, but also provide for increased quality control.

- **Computer Inventories** - Providing computer inventory control methods to minimize the amount of stock purchased.
- **Spills and Sweeping Protocols** - Providing protocols for cleaning up spills and sweeping to ensure the proper segregation of waste.

Waste Water

Contaminated waste water is another pollution concern at many rubber product manufacturing facilities. All but the largest rubber product manufacturing facilities participate in waste water pretreatment programs with local publicly-owned treatment works (POTWs). Many plants meet pretreatment standards without treatment of their waste water. Some facilities, however, require solids settling, pH adjustment, or oil removal. To address the waste water issue, many facilities have implemented water reuse and recycling programs. Options for waste water reuse and recycling include installing a closed-loop water cooling or heating system or a closed-loop ethylene glycol system. Another problem is that waste water is often contaminated by oil and grease. To prevent the spilling and leaking of waste oil and grease which contaminates waste water, the following pollution prevention methods have been considered:

- Substituting lubricating grease for oil, especially for milling equipment. Grease has been shown to reduce substantially the amount of manifested waste.
- Performing preventive maintenance of processing, molding, and curing equipment. Such practices can further reduce the volume of manifested oil and grease waste by reducing waste from worn seals and gaskets.
- Removing oil from oily waste waters prior to disposal to reduce the volume of waste water disposal. For instance, oily waste waters collected from equipment engine pits could be routed through a centrally located oil/water separator prior to discharge.

Spent Solvents

Spent solvents known to contribute to ozone depletion are another pollution problem in rubber product manufacturing facilities. A major initiative by the rubber products industry to eliminate ozone depleting chemicals in 1994 and early 1995 resulted in many innovative spent solvent pollution prevention activities. Among the accomplishments were the replacement of solvent cleaning applications with high pressure water systems, the use of caustic cleaning solutions, and the substitution of old solvents with cleaner, citrus-based solvents. Many mold release compounds, coatings, and adhesives which formerly used ozone depleting chemicals as carriers were reformulated to eliminate the offending chemicals. Process changes and direct elimination of the chemicals

of concern were also accomplished. Most rubber products are now free from having been manufactured with ozone depleting chemicals.

Disposal

A significant issue in the rubber product industry is the disposal of waste rubber. To prevent the improper disposal of scrap rubber, facilities can segregate and recycle rubber wastes. Properly segregating waste streams may be as simple as placing a screen over part of the molding equipment so that waste rubber stock produced during performing operations can be segregated from the oily waste waters and recycled back into the process. Other segregation processes may include separating cured from uncured rubber, and recycling the uncured portion back into the process.

Reclaiming and recycling cured, off-specification rubber is also a waste minimization option. Reprocessing rubber involves taking used rubber products and processing them in a manner that produces a form of rubber filler or an ingredient that can be incorporated into virgin rubber compounds. There are two general methods for producing reprocessed rubber. The first is a severing of cross-links by chemical or steam digestion to produce a product known as reclaiming. The second is a grinding of rubber compounds by ambient grinding, cryogenic grinding, or solution grinding in water. These processes are also applicable to the scrap rubber produced during finishing operations.

Scrap rubber which cannot be recycled within the manufacturing process is being addressed by some of the following methods:

- Adding it to coal and wood waste fuels for firing process boilers
- Making it into sheets and various shapes to use as athletic area surfaces and other floor coverings
- Making it into sheet gasket material
- Making it into loading dock bumpers.

Recycling post-consumer and post-production scrap into products offers great challenges. Automobile components are continuously being designed for greater endurance (e.g., automobiles capable of 150,000 miles without maintenance or a tune up). Such performance standards require manufacturers to use high purity chemicals and quality, precision manufacturing processes. These

rubber products, whether they be tires, belts, hoses, motor mounts, gaskets, or a seals, turn out to be highly engineered entities with strict quality standards. Introducing used, off-specification, or unknown quality ingredients into the dynamically stressed, high performance rubber product can be a problem. As a result, recycling of the post-consumer and post-production waste seems, as a necessity, to apply to the less sophisticated, non-dynamic, static application products.

To better understand how much waste is being produced by their facility in comparison to other facilities, many rubber product manufacturers are monitoring waste indices, i.e., pounds of waste per 100 pounds of product, with the goal of continuously reducing the index. Index criteria include the following:

- Total lbs. of non recyclable waste shipped off-site per 100 lbs. of product
- Total lbs. of solid and hazardous water generated per 100 lbs. of product.

Tires

All of the pollution prevention options discussed in the section on rubber product manufacture also apply to tire production. In addition, the two pollution issues which apply specifically to the tire industry are VOC emissions from the building and assembly process and scrap tire disposal. In terms of pollution prevention for VOC emissions from tire cementing and spraying operations, EPA recommends capture and control technologies for undertread cementing operations, tread end-cementing operations, bead cementing operations, and green tire spraying operations where organic solvent-based sprays are used. EPA also recommends that green tire spraying operations consider switching to water-based sprays (i.e., any green tire spray that contains 12 percent or less, by weight, of VOC as sprayed) or organic solvent-based sprays.

While not technically a "pollution" output from the tire manufacturing process. Scrap tire disposal has been a big waste disposal issue in the U.S. Recently, legislation and initiatives have been finding innovative ways to address this issue. The Scrap Tire Management Council (the Council), made up of rubber industry representatives, is leading the effort to find and expand markets for the environmentally and economically sound uses of scrap tires. According to the Rubber Manufacturers Association, in 1993, an

estimated 33 percent of the 250 million tires scrapped annually were utilized in a positive manner. This represents more than a tripling of scrap tire use since 1990, and more than a five-fold increase since 1985. The principal use of scrap tires is as a fuel and fuel supplement in a variety of utility and industrial applications. Other major uses include ground rubber as an additive to asphalt paving materials, whole and processed tire uses in civil engineering, and utilization of cut, split, and ground tires in new products. The tires not utilized are landfilled or stockpiled.

In 1993, 70 million tires were used in energy recovery. The capacity to use an additional seven million tires in cement kilns was permitted but not utilized. Asphalt paving utilized nearly five million tires, as did civil engineering uses. The equivalent of one million tires were used to manufacture various new products. The Council projections indicate that by 1997, more than 328 million tires could be utilized annually. Exhibit 32 shows the trends in the number of scrap tires used in various capacities.

Exhibit 32
Scrap Tire Usage

SCRAP TIRE USES (Millions of Units)				
	1990	**1992**	**1993**	***1997***
Fuel	24.5	57	70	230
Paving	N/A	5	5	80
Civil Engineering	N/A	5	5	15
Products	N/A	1	1	3
Total Usage	24.5	68	81	328

Source: RMA 1993 Tire Industry Facts.

The first line of defense against increasing scrap tire numbers is tire retreading. The figures presented above do not include retreaded tires because tire casings which are capable of being retreaded are not, by definition, scrap tires. Only tires which can no longer be used for their original intended purpose, even if retreaded, are considered scrap tires. The American Retreaders Association estimates that in 1993, nearly 32 million tires were retreaded and returned to useful life on America's cars, trucks, airplanes, earth movers, and industrial equipment.

The Federal government is working to identify and implement pollution prevention strategies to decrease the number of scrap tires and the economic and environmental problems that accompany scrap tire disposal. For example, in 1989 EPA promulgated

procurement guidelines that promote the use of retread tires by government agencies and entities funded by the government. If the retread markets could be developed so that all passenger and light truck tires suitable for retreading were actually retreaded, approximately 20 million fewer new replacement tires would be needed annually. This would reduce the number of scrap tires generated per year by almost 10 percent.

As of January 1991, 36 States regulated scrap tires as a form of waste, up from only one State in 1985. Twenty-four States have final regulations in place that address storage of tires; typical provisions include requiring permits for tire piles over a certain size and requiring fire lanes in large tire piles. Funds may also be used to provide grants or loans to entrepreneurs who are recycling tires or incinerating them for energy recovery. At least four States (OR, WI, UT, and OK) have developed rebate systems for scrap tires in which users of scrap tires are paid rebates of one cent per pound or more for recycling tires or burning them for energy recovery.

