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 Inc. (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 are included on the following page.

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

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EPA/310-R-95-014

EPA Office of Compliance Sector Notebook Project

Profile of the Printing and Publishing Industry

August 1995

Office of Compliance
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
401 M St., SW (MC 2221-A)
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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
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EPA/310-R-98-005.	Oil and Gas Exploration and Production Industry	Dan Chadwick	564-7054
EPA/310-R-98-008.	Local Government Operations	John Dombrowski	564-7036

*Spanish Translations Available

Printing Industry Sector Notebook Contents

Exhibits Index

List of Acronyms

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

NPDES -	National Pollution Discharge Elimination System (CWA)
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
SO_X -	Sulfur Oxides
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

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 (such as economic sector, and community-based approaches) are becoming an important supplement to traditional single-media approaches to environmental protection. Environmental regulatory agencies are beginning to embrace comprehensive, multi-statute solutions to facility permitting, 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. The desire to move forward with this "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 to provide its staff and managers with summary information for eighteen specific industrial sectors. As other EPA offices, states, the regulated community, and the public became interested in this project, the Office of Compliance expanded the scope of the original project. 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 described 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 desired. 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 document 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.

I.B. Additional Information

Providing Comments

The Office of Compliance plans to periodically review and update 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 Enviroene Bulletin Board or the Enviroene 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 Enviroene 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 PRINTING AND PUBLISHING INDUSTRY

This section provides background information on the size, geographic distribution, employment, production, sales, and economic condition of the printing and publishing 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 printing and publishing industry, defined most broadly, includes firms whose business is dominated by printing operations, firms performing operations commonly associated with printing, such as platemaking or bookbinding, and publishers, whether or not they actually print their own material. This categorization corresponds to the Standard Industrial Classification (SIC) code 27 used by the Bureau of the Census to track the flow of goods and services within the economy. The Census identifies 58,000 firms and 62,000 facilities within SIC code 27.[1,a]

From the printing industry's perspective, the industry is organized by the type of printing process used: lithography, (roto)gravure, flexography, screen, and letterpress. Trade associations, technical foundations, suppliers, and supporting academic institutions are organized along process lines (See Section VIII.C). For example, the Screen Printing Technical Foundation supports the screen printing process and the Graphic Arts Technical Foundation supports lithographers. The Rochester Institute of Technology specifically supports gravure and flexographic printers. Facilities tend to employ one type of printing process exclusively, although some of the larger facilities may use two or more types. Based on the estimated value of shipments from the U.S. printing industry in 1990, lithography dominates the market with a 47 percent market share; gravure, 19 percent, flexography, 17 percent; letterpress, 11 percent; and screen printing, 3 percent.[2]

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

II.B. Characterization of the Printing and Publishing Industry

According to 1987 Census data, the printing and publishing industry was comprised of 58,000 firms operating 62,000 facilities. This figure does not capture the large number of "in-plant" printing operations located throughout the manufacturing sectors. The total number of printing and publishing operations, therefore, could well exceed 100,000. The printing industry has a high ratio of small operations, with nearly one-half of printing facilities employing fewer than five employees. Printing operations are most often located adjacent to population and business centers and therefore their distribution closely parallels the distribution of the U.S. population.

II.B.1. Industry Size and Geographic Distribution

While the precise number of printing and publishing facilities is difficult to determine, 1987 Census data identified approximately 58,000 firms operating 62,000 facilities.[3] Other estimates of industry size are higher, in the range of 70,000, 86 percent of which are thought to have press operations, with the remainder performing printing-related operations such as publishing or platemaking.[4] It is important to note that because printing itself is a process used to transfer images or material to a substrate, "in-plant" printing operations are present in facilities throughout the manufacturing sectors. For example, one of the largest screen printing operations is within Boeing Corporation. Other examples include firms that print textiles, product manufacturers that print their label, and manufacturers of printed circuit boards. The number of printing and publishing operations, therefore, could well exceed 100,000.

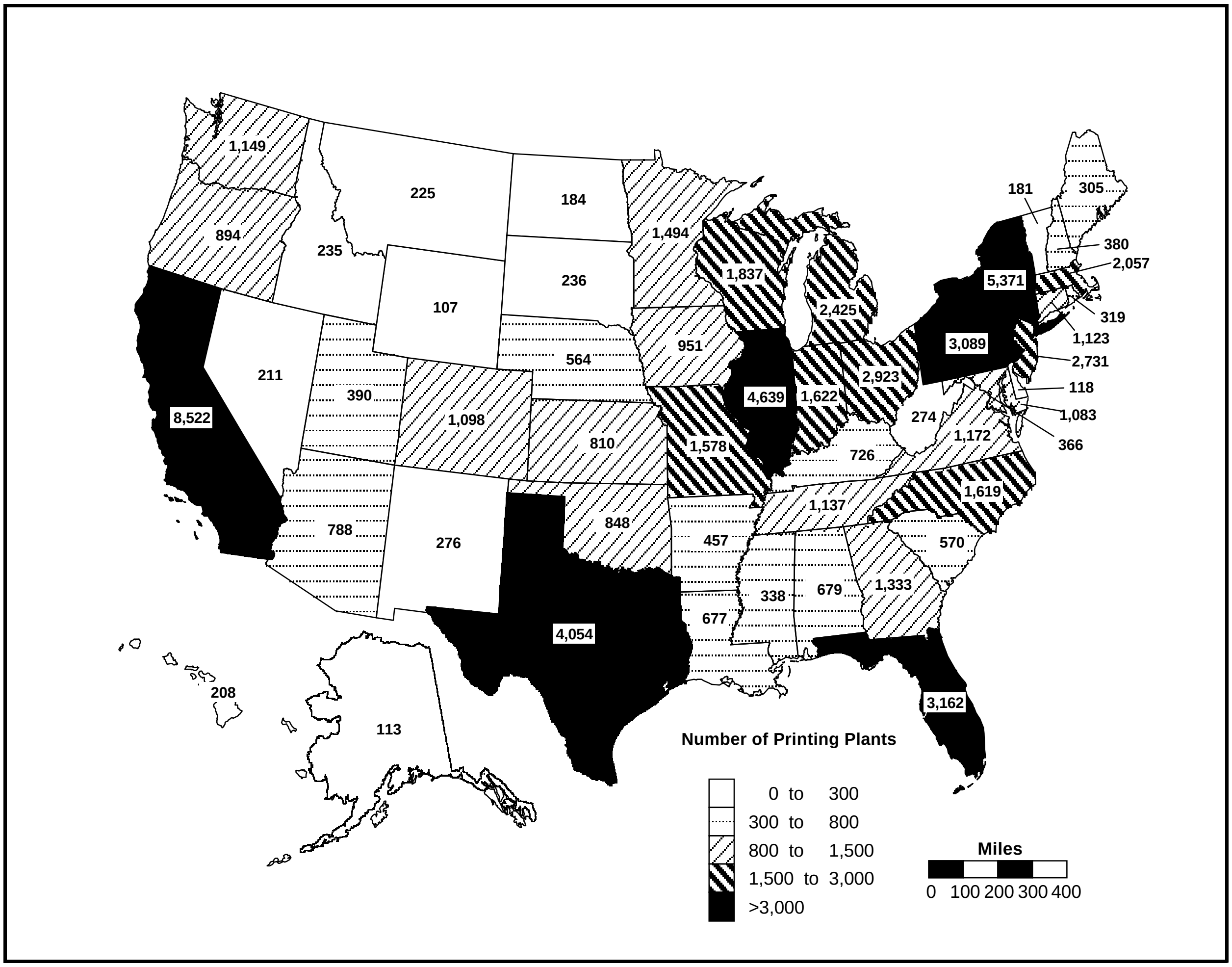
The Bureau of the Census estimates that in 1987, 1.5 million people were employed in printing and publishing.[5] The value of shipments (revenue associated with product sales) generated by printing and publishing facilities totaled $135 billion.[6] This value of shipments figure omits up to $100 million associated with in-plant and quick printers (operating xerographic copiers or small lithographic presses).[7] Sales within the printing industry are expected to grow by 3.5 to 5.3 percent annually between 1990 and the year 2000.[8]

One of the most significant characteristics of the printing industry is the large proportion of very small firms. Almost one-half of all printing facilities have fewer than five employees; approximately 84 percent employ fewer than 20.[9] Flexographic and gravure printers, however, tend to be larger operations and to have more employees.

Exhibit 1: Printing Facilities by Number of Employees		
Employees per Facility	**Number of Facilities**	**Percentage of Facilities**
1-4	**32,158**	**46%**
5-9	**17,068**	**24%**
10-19	**9,800**	**14%**
20-99	**8,652**	**13%**
100+	**2,036**	**3%**
Total	**69,714**	**100%**

Source: U.S. Department of Commerce, Bureau of the Census. 1987 Census of Manufacturers.

Printing facilities typically serve regional or local markets although some firms, such as those producing books and periodicals, serve national and international markets. Consequently, the geographic distribution of printing facilities closely parallels the distribution of the U.S. population. Facilities are most frequently located in light industrial areas in or adjacent to population and business centers, although smaller operations are somewhat more likely to be located in residential settings. Across the U.S., sixty percent of printing facilities are located in just ten states: California (13%), New York (8%), Illinois (7%), Texas (6%), Florida (5%), Pennsylvania (5%), Ohio (4%), New Jersey (4%), Michigan (4%), and Massachusetts (3%).[10]



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

Exhibit 2: Printing Facilities

Ward's Business Directory of U.S. Private and Public Companies, produced by Gale Research Inc., compiles financial data on U.S. companies including those operating within the printing industry. Ward's ranks U.S. companies, whether they are a parent company, subsidiary or division, by sales volume within the 4-digit SIC codes that they have been assigned as their primary activity. Readers should note that: 1) companies are assigned a 4-digit SIC that most closely resembles their principal industry; and 2) sales figures include total company sales, including subsidiaries and operations not related to printing. Additional sources of company specific financial information include Standard & Poor's Stock Report Services, Dun & Bradstreet's Million Dollar Directory, Moody's Manuals, and annual reports.

Exhibit 3: Top U.S. Companies with Printing Operations

Rank[a]	Company[b]	1993 Sales (millions of dollars)
1	R.R. Donnelley & Sons Company - Chicago, IL	3,915
2	Times Mirror Company - Los Angeles, CA	3,624
3	Gannett Company, Inc. - Arlington, VA	3,382
4	Hallmark Cards, Inc. - Kansas City, MO	2,800
5	Reader's Digest Association, Inc. - Pleasantville, NY	2,345
6	Cox Enterprises, Inc. - Atlanta, GA	2,300
7	Knight-Ridder, Inc. - Miami, FL	2,237
8	Tribune Company - Chicago, IL	2,035
9	McGraw-Hill, Inc. - New York, NY	1,943
10	Dow Jones and Company, Inc.	1,725

Note: [a] When Ward's Business Directory lists both a parent and subsidiary in the top ten, only the parent company is presented above to avoid double counting. Not all sales can be attributed to the companies printing operations.
[b] Companies shown listed SIC 2711, 2721, 2731, 2732, 2741, 2752, 2754, 2759, 2761, 2771, 2782, 2789, 2791, 2796 as primary activity.

Source: Ward's Business Directory of U.S. Private and Public Companies - 1993.

II.B.2. Product Characterization

The printing and publishing industry produces a wide array of printed products as well as materials used in the printing process. Some of the products produced within the industry include: newspapers, books, greeting cards, checks, annual reports, magazines, and packaging. Products vary in print quality from newsprint to *National Geographic Magazine*. Also, firms performing operations commonly associated with printing, such as platemaking or bookbinding, and publishers, whether or not they actually print their own material, are included within the industry.

The SIC codes, developed by the Office of Management and Budget, divide the printing and publishing industry according to the product manufactured, such as books, newspapers, and greeting cards. Most facilities identified as printers by SIC code have few, if any, business lines other than those that fall within printing and publishing. However, there are tens of thousands of in-plant printing operations at facilities whose predominant lines of business are not printing. Only if data are collected for multiple SIC codes would it be evident that such facilities engaged in printing. The following list presents the three-digit SIC codes with the associated product they represent, as well as the printing process used in the product's manufacture.

SIC 271 - Newspapers | *Processes used: lithography, flexography and letterpress*
SIC 272 - Periodicals | *Processes used: lithography, flexography and letterpress*
SIC 273 - Books | *Processes used: lithography, gravure and letterpress*
SIC 274 - Miscellaneous Publishing | *Processes used: lithography, gravure, and letterpress*
SIC 275 - Commercial Printing | *Processes used: lithography, gravure, flexography, screen and letterpress*
SIC 276 - Manifold Business Forms | *Processes used: lithography and plateless*
SIC 277 - Greeting Cards | *Processes used: gravure and screen*
SIC 278 - Blankbooks, Looseleaf Binders and Bookbinding | *Primarily nonprinting*
SIC 279 - Service Industries for the Printing Trade | *Primarily nonprinting*

Newspapers (SIC 271) and commercial printing (SIC 275) account for 57 percent of the total value of shipments for the printing and publishing industry. Newspapers (SIC 271) include establishments primarily engaged in publishing newspapers, or in publishing and printing newspapers. Newspaper printers that are not engaged in publishing are classified under Commercial Printing (SIC 275). Commercial printing products include but are not limited to the following: maps, periodicals, coupons, menus, postcards, stationary, envelopes, magazines, and custom products. Other three-digit categories comprised of firms involved primarily in printing accounted for an additional 22 percent of the value of shipments. Other SIC categories include: textile screen printing (SIC 2346) and nameplates (SIC 3993). Firms that may not be involved in printing, such as publishing of blankbooks, bookbinding and printing trade services (e.g., platemaking and typesetting), accounted for the remaining 21 percent of the value of shipments.[11]

II.B.3. Economic Trends

The following discussion has been summarized from the *U.S. Industrial Outlook*, published by the Department of Commerce, which tracks and forecasts the economic performance of most major sectors of the U.S. economy. The U.S. is the world's largest market for printed products. In aggregate, the printing and publishing industry accounts for a significant portion of the nation's goods and services; the 1991 value of shipments totaled $161 billion with an estimated payroll of $39 billion for 1.5 million workers. Printing and publishing is the largest conglomeration of small businesses in the domestic manufacturing sector. While the industry is large in number, many individual facilities, particularly small letterpress operations are marginally profitable. Industry growth is affected by several factors including: business formations and transactions (which drive advertising expenditures), population growth, and trends in certain characteristics of the population, such as leisure time availability and individuals' consumption patterns.[12]

Competitive pressures come from non-print media, such as CD-ROM, other electronic means of transferring information as well as the movement of book printing to offshore facilities where production costs are lower. In 1992, the U.S. imported $2.1 billion worth of printed products, principally from Canada, the United Kingdom, Hong Kong, and Germany. During the same period, the U.S. exported $3.8 billion worth of printed material. The major export markets for U.S. printed material are Canada, the United Kingdom, Japan, and Mexico.[13]

Once the U.S. economy emerges fully from the recession of 1990/1991, printing and publishing sales are expected to grow by 3.8 to 5.3 percent per year through the year 2000. The next five years are expected to offer printers several opportunities for business expansion due to the North American Free Trade Agreement (NAFTA) and the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) which will reduce trade barriers to U.S. exports and strengthen protection of international copyrights.[14]

III. INDUSTRIAL PROCESS DESCRIPTION

This section describes the materials and equipment used, and the processes employed within the printing and publishing industry. 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 of 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 (via air, water, and soil pathways) of these waste products.

III.A. Industrial Processes in the Printing and Publishing Industry

The diversity of technologies and products in the printing industry makes it difficult to characterize the processes and the environmental issues facing the industry as a whole. These process differences can lead to distinct environmental concerns and are critical when developing compliance assistance programs. It is estimated that 97 percent of all printing activities can be categorized within five different printing processes: lithography, gravure, flexography, letterpress, and screen printing.[15] The equipment, applications, and chemicals for each of these processes differ; however, they all print an image on a substrate following the same basic sequence. The fundamental steps in printing are referred to as imaging, pre-press, printing, and post-press operations. The type of printing technology that is used depends on a variety of factors, including the substrate used (e.g., paper, plastic, metal, ceramic, etc.), the length and speed of the print run, the required print image quality, and the end product produced.

The first step in the printing process, imaging, produces an image of the material to be printed. Traditionally, this image is produced photographically, but with increasing frequency the image is produced electronically. The production of a photographic image involves a variety of chemicals similar to those used in other fields of photography. The image on the film is transferred to the image carrier or plate. In pre-press operations, an image carrier is produced that can transfer the ink in the image area and can repel the ink in non-image areas. In printing, ink is applied to the plate and the image is transferred to the substrate. In the post-press step, the printed material may receive any one of numerous finishing operations, depending on the desired form of the final product.

Each of the five predominant printing technologies differ significantly in how the image is transferred from the image carrier to the substrate in the printing step. In general, the imaging and post-press operations are fairly similar for all printing technologies. Therefore, imaging and post-press procedures are discussed for all printing technologies, and the platemaking and press operations are discussed separately for each technology.

III.A.1. Imaging Operations

Imaging operations begin with composition and typesetting, and are followed by the production of a photographic negative or positive. Composition involves the arrangement of art and text into the desired format. This composition task was performed manually. Today, however, computer systems are commonly used to accomplish the task. Computers can be equipped with both optical character recognition and photographic image scanners and digitizers so that pre-typed material and images can be incorporated into the document being composed.[16]

Once the desired format and images are assembled, they are photographed to produce transparencies. The printing industry photographic process uses input materials very similar to those used in other fields of photography. The purpose of this step is to produce a photographic negative (for lithography and letterpress) or a positive (for gravure, screen printing, and other lithographic processes). Input materials for the process include paper, plastic film, or a glass base covered with a light-sensitive coating called a photographic emulsion. This emulsion is usually composed of silver halide salts and gelatin. The desired image is projected onto the film to produce a film negative or a film positive. When the exposed photographic emulsion is developed, the silver halide in the emulsion is converted to metallic silver, in proportion to the amount of exposure it has received. The developing action is stopped by immersing the film in a fixing bath, which is mainly composed of sodium thiosulfate ("hypo"). The fixed photographic emulsion is then rinsed. If an image is to be printed as a color reproduction, transparencies are made for each of the colors to be used on the press. Multi-color printing is done by passing the same substrate through several single-color printing operations.[17] Three or four basic colors are combined on the final product to yield any color desired.

III.A.2. Platemaking and Printing

From photographic negative or positive, a plate is produced that is used in each printing process to carry or transfer ink in the form of the image to the substrate. The plate must pick up ink only in the areas where ink is to be applied to the final image on the substrate. The five basic printing technologies employ five different types of plates. The platemaking step and the printing operations summaries are described below for each technology.