Other Private Sector Initiatives to Improve Environmental Performance

Many dry chemicals are purchased in sealed pre-weighed poly-logs which can be put directly into the manufacturing process thus eliminating fugitive emission. Fluorescent lamps and pressurized spray cans are managed to minimize adverse impact on the environment. Also, packaging materials are being reduced, returnable containers are being used, and waste oil recycled. General production improvements include the upgrading and addition of plant ventilation systems, which provides cleaner air in the workplace, improvement in solvent application efficiency to decrease the amount of solvents needed, use of more efficient coating equipment which speeds the production process, and the refinement of preventive maintenance programs that often virtually eliminate unplanned shutdowns which lead to waste. Solvent use the rubber industry has been reduced through the development of water-based adhesives and coatings, and astute raw material substitution.

Enhanced personnel training, product substitution, and process alternations have led to reduction in the amount of hazardous waste generated, and recycling of paper, wood, skids, plastic shrink wrap, cardboard, cord, wire, fabric, and white office paper have increased. Some manufacturing plants have reduced waste water discharges by installing closed loop water cooling systems, and other companies removed and their underground storage tanks replaced with above ground tanks that are easier to monitor for leaks.

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 two 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

The descriptions within Section VI 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 its 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.

VI.B. Industry Specific Regulations

Although the rubber and plastics products manufacturing industries are grouped together under SIC 30, current Federal regulations separate the two industries. The environmental issues directly addressed for rubber product manufacture are recycling mandates, air emissions, and hazardous waste disposal. For plastic, the only Federally-regulated issue is contaminated waste water. Recycling requirements exist on the State and local level for plastics products and will be expanded upon later. Based on their pollutant outputs, both plastic and rubber products manufacturing processes have the potential to be regulated under the Clean Water Act, the Clean Air Act, and RCRA.

The Clean Air Act (CAA)

In addition to the applicable general requirements of the CAA, rubber and plastics products manufacturing facilities are subject to numerous industry-specific air regulations. Several new source performance standards (NSPS) affect facilities in the rubber and plastics manufacturing industries. One NSPS is 40 CFR Part 60, Subpart BBB, "Standards of Performance for the Rubber Tire Manufacturing Industry." This standard applies to new, modified or reconstructed facilities which mass produce passenger car and light-duty truck tires and similar tires with a bead diameter less than or equal to 0.5 meters (19.7 inches) and a cross section dimension less than 0.325 meters (12.98 inches). The emission limits in the standard are for volatile organic compound (VOC) emissions from undertread cementing, sidewall cementing, tread end cementing, bead cementing and green tire spraying operations.

Another NSPS that affects certain facilities in the rubber and plastics manufacturing industries is 40 CFR Part 60, Subpart TTT, "Standards of Performance for Industrial Surface Coating: Surface Costing of Plastic Parts for Business Machines." This standard applies to new, modified, or reconstructed facilities that apply coatings to plastic parts that will be used in the manufacture of

business machines. The emission limits in the standards are for VOC emissions from prime coats, color coats, texture coats, and touch-up coats. Other NSPS standard such as NSPS DDD - For VOC for the Polymer Manufacturing Industry, and NSPS VVV - For Polymeric Coating of Supporting Substrates Facilities, may also apply to some facilities under SIC 30.

Under Title III of the Clean Air Act Amendments (CAAA), the EPA is developing many national emission standards for hazardous air pollutants (NESHAPs). Several of these will affect certain facilities in the rubber and plastics products manufacturing industries. These include standards for reinforced plastics and composites, rubber tire manufacturing, and plastic parts coating. Development of the standard for reinforced plastics and composites started in 1995. The development of the other two standards has not yet started.

Under Title I of the CAAA and under previous legislation, the EPA has provided guidance and other information to State and local agencies on reducing VOC emissions from existing sources in ozone non-attainment areas. These documents are referred to as Control Techniques Guidelines (CTGs) and Alternative Control Techniques (ACTs). A CTG for rubber tire manufacturing was issued in 1978 (Control of Volatile Organic Compound Emissions from Manufacture of Pneumatic Rubber Tires, EPA-450/2-78/030). An ACT for coating of plastic parts was issued in 1994 (Alternative Control Techniques Document: Surface Coating of Automotive/Transportation and Business Machine Plastic Parts, EPA - 453/R-94/017).

The Clean Water Act (CWA)

In addition to applicable general CWA requirements, rubber product manufacturers are subject to the specific requirements contained in 40 CFR Part 428, "EPA Effluent Guidelines and Standards for Rubber Manufacturing." These regulations contain pre-treatment and performance standards, and requirements for the application of best practicable control technologies (BPT) and/or Best Available Technologies (BAT). The regulated pollutants include TSS, oil and grease, pH, COD, BOD5, lead, and chromium. The standards are promulgated under the authority of §§301, 304, 306, 307, 308, and 501 of the CWA and in response to the settlement reached in Natural Resources Defense Council v. Train.

EPA promulgated regulations contained in the Federal Register, Vol. 55 No. 222, "National Pollutants Discharge Elimination System Permit Application Regulations for Storm Water Discharge; Final

Rule" on November 16, 1990. These regulations require permit applications for storm water discharges from selected municipal and industrial point sources. The rubber manufacturing industry was among the industries required to submit an application for storm water discharge permits. The regulations require that a storm water pollution prevention plan (SWPPP) be developed for each facility covered by this regulation. The regulations state that the SWPPP shall be prepared in accordance with good engineering practices and in accordance with the factors outlined in 40 CFR §§125.3(d)(2) or (3) as appropriate.

Plastics products manufacturers are subject to applicable general CWA requirements and to the specific requirements contained in 40 CFR Part 463, "Plastic Molding and Forming Point Source Category Effluent Limitations Guidelines; Pretreatment Standards and New Source Performance Standards." This regulation establishes effluent limitations guidelines and standards that limit the discharge of pollutants into navigable waters by existing and new sources engaged in plastic molding and forming. The regulated pollutants include BOD5, TSS, oil and grease, and pH.

Resource Conservation and Recovery Act (RCRA)

Facilities engaged in rubber product or rubber tire manufacture use RCRA-regulated unused commercial chemical products which, if spilled or sent for disposal, are considered hazardous waste. These include ethylene thiourea, phenol, guanidines, and some lead, selenium, and cadmium compounds. Because these are all compounding agents which are added to the rubber mixture in their original form, spills are a reasonable possibility and RCRA requirements are likely to apply. Also, according to Toxic Release Inventory (TRI) data, rubber and miscellaneous plastics products manufacturing facilities use many solvents that are regulated by RCRA. These solvents include toluene, methyl ethyl keytone, 1,1,1-trichloroethane, acetone, methanol, xylene, methyl isobutyl keytone, trichlorofluoromethane, freon 113, trichloroethylene, and n-butyl alcohol.

Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA)

Facilities engaged in rubber compounding at either rubber products or tire facilities may be required to report annually any releases to the environment of certain chemicals regulated under §313, Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986. If a rubber compounding facility has 10 or more full time employees, all environmental releases of any §313-listed chemical

or chemical category manufactured or processed by the facility in an amount exceeding 25,000 pounds per year or otherwise used in an amount exceeding 10,000 pounds per year must be reported. It is important to note that approximately 35 percent of all rubber and miscellaneous plastics products manufacturing facilities have less than 10 employees and are not covered by EPCRA.

The Intermodal Surface Transportation Act of 1991

The purpose of the Intermodal Surface Transportation Act is to increase the use of ground tire rubber in asphalt materials which are purchased with Federal funds for use in highway construction and maintenance. Ground tire rubber is produced by recycling used automotive and truck tires that would ordinarily by disposed of by placement in landfills or by other disposal procedures. Increased use of tires in asphalt materials should help to remove tires from the solid waste stream. At the same time, such use will assist in conserving both energy and natural resources used in constructing and maintaining pavement systems.