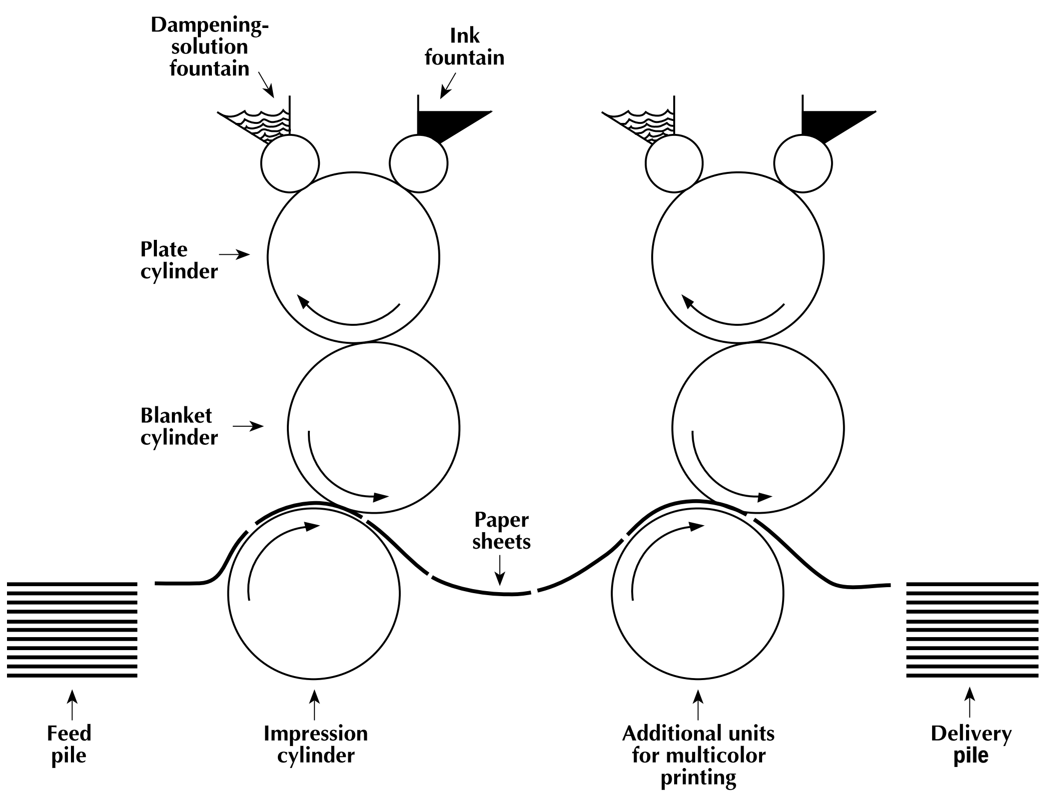
Lithography

In lithography, a planographic plate is used where the image areas and the non-image areas are on the same plane (they are neither raised nor depressed) and are defined by differences in their physiochemical properties. There are several types of lithographic printing, but they all use a planographic plate and they all rely on the fundamental property that oil and water do not mix. As a result, lithographic inks are oil-based and traditionally the ink oils are petroleum based. A metal or paper or plastic printing plate is coated with a light-sensitive chemical which becomes ink receptive when exposed to light. Through the photographic negative, the coating is exposed to light chemically changing the exposed areas, making the image areas ink-receptive. The non-image areas remain water-receptive. Water-based mixtures, referred to as fountain solution, are applied to enhance the non-image area's ability to repel ink. Fountain solutions may contain five to 10 percent isopropyl alcohol or they may contain alcohol substitutes that meet the same needs but with a lower VOC content. Through the use of inking rollers, ink is applied to the plate, adhering only to the image areas. The image is transferred or offset from the plate to a rubber roller (the blanket), which then transfers the image to the substrate being printed. To accelerate drying and control ink flow characteristics, lithographic inks contain solvents. There are lithographic inks that are curable using ultraviolet energy or electron beam, and do not contain solvents.[18]

Depending on the type of substrate or the products printed, the lithographic process is further divided into subprocesses: sheet-fed, heatset web, and non-heatset web. In lithography, as in most printing technologies, presses are available as sheet-fed or as web-fed. On a sheet-fed press, the substrate is fed into the press one sheet at a time. A web-fed press prints on a continuous roll of substrate, known as a web, which is later cut to size. "Offset" lithography refers to the use of a rubber blanket to transfer the image from the plate to the substrate. Within the category of web offset lithography, there is heatset web offset and non-heatset web offset. In the heatset process, the ink is dried by evaporating the ink oil with indirect hot air dryers. This process is potentially the most significant source of VOC emissions in lithography.[19]

Sheet-fed offset lithography is typically used for printing books, posters, brochures, and artwork. Web-fed offset lithography is commonly used for high speed production of magazines, catalogs, and other periodicals, newspapers, magazines and catalogs.

Exhibit 4: Simplified Lithographic Press Layout



Source: EPA 1994

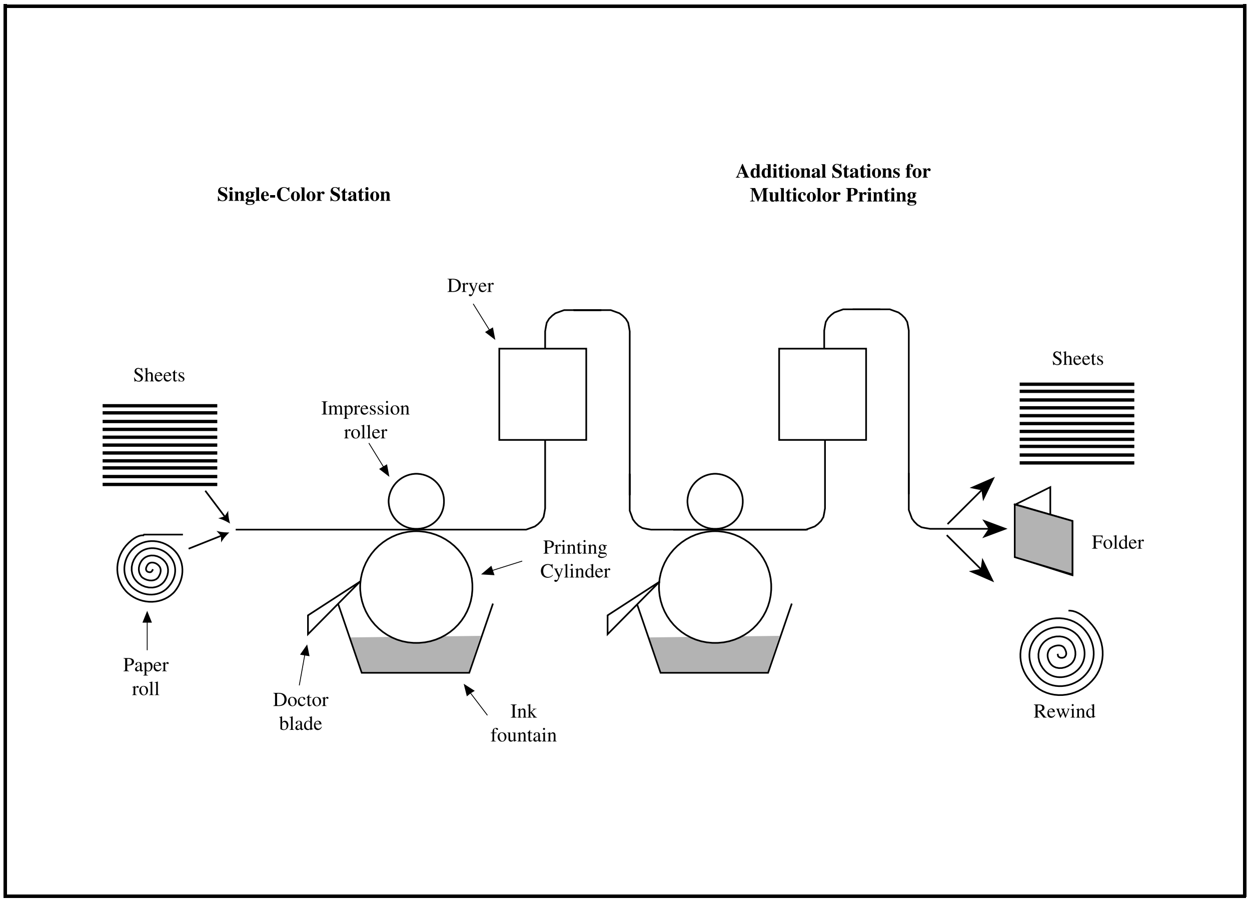
Gravure

Gravure printing uses almost exclusively electro-mechanically engraved copper image carriers to separate the image area from the non-image area. Typically, the gravure image carrier is a cylinder. It consists of a steel or plastic base which is plated with copper or a special alloy. The electro-mechanical engraving is accomplished by the electronic impulses driving the diamond stylus which engraves minute cells at the rate of over 3,000 per second. Today, most of the gravure cylinders are engraved directly from digital files. Chemical etching, which is a dominant technology for the gravure cylinder imaging in the past, represents a very small percentage of the total engravings done today. It is used for special applications only. Gravure was the first printing process capable of direct imaging from electronic data.

In gravure printing, ink is applied to the engraved cylinder, then wiped from the surface by the doctor blade, leaving ink only on the engraved image area. The printing substrate is brought into contact with the cylinder with sufficient pressure so that it picks up the ink left in the depressions on the cylinder. (Exhibit 5) Low viscosity inks are required for gravure printing in order to fill the tiny depressions on the plate. To dry the ink and drive off the solvents, drying ovens are placed in the paper path. The solvent-laden air can be passed through carbon beds to trap and condense the solvent. Most of the ink solvents are recaptured using this process, and can either be reused or destroyed by incineration.[20] Also, low VOC inks can be used making carbon beds unnecessary.

The cost of a gravure cylinder is still considered higher compared to other types of printing plates; however, today gravure is the most mature process in “digital data/direct to plate” technology. Also, gravure cylinders have a very long useful life. Several million impressions can be printed before a cylinder needs to be replaced. Gravure printing is capable of producing high-quality, continuous tone images on a variety of substrates. It is most commonly used for large circulation catalogs, magazines, Sunday supplements, and advertising inserts. Also, gravure printing is used for a variety of packaging materials, postage stamps, greeting cards, currency, resilient floor coverings, and wall paper. As in lithography, the two basic types of gravure presses are sheet-fed and web. In the US, almost all commercial gravure printing is done on web fed rotogravure presses.

Exhibit 5: Rotogravure Press



Source: EPA 1994

Flexography

Flexographic and letterpress plates are made using the same basic technologies. Both technologies employ plates with raised images and only the raised images come in contact with the substrate during printing.

The traditional method of making these plates begins with the exposure of a metal plate through a negative and processing of the exposed plate using an acid bath. The resulting metal engraving may be used directly for letterpress (flatbed), or alternatively used to mold a master using a bakelite board. The board, under pressure and heat, fills the engraving and, when cooled, becomes a master for molding a rubber plate with a raised area that will transfer the graphics. The second method of making plates employs photopolymers in either a solid or liquid state. The photopolymer sheet (consisting of monomers) is exposed to light through a negative and the unexposed areas washed out by means of a solvent or water wash. The result is the relief plate.