The Act mandates that starting in 1991, a "minimum utilization" of five percent of all asphalt pavement financed in whole or in part by the Federal government be asphalt rubber. This minimum is to increase annually by five percent until 1997, when the minimum utilization will have risen to 20 percent. More than 500 tires are consumed to produce asphalt for a one-lane, one-mile stretch of road. By encouraging the use of ground tire rubber, the guideline should result in a decrease in the number of tires going to landfills or to tire stockpiles. In addition, the increased use of rubber in asphalt materials will result in reduced generation of solid wastes, air pollutants, and water pollutants generated during the production of asphalt and the aggregates used in asphalt concrete pavements. To the extent that ground tire rubber replaces the asphalt or the aggregate, these pollutants will be reduced. Implementation of this Act has been delayed many times, and to date it has not been fully implemented.

Guidance for Federal Procurement of Retread Tires

Retreading is the application of a new tread to a worn tire whose casing is still in good condition. Currently, over 1,900 retreaders operate in the U.S., though that number is shrinking because of declining markets for passenger retreads. This decline is due to the relatively low price of new tires and concerns about the safety of retreads. Truck tires, however, are often retreaded three times before they are discarded, and the truck tire retreading business is

increasing. On November 17, 1989, EPA promoted the use of retread tires by government agencies and other government-funded entities by promulgating procurement guidelines for retread tires.

The purpose of retread guidelines is to assist procuring agencies in complying with the requirements of §6002 of RCRA, as amended, 42 U.S.C. 6962, as that section applies to procurement of tires. By May 8, 1986, Federal agencies were required to eliminate from their specifications any exclusion of retread tires and any requirement that tires be manufactured from virgin materials unless there is a technical basis for such exclusion or requirement. The current guideline requires each procuring agency to assure that its specifications require the use of retread tires to the maximum extent possible without jeopardizing the intended end use of these items.

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 the 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: 1 (CT, MA, ME, RI, NH, VT); 2 (NJ, NY, PR, VI); 3 (DC, DE, MD, PA, VA, WV); 4 (AL, FL, GA, KY, MS, NC, SC, TN); 5 (IL, IN, MI, MN, OH, WI); 6 (AR, LA, NM, OK, TX); 7 (IA, KS, MO, NE); 8 (CO, MT, ND, SD, UT, WY); 9 (AZ, CA, HI, NV, Pacific Trust Territories); 10 (AK, ID, OR, WA).

Compliance and Enforcement Data Definitions

General Definitions

Facility 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. The Rubber and Miscellaneous Plastics Products Industry Compliance History

Exhibit 33 provides a Regional breakdown of the five year enforcement and compliance activities for the rubber and miscellaneous plastics products industry. Regions IV and V conducted approximately 60 percent of the inspections of rubber and miscellaneous plastics products manufacturing facilities performed in the United States. This large percentage is due to the concentration of rubber and miscellaneous plastics products facilities in these areas.

Exhibit 33
Five Year Enforcement and Compliance Summary for the Rubber and Plastic Industry

A	B	C	D	E	F	G	H	I	J
Rubber and Plastic SIC 30	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	93	59	233	25	24	40	63%	38%	0.17
Region II	88	57	332	17	28	61	75%	25%	0.18
Region II	152	78	422	23	29	81	79%	21%	0.19
Region IV	411	207	1,371	19	40	125	95%	5%	0.09
Region V	577	253	1,040	35	41	52	85%	15%	0.05
Region VI	166	55	211	50	9	17	71%	29%	0.08
Region VII	100	47	183	34	15	31	32%	68%	0.17
Region VIII	27	12	43	40	4	9	89%	11%	0.21
Region IX	122	30	146	53	4	7	57%	43%	0.05
Region X	41	25	63	41	9	20	60%	40%	0.32
Total/Average	1,777	823	4,044	28	203	443	78%	22%	0.11

VII.B. Comparison of Enforcement Activity Between Selected Industries

Exhibits 34-37 contain summaries of the one and five year enforcement and compliance activities for the rubber and miscellaneous plastics products industry, as well as for other selected industries. As indicated in Exhibits 34 and 35, the rubber and miscellaneous plastics products industry has an average enforcement to inspection rate (12 percent) when compared to other industries. Of the 4,044 inspections conducted at 963 rubber and miscellaneous plastics products manufacturing facilities over a five year period, 496, or 12 percent, resulted in enforcement actions. Approximately 11 percent of inspections in the manufacturing sector as a whole resulted in enforcement actions.

Exhibit 34
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	405	222	777	31	68	212	79%	21%	0.27
Automobiles	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

Exhibit 35
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	0.15
Furniture	293	160	113	66	41%	3	2%	5	0.04
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	405	60	87	80	133%	8	13%	21	0.24
Automobiles	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.

Exhibit 36
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	213	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	222	777	212	16%	2%	14%	3%	66%	90%	3%	5%
Automobiles	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 Substance Control Act, and the Emergency Planning and Community Right-to-Know Act as well as other Federal environmental laws.*

Exhibit 37
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	113	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	60	87	21	17%	2%	14%	7%	69%	87%	<1%	4%
Automobiles	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 Substance 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 the EPA's *Enforcement Accomplishments Report, FY 1991, FY 1992, FY 1993* publications, six significant enforcement cases were resolved between 1991 and 1993 for the rubber and plastics products manufacturing industry. Two of these actions involved violations of CAA, and RCRA, TSCA, CERCLA, and EPCRA accounted for one action each. Five of these cases were brought against either rubber tire or rubber hose manufacturing companies, and one case was brought against a plastic product manufacturer. The cases involving the rubber product manufacturing industry included improper disposal of PCBs, failure to repair or replace PCB transformers, responsibility for a Superfund site, producing mercury and benzene emissions beyond NESHAP requirements, and failure to control VOC emissions. The case involving the plastic product manufacturing industry included operation of a surface impoundment and waste pile in violation of RCRA.

Five of the six enforcement actions resulted in the assessment of a penalty. Penalties ranged from $135,000 to $1,500,000, and in five cases, the defendant was ordered to spend additional money to improve the processes or technologies and to increase future compliance. For example, in The Matter of Goodyear Tire & Rubber Company (1991), the company paid a $135,000 penalty and spent approximately $405,000 to remove and replace eight PCB transformers. The average penalty per case was approximately $500,000. Supplemental Environmental Projects (SEPs) were required in three of the cases. In another case, B.F. Goodrich (1993) was required to implement an environmentally beneficial project to reduce mercury emissions beyond the NESHAP requirement, and to conduct environmental audits at several of its facilities.

The case of U.S. et al. v. Production Plated Plastic, Inc. et al. (1992) is considered significant by the EPA because the court held a corporate officer and the owner of the company personally liable.

VII.C.2. Supplemental Environmental Projects (SEPs)

Below is a list of Supplementary Environmental Projects (SEPs). 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 chart contains a representative sample of the Regional responses addressing the rubber and plastics products industry. The information contained in the chart is not comprehensive and provides only a sample of the types of SEPs developed for the rubber and plastics products industry.

Private Sector Initiatives

Many tire and rubber product manufacturing companies participate in a variety of Federal, State, and local voluntary initiatives including:

- EPA's 33/50 program, a voluntary initiative to reduce toxic waste generation from industrial sources.
- The Green lights program, an initiative encouraging voluntary reductions in energy use through more efficient lighting technologies.
- Energy Star Computer Program, a voluntary partnership between EPA and the manufacturers that sell 60 percent of all desktop computers and 80-90 percent of all laser printers in the U.S. These companies are introducing products that automatically "power-down" to save energy when not in use.