Typically, flexographic plates are made of plastic, rubber, or some other flexible material, which is attached to a roller or cylinder for ink application. Ink is applied to the raised image on the plate, which transfers the image to the substrate. There are three basic configurations of flexographic press -- stack, central impression and in-line. (Presses can be configured to print both sides of the web. (Exhibit 6 illustrates a three-roller webfed rotary press.)[b] In the typical flexographic printing sequence, the substrate is fed into the press from a roll. The image is printed as the substrate travels through a series of stations with each station printing a single color. Each station is made up of four rollers where the first roller transfers the ink from an ink pan to the second roller, the meter roller. The meter roller (also known as an Anilox Roll) meters the ink to a uniform thickness onto the third roller, the plate cylinder. The substrate moves between the plate cylinder and fourth roller. The plate is attached to the third roller (the plate cylinder) and the fourth roller (the impression cylinder) applies pressure to the plate cylinder, thereby forming the image on the substrate. The printed web proceeds through an overhead dryer section to dry the ink before the next station. Upon completion of the printing of the last color, the web may then move through an overhead tunnel dryer to remove all residual solvents. The finished product is rewound onto a roll. The width of flexography presses ranges from 4.5 inches up to 115 inches. The ink tray used on larger flexographic presses is very long, allowing for significant evaporation of ink (which may have a high alcohol content). Modern presses are now equipped with enclosed doctor

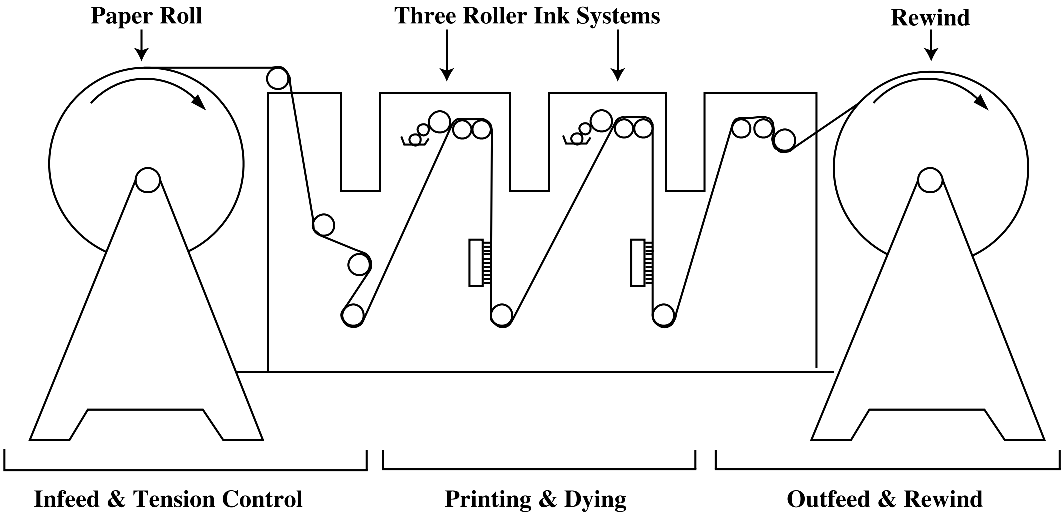
[b] Information on other flexographic printing configurations, such as, the wide web common impression press and the wide web stack type press is available from the Flexographic Technical Association (Section IX).

blade systems which eliminate the fountain roller and fountain, thereby reducing evaporation losses. Printers with the more narrow presses (for tags, labels and tapes) generally use water based inks and UV coatings. Using UV inks reduces the volatility of the ink.

As in gravure, fast-drying, low-viscosity inks are used. These inks lie on the surface of nonabsorbent substrates and solidify when solvents are removed, making flexography ideal for printing on impervious materials such as polyethylene, cellophane and other plastics and metallized surfaces. The soft plates allow quality printing on compressible surfaces such as cardboard packaging.

With low cost plates and a relatively simple two roller press, flexography is one of the least expensive and fastest growing printing processes. According to the Flexographic Technical Association, 85 percent of packaging is printed with flexography.[21] It is used primarily for packaging, such as plastic wrappers, corrugated boxes, milk cartons, labels, and foil and paper bags.

Exhibit 6: Webfed Rotary Flexographic Press



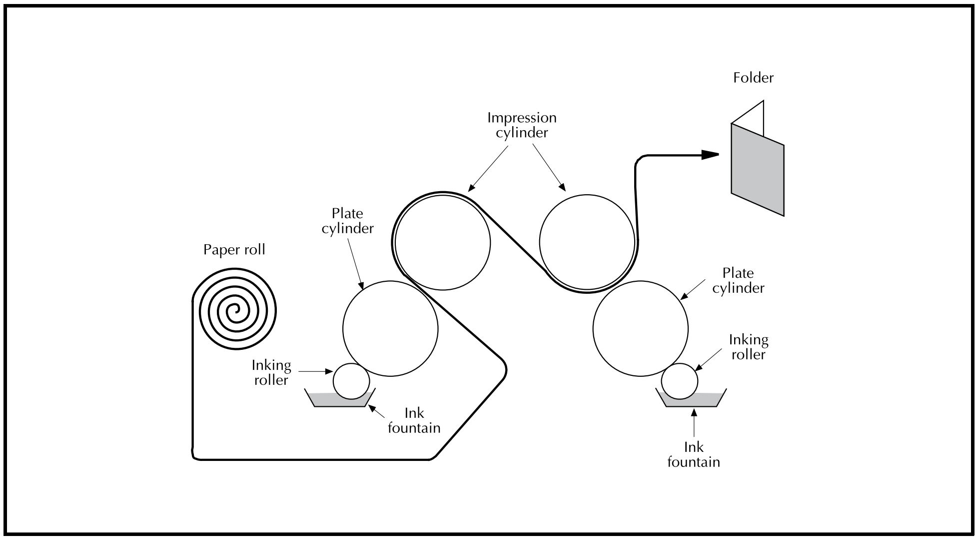
Source: EPA 1994

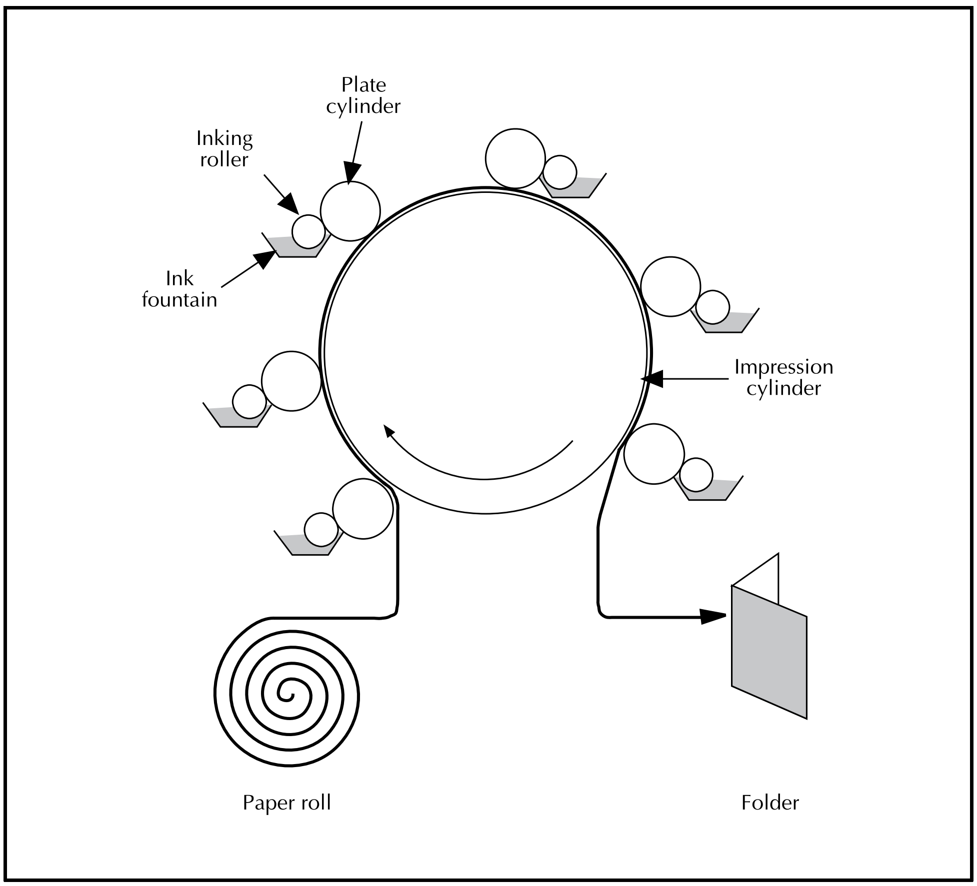
Letterpress

Like flexography, letterpress uses a plate with a raised image on a metal or plastic plate. The three types of letterpresses in use today are the platen, flat-bed, and rotary presses. On the platen press, the raised plate is locked on a flat surface. The substrate is placed on another flat surface and pressed against the inked plate. The flat-bed cylinder press prints as the substrate passes around an impression cylinder on its way from the feed stack to the delivery stack. These presses are often very slow relative to lithographic, flexographic or gravure presses. The most popular letterpress is the web-fed rotary letterpress. Designed to print both sides of the web simultaneously, these presses are used primarily for printing newspapers.

Letterpress was once the predominant printing method, but its prevalence has declined dramatically. It now accounts for an estimated 11 percent of the total value of the U.S. printing industry. Lithographic printing, gravure, and flexography have all begun to replace letterpress. Web letterpress, traditionally used to print newspapers, is being replaced by lithography and flexography. Gravure has largely replaced letterpress for printing long-run magazines and catalogs, while flexography is replacing it for printing paperbacks, labels, and business forms. Today, letterpress is primarily used for printing books, business cards, and advertising brochures.

Exhibit 7: Rotary Letterpress Press





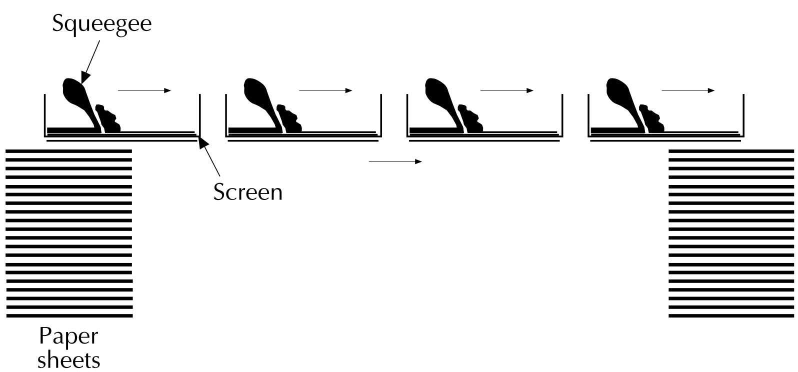
Source: EPA 1994

Screen Printing

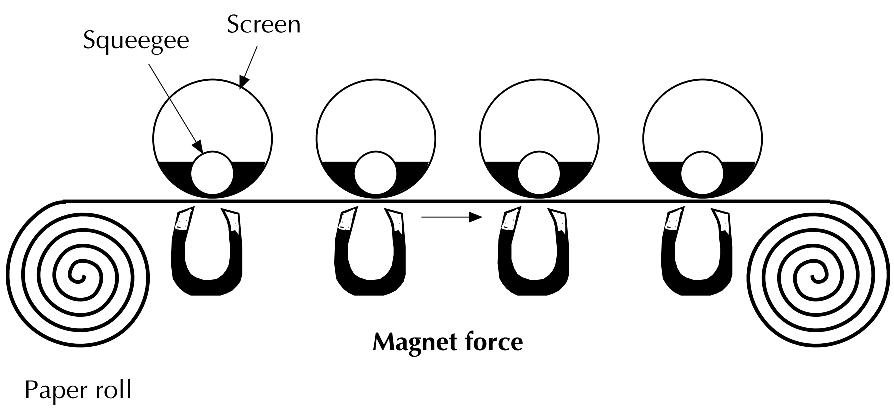
Unlike the impervious plates used in the other four printing processes, the screen printing process uses a porous polyester mesh. The mesh is stretched tightly over a frame, and a stencil, which defines the image to be printed, is applied to the mesh. The squeegee applies pressure to the ink thereby forcing the ink through the open areas of the screen. The thread count and diameter determine the amount of ink deposited onto the substrate below.