Concerning emissions reduction, industry-wide, many dry chemicals are purchases in sealed pre-weighed poly-logs which can be put directly into the manufacturing process thus eliminating fugitive emission. Fluorescent lamps and pressurized spray cans are managed so that they can be disposed of with no adverse impact on the environment. Also, packaging materials are being reduced and returnable containers are being maximized. Throughout the rubber industry, the majority of waste oil is recycled for reuse.

General production improvements include the upgrading and addition of plant ventilation systems, which provides cleaner air in the workplace, improvement in solvent application efficiency to decrease the amount of solvents needed, use of more efficient coating equipment which speeds the production process, and the

Exhibit 38
Supplemental Environmental Projects
Rubber and Plastics (SIC 30)

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
Accurate Plastics Denver, CO	8	EPCRA	Pollution Prevention	$ 14,041	Purchase, install, and operate new air assisted airless spray equipment to reduce the release of VOCs to the atmosphere by as much as ten percent.		$ 2,060
Interplastic Corporation Pryor, OK	6	CERCLA	Equipment Donation	$ 7,000	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.	$ 25,000	$ 5,000
Kerr Group, Inc. Chicago, IL	5	CAA	Pollution Prevention	$ 300,000	Replace gasket manufacturing process with a non-VOC process to reduce VOC emissions by approximately 50 tons/yr.	$ 76,000	$ 38,000
Laminated Products Kenosha, WI	5	EPCRA	Pollution Prevention	$ 173,000	Use a water-based adhesive to eliminate the use and release of 26,000 lbs/yr of acetone and 11,000 lbs/yr of toluene.	$ 40,000	$ 4,000

This page intentionally blank.

VIII. COMPLIANCE ASSURANCE 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

Goodyear, the biggest tire manufacturer in the U.S., has implemented a waste minimization and a SARA chemicals reduction program which has proven to be quite effective. In the mid 1980's, Goodyear set a corporate goal of 10 percent annual reduction in solid waste disposal. In 1988, the CEO of Goodyear established a more ambitious goal of 90 percent reduction in solid waste disposal for North American facilities and an elimination of all landfilling by 1994. Currently, each division of Goodyear is setting annual reduction goals.

Many strategies have been employed to help Goodyear reach its goals. Two internal waste minimization conferences have been held to create a forum for the exchange and discussion of pollution reduction ideas. Plants are now required to track various categories of waste oil and grease, hazardous wastes (i.e., some compounding agents), process waste, and material waste (i.e., fabrics, scrap rubber, etc.). Monthly reports on the waste disposal tracking practices are required for review at corporate headquarters. In addition to the monthly reports, all Goodyear plants created flow diagrams for each waste stream, wrote plant-specific waste reduction plans, and selected yearly projects for waste minimization. The plants also exchange waste minimization ideas and information on successes and failures through corporate headquarters.

The results of these efforts have been very positive. Since 1988, there has been an overall 67 percent reduction of waste generation (based on 1993 data from all North American plants). At present, 35 percent of all waste is recycled at the facilities, and the pounds of waste produced per 100 pounds of finished stock has decreased by 56 percent since 1988. 1,3 butadiene releases were reduced 64 percent by the target date, and as of 1993 has been reduced 83 percent since 1988.

Goodyear is also developing waste minimization plans for the future. Currently, a cross-functional team from the corporate headquarters is working on recyclable packaging for all of the raw materials.

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.

Exhibit 39 lists those companies participating in the 33/50 program that reported under SIC code 30 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 manufacturing Rubber and Miscellaneous Plastic Products. 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 39
Rubber and Misc. Plastic Product Producers Participating in the 33/50 Program

Parent Facility Name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
3m Minnesota Mining & Mfg. Co	St. Paul	MN	3081, 3053, 3229, 3861, 2843, 2899	8	16,481,098	70
A. W. Chesterton Company	Stoneham	MA	3053, 3561, 2869	1	13,250	65
Abbott Laboratories	North Chicago	IL	3069, 3089	2	2,392,515	20
Aladdin Industries Inc	Nashville	TN	3086, 3469, 3648	1	53,741	91
Albar Industries Inc	Lapeer	MI	3089	1	27,760	55
Aldan Rubber Co.	Philadelphia	PA	3069	1	209,030	80
Allied-Signal Inc	Morristown	NJ	3083	2	2,080,501	50
Aluminum Company Of America	Pittsburgh	PA	3089	5	2,403,017	51

Exhibit 39 (cont'd)
Rubber and Misc. Plastic Product Producers Participating in the 33/50 Program

Parent Facility Name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
Ameron Inc Delaware	Pasadena	CA	3084	1	184,882	**
Amsted Industries Incorporated	Chicago	IL	3084	1	1,834,493	66
Apogee Plastic Tech. Inc.	Daytona Beach	FL	3087	1	45,921	33
Avon North America Inc	Cadillac	MI	3061	1	0	***
B F Goodrich Company	Akron	OH	3087, 2821	10	621,207	50
Baker Hughes Incorporated	Houston	TX	3061	1	193,116	20
Barnhardt Manufacturing Co	Charlotte	NC	3086	1	629,426	25
Baxter International Inc	Deerfield	IL	3081, 2671, 3089	1	42,570	80
Bemis Company Inc	Minneapolis	MN	3081, 3083, 2754, 2759, 26713921	3	936,449	50
Bhar Incorporated	Fort Wayne	IN	3087	1	755	50
Bicc Usa Inc	Chicago	IL	3087	1	152,253	15
Blue Ridge Products Co Inc	Hickory	NC	3086	1	39,369	**
Borden Inc	New York	NY	3081, 2754, 2295	2	1,644,614	*
Bp America Inc	Cleveland	OH	3089, 2299	1	1,597,404	24
Bridgestone/Firestone Inc	Akron	OH	3011	5	166,052	50
Brown Group Inc	St Louis	MO	3069, 3079, 3086, 3089	1	213,505	50
Cabot Corporation	Boston	MA	3086	2	2,407,581	50
Caterpillar Inc	Peoria	IL	3052, 3069, 3089, 3086	2	870,439	60
Central Plastics Company	Shawnee	OK	3089, 3494	1	43,635	50
Chem-Tech Rubber Inc	West Haven	CT	3069	1	561,000	***
Chestnut Ridge Foam Inc.	Latrobe	PA	3069	1	22,000	50
Chevron Corporation	San Francisco	CA	3084	1	2,794,502	50
Como Plastics Corporation	Columbus	IN	3082	1	59,657	***
Crain Industries Inc	Fort Smith	AR	3086	12	2,700,636	8
Creative Foam Corporation	Fenton	MI	3069	2	331,566	*
Dana Corporation	Toledo	OH	3053	2	1,652,123	**
Delbar Products Inc	Perkasie	PA	3089, 3465	1	102,983	50
Design House Inc	Germantown	WI	3089	1	98,256	*
Dexter Corporation	Windsor Locks	CT	3087	2	122,127	51
Dow Chemical Company	Midland	MI	3086, 5169, 2821	4	2,769,363	50
Dow Corning Corporation	Midland	MI	3069	2	1,134,610	16
E. I. Du Pont De Nemours & Co	Wilmington	DE	3081, 2821, 2869, 3089	1	11,740,853	50
Eagle-Picher Industries Inc	Cincinnati	OH	3069	6	227,242	50

Exhibit 39 (cont'd)
Rubber and Misc. Plastic Product Producers Participating in the 33/50 Program