The major chemicals used in screen printing process include organic solvents, adhesives and inks. The chemical composition of the ink used varies depending on the substrate printed and the end product produced. There are five main categories of inks used within the screen printing process: UV-curable, solvent-based, and water-based for graphic applications, plastisols for textile applications, and water-based for textile applications. Screen printing is an extremely versatile printing process, and can be used to print on a wide variety of substrates including paper, plastics, glass, metals, nylon and cotton to produce a wide variety of products including, but not limited to, posters, labels, fleet decals, signage, all types of textile garments and membrane circuits.[22]

Exhibit 8: Two Methods of Screen Printing



Schematic drawing of a flat-screen type press.
Screens lift after each application, as substrate advances.



Rotary-screen printing press. Magnet force is applied
to control the squeegee pressure.

Source: EPA 1994

Plateless Technologies

Plateless technologies include electrostatic and laser printing, and other printing methods which do not rely upon the use of a separately developed or prepared plate or screen. Although currently used primarily for low-volume applications, these methods are likely to see increased use as the technologies continue to develop.

III.A.3. Post-press Operations

Post-press processes include cutting, folding, collating, binding, perforating, drilling, and many others. From an environmental impact viewpoint, binding is the most significant of the post-press operations. Liquid glue used for binding is typically a water-based latex that becomes impervious to water when it dries.[23]

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

Printing operations use materials that may adversely affect air, water, and land: certain chemicals involved in printing volatilize, which contributes to air emissions from the facility and to smog formation; other chemicals may be discharged to drains and impact freshwater or marine ecosystems; and solid wastes contribute to the existing local and regional disposal problems. The five printing processes outlined in the previous section have many common wastes; however, they also each have outputs that are process specific. Thus, it is important to note that wastes do differ from process to process and the solutions identified to reduce waste in one printing process do not necessarily apply to other printing processes. The following charts outline potential outputs for each of the five printing processes.

Exhibit 9: Lithography Process: Inputs, and Outputs		
Process	**Inputs**	**Outputs**
Imaging	Film	Used film and out-of-date film.
	Paper	Scrap paper.
	Developer	May be volatile and contribute to air emissions. Spent developer (sent to POTW).
	Fixer	May be volatile and contribute to air emissions. Silver from film is often electrolytically recovered from the fixer prior to discharge of spent fixer to POTW.
	Wash Water	Used rinse water.
	Cleaning Solutions	Rags containing solvents (sent to laundry service or disposed of as hazardous waste).
	Chemical Storage Containers	Empty containers (disposed of or returned to suppliers).
Platemaking	Plates	Used plates.
	Water	Used rinse water (discharged to POTW).
	Developer	Spent developer (may contain alcohol; contributes to air emissions).
Printing	Fountain Solution	May contain VOCs and contribute to air emissions.
	Ink	Waste oil based ink disposed of as hazardous waste. Solvent-based inks contribute to air emissions.
	Paper	Waste paper from bringing press up to required print quality and from rejected prints.
	Cleaning Solutions	Solvents used to clean press and remove excess ink contribute to air emissions.
	Rags	Ink and solvent-laden rags (sent to laundry service, disposed of as hazardous waste, or treated to recover solvents).
Finishing	Paper	Reject prints and edges from trimming.
	Adhesives	Possible losses to the air.
	Shipping boxes	Waste issue.

Exhibit 10: Gravure Process: Inputs, and Outputs		
Process	**Inputs**	**Outputs**
Imaging	Digital Data	Film or engraved image carrier (cylinder)
	Film	Used film and out-of-date film.
	Paper	Scrap paper.
	Photographic processing solution	May be volatile and contribute to air emissions. Waste solution.
	Wash Water	Used rinse water.
	Cleaning Solutions	Rags containing solvents (sent to laundry service, disposed of as hazardous waste, or treated to recover solvents).
	Chemical Storage Containers	Empty containers (disposed of or returned to suppliers).
Cylinder Making	Copper-clad Cylinder	Used cylinders.
	Acid etching solution	Waste solution.
Printing	Ink	Solvent-based inks (toluene-based for mass-circulation printing and alcohol-based for packaging) maintain the required low viscosity and contribute to air emissions. Waste ink disposed of as hazardous waste.
	Heat	Ovens are used to drive off the solvents to dry the ink. Ink solvents are recaptured through chillers and other equipment.
	Paper	Waste paper from bringing press up to required print quality and from rejected prints.
	Cleaning Solutions	Solvents used to remove excess ink contribute to air emissions.
Finishing	Paper	Reject prints and edges from trimming.
	Adhesives	Possible losses to the air.
	Shipping boxes	Waste issue.

Exhibit 11: Flexography Process: Inputs, and Outputs		
Process	**Inputs**	**Outputs**
Imaging	Film	Used film and out-of-date film.
	Paper	Scrap paper.
	Developer	May be volatile and contribute to air emissions. Spent developer (to POTW).
	Fixer	May be volatile and contribute to air emissions. Silver from film is often electrolytically recovered from the fixer prior to disposal of spent fixer to POTW).
	Wash Water	Used rinse water.
	Cleaning Solutions	Rags containing solvents (sent to laundry service, disposed of as hazardous waste, or treated to recover solvents).
	Chemical Storage Containers	Empty containers (disposed of or returned to suppliers).
Platemaking	Plate mold	Used molds, engravings and washes.
	Rubber plate	Used plates, defective plates and photopolymer.
	Etching and wash-out solutions	Waste solution and spent solvents.
Printing	Ink	Waste ink disposed of as hazardous waste. Solvent-based inks contribute to air emissions.
	Paper/film	Waste paper and film from bringing press up to required print quality and from rejected prints.
	Heat	Exhaust heat and odor. High alcohol content of some inks contribute to air emissions as ink dries. Water-based inks are used for paper and some films.
	Cleaning Solutions	Solvents used to remove excess ink contribute to air emissions and hazardous wastes.
Finishing	Paper/film	Reject prints, edges from trimming, box and bag-making wastes.
	Adhesives	Possible losses to the air.
	Shipping boxes	Waste issue.

Exhibit 12: Letterpress Process: Inputs, and Outputs		
Process	**Inputs**	**Outputs**
Imaging	Film	Used film and out-of-date film.
	Paper	Scrap paper.
	Developer	May be volatile and contribute to air emissions. Spent developer to POTW.
	Fixer	May be volatile and contribute to air emissions. Spent fixer (silver from film is often electrolytically recovered from the fixer prior to disposal of spent fixer to POTW).
	Wash Water	Used rinse water.
	Cleaning Solutions	Rags containing cleaning solvents (sent to laundry service, disposed of as hazardous waste, or treated to recover solvents).
	Chemical Storage Containers	Empty containers (disposed of or returned to suppliers).
Platemaking	Plate mold	Used molds.
	Plate	Used plates.
	Plate developer solution	Waste solution.
Printing	Ink	Waste ink disposed of as hazardous wastewater. Solvent-based inks contribute to air emissions.
	Paper	Waste paper from bringing press up to required print quality and from rejected prints.
	Cleaning Solutions	Solvents used to remove excess ink contribute to air emissions.
Finishing	Paper	Reject prints and edges from trimming.
	Adhesives	Possible losses to the air.
	Shipping boxes	Waste issue.

Exhibit 13: Screen Printing Process: Inputs, and Outputs		
Process	**Inputs**	**Outputs**
Imaging and Screen Making	Emulsion	Waste emulsion and out-of-date product.
	Photosensitization solution (needed for unsensitized films only)	Waste solution.
	Screen (polyester, nylon or wire mesh)	Excess screen trimmings; used screens.
	Frame	Reused.
	Developer	Spent developer (sent to POTW).
	Fixer	Spent fixer.
	Chemical Storage Containers	Empty containers.
Printing	Ink	Waste ink usually disposed of as hazardous waste. Solvent-based inks contribute to air emissions.
	Paper or other printing substrate	Waste paper from bringing press up to required print quality and from rejected prints.
	Blockout	Removed during screen reclamation and disposed with screen reclaim chemicals.
	Screen Reclamation Chemicals	Screen reclamation chemicals and ink are disposed of in rags and in clean-up wastewater.
	Water	Water used for screen reclamation is discharged to POTW; sometimes it is filtered prior to discharge.
Finishing	Paper or other printing substrate	Reject prints and edges from trimming.
	Adhesives	Possible losses to the air.
	Shipping boxes	Waste issue.

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 (EPCRA), TRI includes self-reported facility release and transfer data for over 600 toxic chemicals. Facilities within SIC Codes 20 through 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, 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 43 percent between 1988 and 1993. Although on-site releases have decreased, the total amount of reported toxic waste has not declined because the amount of toxic chemicals transferred off-site has increased. Transfers have increased from 3.7 billion pounds in 1991 to 4.7 billion pounds in 1993. Better management practices have led to increases in off-site transfers of toxic chemicals for recycling. More detailed information can be obtained from EPA's annual Toxics Release Inventory Public Data Release book (which is available through the EPCRA Hotline at 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 TRI data presented here does not accurately portray the printing industry's toxic chemical outputs due to the small number of printing facilities that report under EPCRA §313. The 1992 TRI printing industry data is based on information from 374 facilities, yet the printing industry universe has been put at approximately 70,000 facilities by industry sources; the TRI data covers less than one percent of U.S. printers. Small facilities that do not report to TRI because they are below the reporting thresholds of chemical use and/or employment are also somewhat less likely to be subject to the same regulatory requirements as larger facilities. A comprehensive picture of the chemical releases and transfers for the printing industry will be difficult without a separate release and transfer profile of the non-TRI-reporting printing facilities.

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 -- is 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 through 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 emission 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 toxic chemicals in waste to on-site landfills, land treated or incorporation 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 Printing and Publishing Industry

The total amount of TRI toxic chemicals generated by the printing industry is a gross profile of the types and relative amounts of chemical outputs from printing processes. Additional information which can be related back to possible compliance requirements is available from the distribution of chemical releases across specific media within the environment. The TRI data requires filers to separate the total releases for the printing industry for air, water, and land releases. This distribution across media can also be compared to the profile of other industry sectors.

The printing industry releases 99 percent of its total TRI poundage to the air, while the remaining one percent of releases are split between water and land disposal. This release profile differs significantly from other TRI industries which average approximately 60 percent to air, 30 percent to land, and 10 percent to water release respectively. Examining the printing industry's TRI reported toxic chemicals by chemical highlights the likely origins of the large air releases for the industry (see following table).

Of the top ten toxic chemicals in the list, the prevalence of volatile chemicals explains the air intensive toxic chemical loading of the printing industry. Of these ten toxic chemicals, seven are highly volatile. The four top toxic chemicals released, toluene, methyl ethyl ketone, xylene, and 1,1,1-trichloroethane, are all solvents of high volatility. By far the single largest toxic chemical used (released/transferred) by the printing industry is the solvent toluene; toluene comprises roughly 70 percent of the total chemicals released and transferred by the industry. Toluene is used heavily in the gravure printing process as an ink solvent, but is also used throughout printing for cleaning purposes. Metals on the other hand are typically transferred off-site, as a component of hazardous wastes or discharged to the sewer.

Exhibit 14: 1993 Releases for Printing Facilities in TRI, by Number of Facilities Reporting
(Releases reported in pounds/year)

CHEMICAL NAME	# REPORTING CHEMICAL	FUGITIVE AIR	POINT AIR	WATER DISCHARGES	UNDERGROUND INJECTION	LAND DISPOSAL	TOTAL RELEASES	AVG. RELEASE PER FACILITY
TOLUENE	104	15,158,9	13,295,1	185	0	500	28,454,81	273,604
GLYCOL ETHERS	66	684,589	711,528	255	0	0	1,396,372	21,157
METHYL ETHYL	50	579,621	959,265	0	0	0	1,538,886	30,778
XYLENE (MIXED	45	741,467	839,616	105	0	0	1,581,188	35,138
1,1,1-	37	1,085,82	340,447	0	0	7,476	1,433,743	38,750
NITRIC ACID	30	6,320	7,285	0	0	0	13,605	454
SULFURIC ACID	28	1,032	2,533	0	0	0	3,565	127
ZINC COMPOUNDS	27	750	777	10	0	0	1,537	57
ACETONE	26	343,897	287,530	5	0	0	631,432	24,286
METHANOL	26	164,933	136,103	0	0	0	301,036	11,578
COPPER COMPOUNDS	24	250	1,000	23	0	0	1,273	53
BARIUM COMPOUNDS	22	1,371	1,464	0	0	0	2,835	129
COPPER	19	5	0	9	0	0	14	1
TETRACHLOROETHYLENE	16	27,948	79,692	0	0	0	107,640	6,728
METHYL ISOBUTYL	14	75,997	187,089	0	0	0	263,086	18,792
DICHLOROMETHANE	13	50,359	123,003	0	0	0	173,362	13,336
ETHYLENE GLYCOL	13	75,680	31,003	0	0	0	106,683	8,206
N-BUTYL ALCOHOL	11	36,182	22,224	0	0	0	58,406	5,310
AMMONIA	10	11,760	64,403	0	0	0	76,163	7,616
1,2,4-	7	89,733	4,870	0	0	1,083	95,686	13,669
DIBUTYL PHTHALATE	5	0	18,300	0	0	0	18,300	3,660
ISOPROPYL ALCOHOL	5	38,864	44,056	0	0	0	82,920	16,584
ETHYLBENZENE	4	6,691	44,516	0	0	0	51,207	12,802
2-METHOXYETHANOL	4	11,493	19,176	0	0	0	30,669	7,667
TRICHLOROETHYLENE	3	62,689	0	0	0	0	62,689	20,896
DI(2-ETHYLHEXYL)	2	0	8,057	0	0	0	8,057	4,029
HYDROQUINONE	2	695	0	0	0	0	695	348
NICKEL	2	0	0	0	0	0	0	0
BENZENE	1	0	0	0	0	0	0	0
CHROMIUM COMPOUNDS	1	0	250	0	0	0	250	250
CYCLOHEXANE	1	0	0	0	0	0	0	0
FORMALDEHYDE	1	160	500	0	0	0	660	660
FREON 113	1	10,691	0	0	0	0	10,691	10,691
HYDROCHLORIC ACID	1	5	0	0	0	0	5	5
LEAD	1	0	0	0	0	98	98	98
MANGANESE	1	5	0	0	0	0	5	5
NAPHTHALENE	1	19,484	2,408	0	0	0	21,892	21,892
O-XYLENE	1	881	848	0	0	0	1,729	1,729
PHENOL	1	2,200	720	0	0	0	2,920	2,920
PHOSPHORIC ACID	1	250	5	0	0	0	255	255

Exhibit 15: 1993 Transfers for Printing Facilities in TRI, by Number of Facilities Reporting (Transfers reported in pounds/year)

H MI AL NAM	# R PORTING H MI AL	POTW IS HARG S	ISPOSAL	R Y LIN G	TR ATM N T	N RGY R OV RY	TOTAL TRANSF R S	AVG. TRANSF R P R FA ILITY
TOLUENE	104	10,637	2,159	3,552,82	60,841	1,705,39	5,331,85	51,268
GLYCOL ETHERS	66	212,203	4,200	81,810	39,034	640,347	977,594	14,812
METHYL ETHYL KETONE	50	5	18,050	254,764	60,032	806,136	1,138,98	22,780
XYLENE (MIXED ISOMERS)	45	39	21,748	165,614	5,735	227,411	420,547	9,345
1,1,1-TRICHLOROETHANE	37	5	12,365	49,680	12,274	116,972	191,296	5,170
NITRIC ACID	30	68,984	0	0	28,825	0	97,809	3,260
SULFURIC ACID	28	11	0	0	340	0	351	13
ZINC COMPOUNDS	27	557	22,813	4,671	9,155	20,275	57,471	2,129
ACETONE	26	1	9,555	129,475	15,516	110,189	264,736	10,182
METHANOL	26	21,042	2,755	3,885	10	68,800	96,879	3,726
COPPER COMPOUNDS	24	2,385	3,205	395,345	12,410	50	413,395	17,225
BARIUM COMPOUNDS	22	26	64,390	4,051	1,942	566	70,975	3,226
COPPER	19	1,234	9,124	373,827	14,192	0	398,377	20,967
TETRACHLOROETHYLENE	16	0	0	199,620	36,038	1,617	237,275	14,830
METHYL ISOBUTYL KETONE	14	0	500	30,532	23,635	48,912	103,579	7,399
DICHLOROMETHANE	13	0	0	0	7,919	250	8,169	628
ETHYLENE GLYCOL	13	22,726	0	0	2,020	0	24,746	1,904
N-BUTYL ALCOHOL	11	2,060	0	12,492	4,937	44,275	63,764	5,797
AMMONIA	10	300	5	250	6,327	0	6,882	688
1,2,4-TRIMETHYLBENZENE	7	0	0	0	13,400	12,688	28,890	4,127
DIBUTYL PHTHALATE	5	0	4,100	0	3,101	15,600	22,801	4,560
ISOPROPYL ALCOHOL	5	250	0	11,850	0	20,850	32,950	6,590
ETHYLBENZENE	4	0	0	0	500	6,730	7,230	1,808
2-METHOXYETHANOL	4	0	0	0	0	93,409	93,409	23,352
TRICHLOROETHYLENE	3	0	0	9,000	0	0	9,000	3,000
DI(2-ETHYLHEXYL)	2	0	8,500	0	0	0	8,500	4,250
HYDROQUINONE	2	0	0	9,700	0	0	9,700	4,850
NICKEL	2	4	1,760	10,759	0	0	12,523	6,262
BENZENE	1	0	0	0	0	0	0	0
CHROMIUM COMPOUNDS	1	2,200	3,600	0	2,255	0	8,055	8,055
CYCLOHEXANE	1	0	0	0	0	0	0	0
FORMALDEHYDE	1	0	0	0	0	0	0	0
FREON 113	1	0	0	0	0	0	0	0
HYDROCHLORIC ACID	1	0	0	0	0	0	0	0
LEAD	1	0	0	62,770	0	0	62,770	62,770
MANGANESE COMPOUNDS	1	0	250	0	0	0	250	250
NAPHTHALENE	1	0	0	916	0	0	916	916
O-XYLENE	1	0	0	0	0	0	0	0
PHENOL	1	0	0	0	0	0	0	0
PHOSPHORIC ACID	1	0	0	0	0	0	0	0
2-ETHOXYETHANOL	1	0	0	0	0	3,000	3,000	3,000
TOTAL	318	344,669	189,079	5,363,83	360,438	3,943,46	10,204,6	32,090

Source: U.S. EPA, Toxic Release Inventory Database, 1993.

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 16.

Exhibit 16: Top 10 TRI Releasing Printing Facilities[c]

Rank	Facility	Total TRI Releases in Pounds
1	Ringier America Inc. - Corinth, MS	2,734,080
2	R. R. Donnelley & Sons Co. - Warsaw, IN	2,304,148
3	Quebecor Printing Inc. - Glen Burnie, MD	1,991,284
4	Quebecor Printing Inc. - Memphis, TN	1,741,875
5	Quebecor Printing Inc. - Dickson, TN	1,666,416
6	Brown Printing Co. - Franklin, KY	1,643,881
7	R. R. Donnelley Printing - Lynchburg, VA	1,431,502
8	Quebecor Printing Inc. - Providence, RI	1,366,140
9	R. R. Donnelley & Sons Co. - Gallatin, TN	1,193,120
10	Quebecor Printing Inc. - Mount Morris, IL	1,190,988

Source: U.S. EPA, Toxic Release Inventory Database, 1993.