Parent Facility Name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
Eastman Kodak Company	Rochester	NY	3087	1	5,827,091	50
Ebonite International Inc	Hopkinsville	KY	3089	1	25,700	94
Ensign-Bickford Ind. Inc.	Simsbury	CT	3081	1	26,233	***
Federal-Mogul Corporation	Southfield	MI	3053	3	255,996	50
Ferro Corporation	Cleveland	OH	3087	1	165,529	50
Flexcon Company Inc	Spencer	MA	3081	3	309,851	54
Ford Motor Company	Dearborn	MI	3089, 3114	2	15,368,032	15
Forsch Ltd	Atlanta	GA	3089	2	494,675	21
Gates Corporation	Denver	CO	3052	6	478,941	***
Gencorp Inc	Akron	OH	3069	10	5,453,359	34
General Electric Company	Fairfield	CT	3083, 3299, 2821	1	5,010,856	50
General Motors Corporation	Detroit	MI	3469, 3674, 3089, 3694, 3679, 3471	3	16,751,198	*
General Tire Inc	Akron	OH	3011	1	54,969	***
Georgia Gulf Corporation	Atlanta	GA	3087	1	39,480	80
Globe Manufacturing Co	Fall River	MA	3069, 2824	1	374,293	45
Goodyear Tire & Rubber Co	Akron	OH	3011	7	3,932,157	50
Great Western Foam Pdts Corp	Orange	CA	3086	3	1,264,978	*
Great Western Foam Pdts Corp	Hayward	CA	3086	2	25,000	***
Hartzell Manufacturing Inc	Saint Paul	MN	3089	1	15,050	85
HBDIndustries Inc	Bellefontaine	OH	3052	2	361,100	*
Hercules Incorporated	Wilmington	DE	3089, 3764	1	5,014,664	50
HM Anglo-American Ltd	New York	NY	3089, 3471, 3451, 3579	3	1,265,741	2
Home Interiors & Gifts Inc	Dallas	TX	3089	1	181,140	83
ICI Americas	Wilmington	DE	3089, 2869	2	165,162	50
International Paper Company	Purchase	NY	3083	2	2,784,831	50
Iten Industries Inc	Ashtabula	OH	3083	1	669	*
Itt Corporation	New York	NY	3052, 3714	1	735,332	7
J P Emco Inc	Ada	OK	3089	1	316,600	75
JMK International Inc	Fort Worth	TX	3069, 2822	1	34,141	50
Jones & Vining Incorporated	Braintree	MA	3089	1	394,001	89
Keene Corporation	New York	NY	3089, 2821	1	14,450	**
Key Plastics Inc	Plymouth	MI	3089	1	44,340	50
Kimberly-Clark Corporation	Irving	TX	3086, 3842, 3949	1	488,160	50
Lacks Enterprises Inc	Grand Rapids	MI	3089, 3471	6	867,354	27
Liberty Polyglas Inc	West Mifflin	PA	3083	1	18,718	*
Lord Corporation	Erie	PA	3069, 3471	3	1,111,309	58

Exhibit 39 (cont'd)
Rubber and Misc. Plastic Product Producers Participating in the 33/50 Program

Parent Facility Name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
Louisville Tile Distributors	Louisville	KY	3088	1	27,000	50
Macho Products Inc	Palm Bay	FL	3069, 3949, 3086	1	471,824	**
Marley Usa Holding Corporation	Johnson City	TN	3089, 2499	1	74,713	*
Masco Industries Inc	Taylor	MI	3053	3	488,484	***
Mascotech	Taylor	MI	3069	1	3,163,830	35
Miles Inc	Pittsburgh	PA	3069	1	1,095,504	40
Milliken & Company	Spartanburg	SC	3069	1	13,500	50
Millipore Corporation	Bedford	MA	3089	1	65,529	50
Mobil Corporation	Fairfax	VA	3081, 2673	1	4,263,284	50
Molded Fiber Glass Companies	Ashtabula	OH	3089	3	86,211	50
Monsanto Company	Saint Louis	MO	3086, 2821	2	1,683,580	23
Morgan Stanley Leveraged Fund	New York	NY	3087	4	2,166,420	13
Newell Co	Freeport	IL	3089	1	324,283	23
Norton Company	Worcester	MA	3086	1	40,831	63
O'Sullivan Corporation	Winchester	VA	3082	4	2,461,791	*
Oberg Industries Inc	Freeport	PA	3469, 3471, 3089	1	18,435	85
Occidental Petroleum Corp	Los Angeles	CA	3081, 3087	1	8,896,126	19
Owens-Illinois Inc	Toledo	OH	3469, 3089	1	412,573	***
Parker Hannifin Corporation	Cleveland	OH	3052	3	244,966	50
Peco Manufacturing Co. Inc.	Portland	OR	3089, 3363, 3382	1	16,409	100
Permacel	North Brunswick	NJ	3069, 3089	1	485,521	47
Phifer Wire Products Inc	Tuscaloosa	AL	3089, 3496	1	24,500	50
Phillips Petroleum Company	Bartlesville	OK	2869, 2879, 3083, 2087, 2821	1	2,367,877	50
Phillips Plastics Corporation	Phillips	WI	3089	1	33,112	***
Plymouth Rubber Company Inc	Canton	MA	3069, 3089	1	343,000	*
PPG Industries Inc	Pittsburgh	PA	2821, 2819, 2869, 3081	1	2,772,331	50
Premix Inc	N Kingsville	OH	3089	2	497,852	23
Purethane Inc	West Branch	IA	3086, 3714	1	213,153	50
Rayven Inc	Saint Paul	MN	3081	1	14,412	**
Reinz Wisconsin Gasket	Milwaukee	WI	3053	1	16,820	55
Reynolds Metals Company	Richmond	VA	3089, 3497, 2671, 2754	2	2,055,294	38
Rogers Corporation	Rogers	CT	3061, 3086	3	76,995	***
Rohm And Haas Company	Philadelphia	PA	3081	1	1,210,244	50

Exhibit 39 (cont'd)
Rubber and Misc. Plastic Product Producers Participating in the 33/50 Program

Parent Facility Name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
S C Johnson & Son Inc	Racine	WI	2821, 2842, 2879, 2844, 2899, 3089	1	104,055	50
S M R Technologies Inc	Sharon Center	OH	3069	1	34,600	33
Sandoz Corporation	New York	NY	3087	5	104,490	50
Seaward Intl. Inc.	Clear Brook	VA	3089	1	69,000	60
Shell Petroleum Inc	Houston	TX	3089	2	3,240,716	55
Siebe Industries Inc	Richmond	VA	3069	4	849,335	2
SKF Usa Inc	King Of Prussia	PA	3053	5	150,772	***
Solvay America Inc	Houston	TX	3081	1	123,583	*
Sonoco Products Company	Hartsville	SC	3089	3	621,380	1
Stanley Works	New Britain	CT	3231, 3089, 2499	2	508,199	50
Stern Rubber Company	Staples	MN	3061	1	8,610	75
Superior Home Products	Maryville	IL	3088	1	14,500	50
Sweetheart Holdings Inc	Chicago	IL	2656, 3082, 3089, 2679	1	12,404	49
Tech Industries Inc	Woonsocket	RI	3089, 3471	1	27,003	64
Tenneco Inc	Houston	TX	3353, 3081	1	1,272,423	8
Texas Instruments Incorporated	Dallas	TX	3625, 3822, 2714, 3672, 3089	1	344,225	25
Therma-Tru Corp	Sylvania	OH	3442, 3089	1	17,255	41
Thyssen Holding Corporation	Troy	MI	3089	2	313,705	11
Trinity American Corp	Glenola	NC	3086	1	750	***
Trinova Corporation	Maumee	OH	3089	9	488,879	50
Union Carbide Corporation	Danbury	CT	3069	1	728,129	50
United Silk Mills (Usa) Ltd	New York	NY	3052	1	14,500	60
United Technologies Corp	Hartford	CT	3089	8	2,393,252	50
Vernay Laboratories Inc	Yellow Springs	OH	3069	1	13,347	50
Vista Chemical Company	Houston	TX	3087	2	106,497	50
Vytech Ind. Inc.	Anderson	SC	3081, 2295, 2893, 3089	1	599,701	*
W R Grace & Co Inc	Boca Raton	FL	3089	5	615,509	50
Westinghouse Electric Corp	Pittsburgh	PA	3083, 3089, 2672	2	1,137,198	28
Witco Corporation	New York	NY	3089	3	327,611	50
Woodbridge Holdings Inc	Mississauga, Ont., Canada		3086	1	45,081	***
Zeneca Holdings Inc	Wilmington	DE	2295, 3087	1	1,609,047	*

*** = 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. (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, or contact Jon Kessler at EPA's 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 at 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 1-800-372-9473)

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

In an effort to determine private sector activities, major trade associations and corporations were contacted. There are a significant number of activities occurring in both the rubber and plastic industries. The Rubber Manufacturers Association (RMA) has projects completed or underway which are looking at issues such as storm water, emissions factors, scrap tires, and leaching potentials of rubber products. The Society of the Plastic Industry has started an incentive program called Operation Clean Sweep (OCS) to help plastic product manufacturers comply with the EPA-regulated problem of plastic pellet resin loss.

VIII.C.1. Environmental Programs

Storm Water

EPA has identified storm water runoff as one of the leading causes of the deterioration of water quality in rivers, lakes, streams, wetlands, and estuaries. As a result, EPA promulgated regulations on November 16, 1990, that required permit applications for storm water discharges from selected municipal and industrial point sources. In 1990, the RMA sponsored a group storm water application project which involved over 275 individual facilities. Storm water sampling indicated that the rubber product manufacturing facilities have minimal storm water pollution concerns. The draft NPDES permits published in the Federal Register on November 19, 1993 for the rubber industry reflect this "minimal concern" by proposing the following provisions:

- No specific numerical effluent limitations are needed.
- Best management practices (BMP) are effective at reducing pollutants.
- Quarterly visual observation of storm water discharges will help minimize pollution.

Many States are not waiting for EPA to finalize the permitting requirements and have requested that plants obtain local permits with reporting and chemical analysis provisions.

Air Emissions

The RMA is also looking into air emissions. Accurate emissions factors for hazardous air pollutants (HAPs) are required by CAA Title V for preparation of emissions inventories in rubber manufacturing plants. The rubber manufacturing industry is one of the industries for which up-to-date emissions factors are not available. The RMA has initiated an emissions sampling program, on behalf of its members, to develop HAP emissions factors for processes with little available air pollutant emissions data. Six processes common to both the tire and general rubber products industries were the subject of this project. The processes were: mixing, milling, extruding, calendering, vulcanizing, and grinding. Twenty-six rubber compounds/mixtures were studied in this program. For each test, emissions rates were developed as pounds of pollutant emitted per pound of rubber (or product) processed.

The emissions factors project is breaking new ground as this type of testing has never been done on such a scale for the tire and rubber industry. RMA and members of its Environment Committee have held three meetings with EPA's air program in Research Triangle Park. EPA officials have indicated to RMA representatives a willingness to use the results of this project as the basis for a new section of AP-42, EPA's compilation of air pollutant emissions factors. EPA predicts that the new rubber industry factors could be on EPA's Bulletin Board by the end of 1995 and that full print publication could take place in 1996.

Scrap Tire Disposal

Scrap tire disposal is another issue being addressed by the rubber industry. In 1990, members of the RMA created the Scrap Tire Management Council (the Council). The Council is working to find uses for scrap tires that are both economically and environmentally sound. The three main themes held by the council are reuse, recycle, or recovery. To date, improvements in finding uses for scrap tires have been strong. In 1993, approximately 33 percent of the 250 million scrap tires introduced that year were used in some way. This represents a tripling of the amount of scrap tires used in 1990 and more than a five fold increase in scrap tire usage since 1985.

The RMA is also looking into the leaching potential of disposed scrap rubber. In 1989 the RMA conducted an assessment using EPA's proposed Toxicity Characterization leaching Procedure (TCLP), to determine what levels of chemicals, if any, are leached from representative RMA products. The TCLP proposes to add chemicals to the existing list of compounds regulated under Subtitle C of RCRA, and to introduce new extraction methods. The results of the TCLP analysis showed that none of the products tested, cured or uncured, exceeded proposed TCLP regulatory levels. The RMA also compared the effect of a modification to the TCLP recently proposed by EPA in 1989 which would eliminate grinding prior to leaching; in effect making TCLP tests of rubber products more representative of disposal practices. The results from tests of ground and unground samples were comparable.

Within the plastics products industry, the Society of the Plastic Industry (SPI) started the incentive program Operation Clean Sweep (OCS) to promote efforts to reduce plastic resin pellet loss. SPI implements the program informally, by requiring all participating facilities to encourage spill minimization, prompt and thorough

cleanup of spills, and proper pellet disposal. The participating manufacturers sign a pledge which says they will try to prevent pellet loss. They then draft and submit an action plan stating how they plan to comply with the pledge. A typical action plan includes measures such as employee education, conscientious sweeping efforts, enhanced pellet capture methods, and disposal precautions. In 1992, SPI held a conference as part of OCS to encourage dialog within the industry on how to control resin pellet loss options. Currently, SPI is in the process of putting labels on all hoppers and cars used to transport the pellets to remind employees of the importance of not spilling the pellets. They are also offering OCS education videos, manuals, hats, t-shirts, and posters.

VIII.C.2. Summary of Trade Associations

Rubber Manufacturers Association (RMA) 1400 K Street, N.W. Washington, D.C. 20005 Phone: (202) 682-4800 Fax: (202) 682-4854	Members: 185 Staff: 25 Budget: Contact: Thomas E. Cole

Founded in 1900, RMA represents manufactures of tires, tubes, mechanical and industrial products, roofing, sporting goods, and other rubber products. RMA compiles monthly, quarterly, and annual statistics on rubber and rubber products. Committees within the organization include Economics and Trade, Education, Electronic Data Processing, Energy, Environment, Government Relations, OSHA, Public Relations, and Statistics. Divisions within the organization include Industrial Products, Molded and Extruded Products, Roofing Products, Sealing Products, and Sundries and Tires.

International Tire Association (ITA) P.O. Box 1067 Farmington, CT 06034 Phone: (203) 228-4739 Fax:	Members: 1,000 Staff: 2 Budget: Contact: Ann E. Evans

Founded in 1985, ITA is comprised of individuals working in the tire industry. It promotes international goodwill and communication in the industry and encourages publications. ITA bestows membership and achievement awards and sponsors seminars on tire industry issues. ITA also compiles statistics and sponsors lectures on scrap tires and universal sizing of tires. ITA publishes the Tire Advocate (quarterly).

Tire and Rim Association (TRA) 175 Montrose Avenue, West Copley, OH 44321 Phone: (216) 666-8121 Fax: (216) 666-8340	Members: 123 Staff: 3 Budget: Contact: J.F. Pacuit

Founded in 1903, TRA includes manufacturers of tires, rims, wheels, and related parts. TRA establishes standards (primarily dimensional) for the interchanging of tires, rim contours, tubes, valves, and flaps for passenger cars, motorcycles, trucks, buses, airplanes, and for earth moving, road building, agricultural, and industrial vehicles. TRA includes a Standards and Technical Advisory Committee. Subcommittees include Agricultural Tire and Rim, Aircraft Tire and Rim, Cycle Tire and Rim, Industrial Tire and Rim, Off-the-Road Tire and Rim; Passenger Car Tire and Rim; Truck-Bus Tire and Rim; and Tube and Valve. TRA also publishes Engineering Design Information for Aircraft Tires and Rims (periodic), Engineering Design Information for Ground Vehicles Tires and Rims (quarterly), Tire and Rim Association-Aircraft Year Book, and Tire and Rim Association Year Book.