IV.B. Summary of Selected Chemicals Released

The brief descriptions provided below were taken from the *1993 Toxics Release Inventory Public Data Release* (EPA, 1994), and the Hazardous Substances Data Bank (HSDB), accessed via TOXNET. TOXNET is a computer system run by the National Library of Medicine. It includes a number of toxicological databases managed by EPA, National Cancer Institute, and the National Institute for Occupational Safety and Health.[d] HSDB contains chemical-specific information on manufacturing and use, chemical and physical properties, safety and handling, toxicity and biomedical

[c] Being included on this list does not mean that the release is associated with non-compliance with environmental laws.

[d] 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 Release Inventory).

effects, pharmacology, environmental fate and exposure potential, exposure standards and regulations, monitoring and analysis methods, and additional references. 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. For more information on TOXNET, contact the TOXNET help line at 800-231-3766.

Toluene (CAS: 108-88-3)

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.

Glycol Ethers

Data on ethylene glycol mono-n-butyl ether (2-butoxyethanol) are used to represent all glycol ethers because it is the most commonly used glycol ether in printing.

Ethylene Glycol Mono-n-Butyl Ether (2-Butoxyethanol)

Toxicity. Exposure to moderate concentrations of 2-butoxyethanol may cause central nervous system depression, including headaches, drowsiness, weakness, slurred speech, stuttering, staggering, tremors, blurred vision, and personality changes. These symptoms are such that a patient, in the absence of an accurate occupational history, may be treated for schizophrenia or narcolepsy. Other symptoms of moderate poisoning include nausea; vomiting; diarrhea; blood toxicity; abdominal and lumbar pain; and lesions in the brain, lung, liver, meninges and heart. Exposure to higher concentrations may lead to skin, respiratory, and eye irritation; kidney and liver damage; and coma.

It appears that 2-butoxyethanol is one of the few materials to which humans are more resistant than experimental animals. This appears to be at least partly due to the fact that humans are more resistant to the chemical's red blood cell-destroying properties than are most lab animals.

Environmental fate. The chemical 2-butoxyethanol is highly mobile in soils and should not accumulate in organic matter contained in sediments and suspended solids. Limited monitoring data has shown that it can leach to ground water. Hydrolysis, direct photolysis, volatilization, adsorption, and bioconcentration are not important fate processes for 2-butoxyethanol. Biodegradation is likely to be the most important removal mechanism of 2-butoxyethanol from aerobic soil and water. In the atmosphere, it reacts with photochemically produced hydroxyl radicals with an estimated half-life of 17 hours.

Methyl Ethyl Ketone (CAS: 78-93-3)

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.

Environmental Fate. MEK is a flammable liquid. 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.

1,1,1-Trichloroethane (CAS: 71-55-6)

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

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

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

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

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

Xylene (Mixed Isomers) (CAS: 1330-20-7)

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 toxic chemical release data obtained from TRI allows for a comparison across years and industry sectors. Reported chemicals are limited however to the 316 reported chemicals. The EPA Office of Air Quality Planning and Standards has compiled air pollutant emmission factors for determining the total air emissions of priority pollutants (e.g., total hydrocarbons, SO_X, NOx, CO, particulates, etc.) from various industry sectors including printing facilities.

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 17 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 17: Pollutant Releases (short tons/year)						
Industry Sector	CO	NO2	PM10	PT	SO2	VOC
Metal Mining	5,391	28,583	39,359	140,052	84,222	1,283
Nonmetal Mining	4,525	28,804	59,305	167,948	24,129	1,736
Lumber and Wood Production	123,756	42,658	14,135	63,761	9,419	41,423
Furniture and Fixtures	2,069	2,981	2,165	3,178	1,606	59,426
Pulp and Paper	624,291	394,448	35,579	113,571	541,002	96,875
Printing	**8,463**	**4,915**	**399**	**1,031**	**1,728**	**101,537**
Inorganic Chemicals	166,147	103,575	4,107	39,062	182,189	52,091
Organic Chemicals	146,947	236,826	26,493	44,860	132,459	201,888
Petroleum Refining	419,311	380,641	18,787	36,877	648,155	369,058
Rubber and Misc. Plastics	2,090	11,914	2,407	5,355	29,364	140,741
Stone, Clay and Concrete	58,043	338,482	74,623	171,853	339,216	30,262
Iron and Steel	1,518,642	138,985	42,368	83,017	238,268	82,292
Nonferrous Metals	448,758	55,658	20,074	22,490	373,007	27,375
Fabricated Metals	3,851	16,424	1,185	3,136	4,019	102,186
Computer and Office Equipment	24	0	0	0	0	0
Electronics and Other Electrical Equipment and Components	367	1,129	207	293	453	4,854
Motor Vehicles, Bodies, Parts and Accessories	35,303	23,725	2,406	12,853	25,462	101,275
Dry Cleaning	101	179	3	28	152	7,310

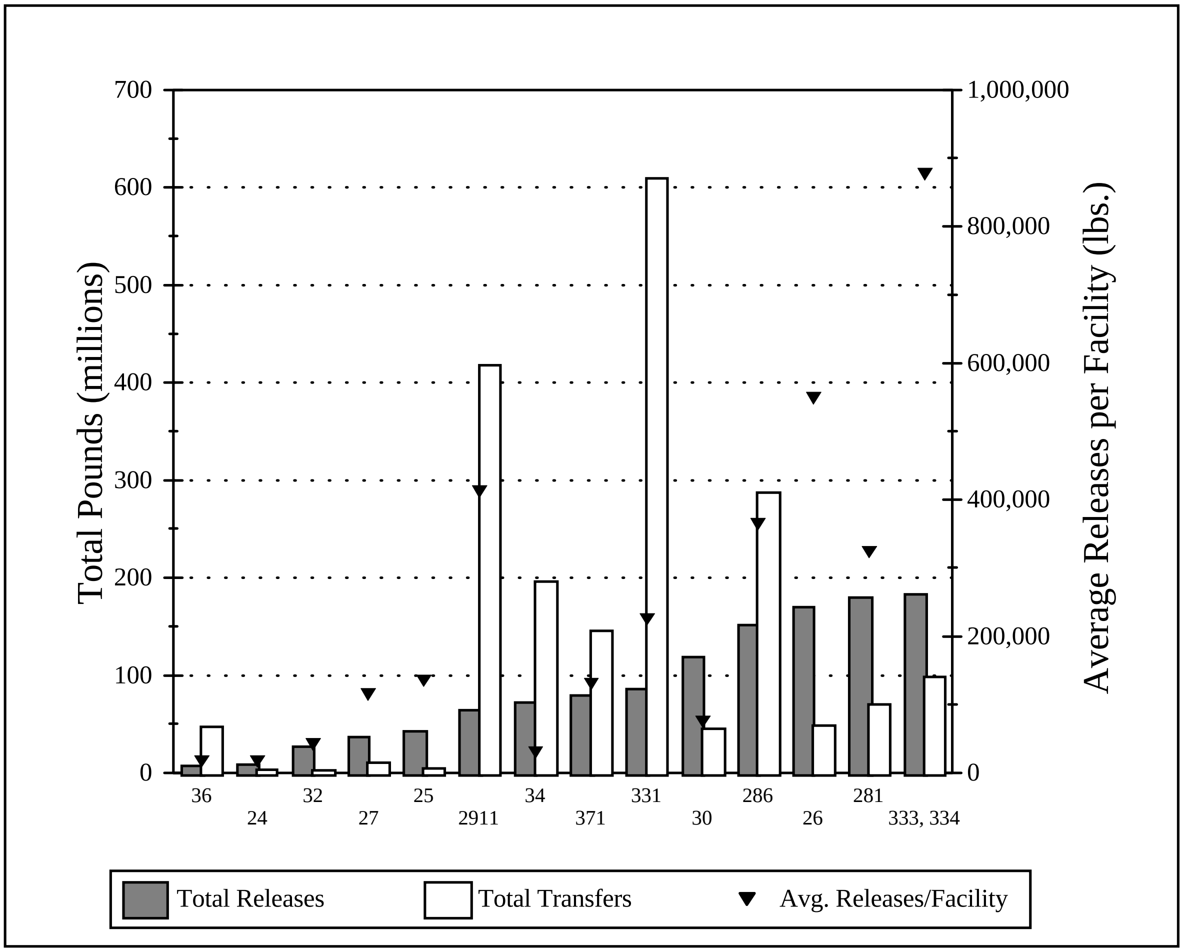
Source: U.S. EPA Office of Air and Radiation, AIRS Database, May 1995.

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

The following information is presented as a comparison of pollutant release and transfer data cross 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 figure and table do 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 18 is a graphical representation of a summary of the 1993 TRI data for the Printing and Publishing 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 19 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 Printing and Publishing, the 1993 TRI data presented here covers 318 facilities. These facilities listed SIC 2711-2789 (Printing and Publishing) as a primary SIC code.

Exhibit 18: 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 Accessories	281	Inorganic Chemical Mfg.
27	Printing	331	Iron and Steel	333,334	Nonferrous Metals
25	Wood Furniture and Fixtures	30	Rubber and Misc. Plastics		

Exhibit 19: Toxics Release Inventory Data for Selected Industries

Industry Sector	SIC Range	# TRI Facilities	1993 TRI Releases: Total Releases (million lbs.)	1993 TRI Releases: Average Releases per Facility (pounds)	1993 TRI Transfers: Total Transfers (million lbs.)	1993 TRI Transfers: Average Transfers per Facility (pounds)	Total Releases + Transfers (million lbs.)	Average Releases + Transfers per Facility (pounds)
Stone, Clay, and Concrete	32	634	26.6	42,000	2.2	4,000	28.8	46,000
Lumber and Wood Products	24	491	8.4	17,000	3.5	7,000	11.9	24,000
Furniture and Fixtures	25	313	42.2	135,000	4.2	13,000	46.4	148,000
Printing	**2711-2789**	**318**	**36.5**	**115,000**	**10.2**	**32,000**	**46.7**	**147,000**
Electronic Equip. and Components	36	406	6.7	17,000	47.1	116,000	53.7	133,000
Rubber and Misc. Plastics	30	1,579	118.4	75,000	45	29,000	163.4	104,000
Motor Vehicles, Bodies, Parts, and Accessories	371	609	79.3	130,000	145.5	239,000	224.8	369,000
Pulp and Paper	2611-2631	309	169.7	549,000	48.4	157,000	218.1	706,000
Inorganic Chem. Mfg.	2812-2819	555	179.6	324,000	70	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	30,000	195.7	83,000	267.7	123,000
Iron and Steel	331	381	85.8	225,000	609.5	1,600,000	695.3	1,825,000
Nonferrous Metals	333, 334	208	182.5	877,000	98.2	472,000	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	7216	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. Industries have creatively implemented pollution prevention techniques that improve efficiency and increase profits while at the same time minimizing environmental impacts. This can be done in many ways such as reducing material inputs, re-engineering processes to reuse by-products, improving management practices, and employing substitution of toxic chemicals. Some smaller facilities are able to actually get below regulatory thresholds just by reducing pollutant releases through aggressive pollution prevention policies.