National Tire Dealers and Retreaders Association (NTDRA) 6333 Long Street, Suite 340 Shawnee, KS 66216 Phone: (913) 268-6273 Fax: (913) 268-6388	Members: 5,000 Staff: 30 Budget: Contact: Philip P. Friedlander

Founded in 1920, NTDRA represents independent tire dealers and retreaders. It includes 25 State and 80 local groups. NTDRA publishes Master Retreader (bimonthly), National Tire Dealers and Retreaders Association-Hotline (bimonthly), National Tire Dealers and Retreaders Association-Who's Who Membership Directory (annual), NTDRA Dealer News (monthly), and NTDRA Membergram (monthly).

Society of the Plastic Industry (SPI) 1275 K Street, N.W., Suite 400 Washington, D.C. 20005 Phone: (202) 371-5200 Fax: (202) 371-1022	Members: 2,000 Staff: 120 Budget: Contact: Larry L. Thomas

Founded in 1937, SPI represents manufacturers and processors of molded, extruded, fabricated, laminated, calendered, and reinforced plastic; manufacturers of raw materials, machinery, tools, dies, and

molds; and testing laboratories. SPI supports research, proposes standards for plastics products, compiles statistics, maintains a speakers' bureau, organizes competitions, and bestows awards. SPI also publishes Financial and Operating Ratios (annual); Plastic News Briefs (monthly); Society of the Plastic Industry - Facts and Figures (annual); Society of the Plastic Industry - Labor Survey (annual); and Society of the Plastic Industry - Membership (annual).

Society of Plastic Engineers (SPE) 14 Fairfield Drive Brookfield, CT 06804-0403 Phone: (203) 775-0471 Fax: (203) 775-8490	Members: 37,000 Staff: 35 Budget: $5,000,000 Contact: Robert D. Forger

SPE is a professional society of plastic scientists, engineers, educators, students, and others interested in the design, development, production, and utilization of plastic materials, products, and equipment. SPE awards a plaque, gold medal, and $5,000 in recognition of fundamental contributions to the technology of polymer science and engineering, plus seven other awards of $2,500 each for achievements in engineering and technology, education, business management, research, production of unique plastics products for consumer and industrial use, and contribution to mankind in the field of plastic. SPE also conducts seminars. Committees within SPE include Award, Credentials, Education, Education Seminar, International Relations, Management Involvement, New Technology, Plastic Education Foundation, Public Interest, Technical Programs, and Technical Volumes. Divisions include Advanced Polymer Composites, Automotive, Blow Molding, Color and Appearance, Decorating, Electrical and Electronics, Engineering Properties and Structure, Extrusion, Injection Molding, Marketing, Medical Plastic, Mold Making and Mold Design, Plastic Analysis, Plastic Recycling, Polymodifers and Additives, Thermoforming, Thermoplastic Materials and Foams, Thermosetting Molding, and Vinyl Plastic. SPE also publishes the Journal of Vinyl Technology (quarterly); Plastic Engineering (monthly); Polymer Composites (bimonthly); Polymer Engineering and Science (semimonthly); and Preprint Volumes and the Plastic Engineering Series (books).

Association of Rotational Molders (ARM) 435 North Michigan avenue, Suite 1717 Chicago, IL 60611-4067 Phone: (312) 644-0828 Fax:	Members: 300 Staff: 3 Budget: $500,000 Contact: Charles D. Fredrick

Founded in 1976, ARM represents plastic processors who use the rotational molding process, their suppliers, and overseas molders. ARM's purposes are to increase awareness of roto-molding, exchange technical information, provide education, and standardize production guidelines. ARM conducts research seminars, educational video, and slide programs, maintains a private library, sponsors a product contest, and bestows awards. ARM also offers a membership database. ARM publishes the ARM Roster (annual) and the Roto-Molder Review (4-6/year).

National Association of Plastic Distributors (NAPD) 6333 Long Street, Suite 340 Shawnee, KS 66216 Phone: (913) 268-6273 Fax: (913) 268-6388	Members: 450 Staff: 4 Budget: $825,000 Contact: Carol K. Wagner

Founded in 1955, NAPD represents distributors of plastic materials, firms that both manufacture and distribute these materials, and manufacturers who sell their products through plastic distributors. The objective of NAPD is to promote proper and efficient distributor involvement in the plastic industry. NAPD maintains liaison with associated organizations, operates a library, bestows awards, and compiles statistics. Publications include the Cost-of-Doing Business Survey (annual); the Membership Directory (annual); the NAPD Magazine (monthly); and computerized data processing manuals, charts, and other materials.

Tube and Pipe Fabricators Association, International (TPFA) 5411 East State Street Rockford, IL 61108 Phone: (815) 399-8700 Fax: (815) 339-7279	Members: 450 Staff: 8 Budget: Contact: John Nandzik

Founded in 1983, TPFA represents companies that are responsible for the fabrication of plastic tubing and piping, and suppliers of equipment and services. TPFA provides a forum for individuals involved in the tube and pipe fabricating industry. It encourages discussion on problems involved in pipe manufacturing and assists in formulating standards. TPFA's publications include Membership Directory (annual), Technology Update (quarterly), TPQ - The Tube and Pipe Quarterly, news releases, and voluntary standards relevant to the pipe producing industry.

Plastic Pipe and Fittings Association (PPFA) Building C, Suite 20 800 Roosevelt Road Glen Ellyn, IL 60137 Phone: (708) 858-6540 Fax:	Members: 48 Staff: 4 Budget: Contact: Richard W. Church

Founded in 1978, PPFA represents raw material suppliers and processors of plastic pipe and fittings. PPFA's objectives are to provide a forum for exchange of information and ideas; to see that existing code approvals for use of plastic pipe and fittings are retained; to obtain additional code approvals and develop new markets for products; to provide leadership and continuity for the industry; and to seek liaison and involvement with other organizations within the industry.

IX. CONTACTS/ACKNOWLEDGMENTS/RESOURCE MATERIALS/BIBLIOGRAPHY

General Profile

Industry and Trade Summary - Pneumatic Tires and Tubes, U.S. International Trade Commission, Washington, D.C., February 1994.

Natural Rubber, Senior Policy Paper, Theodore J. Goering, The World Bank, Washington, D.C., 1982.

Tire Business - 1993 Annual Report, Tire Business, Akron, OH.

U.S. Industrial Outlook 1994, Department of Commerce.

1987 Census of Manufacturers: Rubber and Plastics products, Bureau of the Census, 1987.

Process Descriptions

The Chemical Process Industries, First ed., R. Norris Shreve, McGraw-Hill Book Company, Inc., New York, NY, 1945.

Assessment of Industrial Hazardous Waste Practices - Rubber and Plastic Industry, Foster D. Snell for the U.S. EPA, Cleveland, OH, 1975.

Foam Processing, Modern Plastic, October 1991.

The Identification of Effluents from Rubber Vulcanization, Stephen M. Rappaport, University of North Carolina, Chapel Hill, Presented at the Conference on Environmental Aspects of Chemical Use in Rubber Processing, Akron, OH, 1975.

McGraw-Hill Encyclopedia of Science & Technology, 6th Edition, McGraw-Hill Book Company, New York, NY, 1992.

Tire Materials and Construction, Kevin Jost, Automotive Engineering, October 1992.

Regulatory Profile

Federal Register: Standards of Performance for New Stationary Sources; Rubber Tire Manufacturing Industry; Final Rule. 52 FR 34868, September 15, 1987.

Federal Register: Plastic Molding and Forming Point Source Category Effluent Limitations Guidelines; Pretreatment Standards and New Source Performance Standards; Final Regulation. 49 FR 49026, December 17, 1984.

The Society of the Plastic Industry Issues, Volume V, No. 1-8, The Society of the Plastic Industry, Washington, D.C., 1994.

Pollution Prevention

Environmental Fact Sheet - Plastic: The Facts About Production, Use, and Disposal, U.S. EPA, Office of Solid Waste and Emergency Response, February 1990.

Environmental Fact Sheet - Plastic: The Facts on Source Reduction, U.S. EPA, Office of Solid Waste and Emergency Response, February 1990.

Environmental Fact Sheet - The Facts on Degradable Plastic, U.S. EPA, Office of Solid Waste and Emergency Response, February 1990.

Environmental Fact Sheet - The Facts on Recycling Plastic, U.S. EPA, Office of Solid Waste and Emergency Response, February 1990.

Operation Clean Sweep, Only You Can Stop Resin Pellet Loss!, The Society of the Plastic Industry, Washington, D.C.

Recent Experience in Encouraging the Use of Pollution Prevention in Enforcement Settlements, Monica M Becker and Nicholas A Ashford, Massachusetts Institute of Technology, Center for Technology, Policy, and Industrial Development, Cambridge, MA, May 1992.

Scrap Tires: Alternative and Markets in the United States, Goodyear Tire and Rubber Company, Akron, OH.

Scrap Tires for Fuel, an Energy Alternative, A.L. Eastman, Goodyear Tire and Rubber Company, Presented at the Akron Rubber Fall Technical Symposium, October 1991.

Scrap Tires - Understanding the Challenge, Goodyear Tire and Rubber Company, Akron, OH, 1990.

A Study of the Use of Recycled Paving Material, Report to Congress, U.S. Department of Transportation, Federal Highway Administration and U.S. EPA, June 1993. (FHWA-RD-93-147; EPA 530/R-93/013).

Summary of Markets for Scrap Tires, U.S. EPA, Office of Solid Waste and Emergency Response, October 1991.

Title III Section 313, Release Reporting Guidance, Estimating Chemical Releases From Rubber Production and Compounding, U.S. EPA, Office of Pesticides and Toxic Substances, March 1992. (EPA 560/4-88/004q)

Waste Minimization Strategies for the Fabricated Rubber Products Industry, Christopher Bozzini, Thomas O'Regan, Patrick Sheehan, and Catherine Walsh, Prepared for the U.S. EPA, August 1992.

Contacts *	Organization	Telephone
David Chapman	Goodyear Tire Company	(216) 796-2121
Pat Toner	Society of the Plastic Industry	(202) 371-5202
Maureen Healy	Society of the Plastic Industry	(202) 371-5200
Greg Kennedy	Tire Business (magazine)	(216) 836-9186
Bob Larch	Ohio EPA, Solid Waste	(614) 644-2734
Hope Pillsbury	EPA, Solid Waste	(202) 260-2797
Sergio Saio	NEIC	(303) 236-5124
Judy Sophianopoulas	EPA, Region IV	(404) 347-7603
Steven Teslik	American Plastic Council	(202) 371-5357
Dale Louda	Rubber Manufacturers Association	(202) 682-4839
Ernie Karger	The Gates Rubber Company	(303) 744-4935
Dave Salman	EPA, Office of Air Quality Planning and Standards	(919) 541-0859

* Many of the contacts listed above have provided valuable background information and comments during the development of this document. EPA appreciates this support and acknowledges that the individuals listed do not necessarily endorse all statements made within this notebook.

APPENDIX A
INSTRUCTIONS FOR DOWNLOADING THIS NOTEBOOK

Electronic Access to this Notebook via the World Wide Web (WWW)

This Notebook is available on the Internet through the World Wide Web. The Enviroene Communications Network is a free, public, interagency-supported system operated by EPA's Office of Enforcement and Compliance Assurance and the Office of Research and Development. The Network allows regulators, the regulated community, technical experts, and the general public to share information regarding: pollution prevention and innovative technologies; environmental enforcement and compliance assistance; laws, executive orders, regulations, and policies; points of contact for services and equipment; and other related topics. The Network welcomes receipt of environmental messages, information, and data from any public or private person or organization.

ACCESS THROUGH THE ENVIROENE WORLD WIDE WEB

To access this Notebook through the Enviroene World Wide Web, set your World Wide Web Browser to the following address:

http://es.inel.gov/oeca - then select "EPA Sector Notebooks"

or after 1997, (when EPA plans to have completed a restructuring of its web site) set your web browser to the following address:

www.epa.gov/oeca - then select the button labeled Gov't and Business Sectors and select the appropriate sector from the menu. The Notebook will be listed.

HOTLINE NUMBER FOR E$WWW: 208-526-6956

EPA E$WWW MANAGERS: Louis Paley 202-564-2613
Myles Morse 202-260-3151

United States Government INFORMATION

PUBLICATIONS ★ PERIODICALS ★ ELECTRONIC PRODUCTS

Charge your order. It's easy!

VISA MasterCard DISCOVER NOVUS

Order Processing Code:
* 3212

Fax your orders (202) 512–2250
Phone your orders (202) 512–1800

Qty.	Stock Number	**Published in 1995** Title	Price Each	Total Price
	055-000-00512-5	Dry Cleaning Industry, 104 pages	$ 6.50	
	055-000-00513-3	Electronics and Computer Industry, 160 pages	11.00	
	055-000-00518-4	Fabricated Metal Products Industry, 164 pages	11.00	
	055-000-00515-0	Inorganic Chemical Industry, 136 pages	9.00	
	055-000-00516-8	Iron and Steel Industry, 128 pages	8.00	
	055-000-00517-6	Lumber and Wood Products Industry, 136 pages	9.00	
	055-000-00519-2	Metal Mining Industry, 148 pages	10.00	
	055-000-00520-6	Motor Vehicle Assembly Industry, 156 pages	11.00	
	055-000-00521-4	Nonferrous Metals Industry, 140 pages	9.00	
	055-000-00522-2	Non-Fuel, Non-Metal Mining Industry, 108 pages	6.50	
	055-000-00523-1	Organic Chemical Industry, 152 pages	11.00	
	055-000-00524-9	Petroleum Refining Industry, 160 pages	11.00	
	055-000-00525-7	Printing Industry, 124 pages	7.50	
	055-000-00526-5	Pulp and Paper Industry, 156 pages	11.00	
	055-000-00527-3	Rubber and Plastic Industry, 152 pages	11.00	
	055-000-00528-1	Stone, Clay, Glass and Concrete Industry, 124 pages	7.50	
	055-000-00529-0	Transportation Equipment Cleaning Industry, 84 pages	5.50	
	055-000-00514-1	Wood Furniture and Fixtures Industry, 132 pages	8.00	

Qty.	Stock Number	**Published in 1997** Title	Price Each	Total Price
	055–000–00570–2	Air Transportation Industry, 90 pages	$ 7.50	
	055–000–00571–1	Ground Transportation Industry, 130 pages	10.00	
	055–000–00572–9	Water Transportation Industry, 90 pages	7.50	
	055–000–00573–7	Metal Casting Industry, 150 pages	13.00	
	055–000–00574–5	Pharmaceutical Manufacturing Industry, 147 pages	13.00	
	055–000–00575–3	Plastic Resin & Man–made Fiber Industry, 180 pages	15.00	
	055–000–00576–1	Fossil Fuel Electric Power Generation Industry, 160 pages	14.00	
	055–000–00577–0	Shipbuilding and Repair Industry, 120 pages	9.50	
	055–000–00578–8	Textile Industry, 130 pages	10.00	
	055–000–00579–6	Sector Notebook Data Refresh –1997, 210 pages	17.00	
			Total for Publications	

The total cost of my order is $_____. Price includes regular shipping and handling and is subject to change.

Company or personal name (Please type or print)

Additional address/attention line

Street address

City, State, Zip code

Daytime phone including area code

Purchase order number (optional)

Check method of payment:

❑ Check payable to Superintendent of Documents

❑ GPO Deposit Account ☐☐☐☐☐☐☐–☐

❑ VISA ❑ MasterCard ❑ Discover/NOVUS

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

☐☐☐☐ (expiration date) *Thank you for your order!*

Authorizing signature 7/97

Mail to: Superintendent of Documents
P.O. Box 371954, Pittsburgh, PA 15250–7954

Important: Please include this completed order form with your remittance.