In order to encourage these approaches, this section provides both general and company-specific descriptions of some pollution prevention advances that have been implemented within the printing and publishing 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 also provides the context (in terms of type of industry and/or type of process affected) in which the pollution prevention technique can effectively be used.

V.A. Pollution Prevention Opportunities for the Printing and Publishing Industry

Printers use various chemicals throughout their facilities. The payoff from many of the possible changes in the printing process or product choice is unlikely to have a significant effect on a facility's overall emissions profile because these chemicals and chemical formulations are often used in relatively small quantities. Instead, pollution prevention for printers involves a longer-term reorientation of production staff and management priorities so that opportunities are recognized and acted upon as they arise. For example, a one-time pollution prevention audit may not identify novel press technologies capable of reducing VOC emissions if the purchase is not likely to occur for several years, but the practice of on-going pollution prevention auditing, once established, will identify when the time and conditions are right.

This section is structured according to the steps within pre-press, press and post-press operations. Pollution prevention opportunities for specific printing processes (e.g., lithography) are presented separately wherever warranted.

V.A.1. Pre-press - Image Making Operations

Image making most frequently involves typesetting and photodeveloping. Typical wastestreams include: photographic chemicals, paper and films, silver, and solid wastes. Pollution prevention opportunities include:

- Implementing operational and work practice changes that can extend the life of chemical baths, reduce the amount of chemicals used and reduce wastewater generation;
- Using chemical substitutes, such as non-silver photographic films (under development);
- Replacing the sometimes repetitive steps of photographing, editing, re-shooting, and the photodeveloping process with electronic imaging (including the capability to edit images on a computer)
- Developing inventory control programs that offer the advantage of reducing spoilage of photodeveloping chemicals and supplies such as paper and film.

V.A.2. Pre-press - Plate Making/Screen Making Operations

Typical wastestreams include: outdated material and chemicals, damaged or used plates and screens, wastewaters containing acids, alkalis, solvents, plate coatings, developers, screen emulsions, and rinse water. Pollution prevention opportunities include:

- Changing operational and work practices to reduce chemical use including recovery and recycling of spent chemicals and heavy metals, which require steps to reduce contamination of chemical baths; counter-current washing; and filtration of screen making wastewaters to remove particulates;
- Recycling plates and plate materials to the manufacturer or a metal recoverer;
- Researching and commercializing of other major changes in printing plate development, primarily related to alternative chemistries. For example, using water-developed lithographic plates and film instead of solvent processing may eliminate the need for pretreatment of wastewaters if they are being discharged to the sewer;
- Replacing ferrocyanide bleaches with iron-EDTA bleaches which eliminate certain treatment and disposal requirements;
- Reducing environmental releases related to plate-making and screen-making through new techniques. For example, laser plate making using non-silver plates is under commercial development and could replace chemical development of plates;

- Reducing wastewater through new technologies such as "washless" processing systems. While still expensive to install, these systems can reduce wastewater by as much as 97 percent.

V.A.3. Press Operations

During printing, the image is transferred to a substrate of paper or some other material. Typical wastestreams include: inks, substrate, cleaning solutions, and in the case of lithography, fountain solutions. Pollution prevention opportunities include:

- Improving housekeeping and better operating practices, such as covering reservoirs and containers, scheduling jobs according to increasing darkness of ink color, using wipes as long as possible, and controlling inventory, can all minimize solvent losses from inks and cleaning solutions.
- Reducing ink vaporization by using diaphragm pumps which do not heat ink as much as mechanical vane pumps.
- Recycling waste solvents on-site or off-site. Segregating of solvents may allow a second use (e.g., for equipment cleaning or ink thinning).
- Recycling of certain waste inks where possible.
- Recycling of product rejects where possible.
- Using alternative ink and cleaning products with reduced VOC emissions. Lowering the VOC emissions from printing and press cleanup may be accomplished using vegetable oil-based inks or water-based inks (rather than solvent-based inks) where possible and using low-VOC or VOC-free cleaning solutions. A new printing system that features an oil-based lithographic ink that can be converted to a water-soluble state is currently available, allowing a water-based blanket wash to be used.
- Eliminating the use of chromium-containing fountain solutions to reduce the toxicity of spent fountain solutions.
- Installing automatic ink levelers help to keep ink conditions optimal.
- Using automatic cleaning equipment which can often be retrofitted to existing presses and operations. Typically, lower volumes of cleaning formulations are applied with such cleaning equipment, air contact, and thus volatilization, is reduced, and most are designed to include recycling and reuse of cleaning solutions.
- Minimizing finished product rejects by automating (noncontact) monitoring technologies which detect tears in web and press performance.
- Using fountain coolers to reduce evaporation from the dampening fountain.

V.A.4. Post-Press Operations

The final steps in making a printed product may involve folding, trimming, binding, laminating and embossing. Typical wastestreams include: scrap substrate from trimming, rejects from finishing operations, and VOCs released from adhesives. Pollution prevention opportunities include:

- Collecting and reclaiming recyclable materials is often done.
- Replacing VOC-based adhesives with water-soluble adhesives (binding adhesives that are not water-soluble may interfere with later recycling), hot-melt adhesives, or mechanical methods in binding operations.

VI. SUMMARY OF APPLICABLE FEDERAL STATUTES AND REGULATIONS

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

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

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 record keeping 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, record keeping 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 generates, 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 record keeping 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., ET, 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., ET, excluding Federal holidays.

Emergency Planning And Community Right-To-Know Act

The Superfund Amendments and Reauthorization Act (SARA) of 1986 created the Emergency Planning and Community Right-to-Know Act (EPCRA, also known as SARA Title III), a statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by State and local governments. EPCRA required the establishment of State emergency response commissions (SERCs), responsible for coordinating certain emergency response activities and for appointing local emergency planning committees (LEPCs).

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

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

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

- **EPCRA §311 and §312** require a facility at which a hazardous chemical, as defined by the Occupational Safety and Health Act, is present in an amount exceeding a specified threshold to submit to the SERC, LEPC and local fire department material safety data sheets (MSDSs) or lists of MSDS's 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., ET, 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 authorized approximately forty States to administer the NPDES program), contain industry-specific, technology-based and/or water quality-based limits, and establish pollutant monitoring 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. Stormwater discharge associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing or raw material 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 an 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 229-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., ET, 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 chemicals 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., ET, 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 Regulatory Requiremets

While the list of environmental statutes *potentially* affecting printers includes all of the major media-oriented statutes, the actual number is much smaller. In general, printers' relatively small size and lower chemical usage place them below many of the thresholds which would trigger regulatory requirements. For example, the 70 percent of printers with fewer than ten employees typically face only RCRA manifesting and discharge limits established by the local publicly owned wastewater treatment works (POTW). Larger facilities, however, may have to meet Clean Air Act requirements in ozone nonattainment areas, Emergency Planning and Community Right-to Know Act requirements, as well as state requirements established by the State Implementation Plan (SIP) process. These statutes are most frequently triggered because of solvent releases from image developing, inks and cleaning operations.

A fairly complete list of environmental regulations affecting the printing industry is available from the Agency's Design for the Environment Program or, more specifically, the document entitled *Federal Environmental Regulations Potentially Affecting the Commercial Printing Industry* (Contact: Stephanie Bergman 202-260-1821). Most importantly, it includes examples connecting chemicals used in the printing industry to applicable regulations. More accurate profiles of the regulatory requirements for printing facilities may become available in the near future as projects in support of consolidated reporting are completed.

Clean Air Act (CAA)

Title I - Provisions for Attainment and Maintenance of the National Ambient Air Quality Standards (NAAQS):

- Reasonably Available Control Technologies (RACTs) as defined in State Implementation Plans (SIPs) are required at major sources in "nonattainment" areas, defined by severity of air quality problems. NAAQS have been established for six pollutants: ozone, carbon monoxide particulate matter, sulfur dioxide, nitrogen dioxide and lead. Regulations relating to ozone (VOCs react to form O_3), NO_x and particulates are likely to have a significant impact on the printing industry. Control Technology Guidelines (CTGs) exist for gravure and flexographic printing, and fabric and paper coating. These CTGs apply primarily in ozone nonattainment areas to sources with potential uncontrolled VOC emissions (ozone precursors) of 25 tons or more per year depending on the severity of the non-attainment classification. (Contact: David Salman 919-541-0859)

- There are also New Source Performance Standards for the construction, operation or modification of presses, coaters, control devices, boilers, cyclones, evaporators, distillation units, and some bindery equipment.

Title V - Permits:

- A new permit system will require all major sources to obtain operating permits to cover all applicable control requirements. States were required to develop and implement the program in 1993 and the first permits are likely to be issued in late 1995. Although revisions to the definition of what constitutes a major source were being negotiated at the time that this document went to press, it is important to note that major source determination will likely be based on a facility's <u>potential</u> emissions and not its actual emissions; require emissions monitoring, and record keeping and reporting.

Resource Conservation and Recovery Act (RCRA)

Hazardous waste generators are divided in three categories: large quantity generators (1,000 kg or more/month or more than one kg/month of extremely hazardous waste); small quantity generators (100 to 1,000 kg/month and less than one kg/month of extremely hazardous waste); and conditionally exempt small generators (less than 100 kg/month and less than one kg/month of extremely hazardous waste). Each generator bears the responsibility for determining whether or not a waste is hazardous and the appropriate waste code.

- Facility Status (40 CFR Part 262) - Facilities may possibly be classified as Treatment Storage or Disposal Facilities (TSDFs) if they do not send their waste off-site before the applicable time limit (90 to 180 days depending upon the volume).
- Waste Containers (40 CFR §§262.32, 262.34, 265.171, 265.172 and 265.173) - Wastes must be properly stored to meet basic safety requirements and prevent leaks, and must be labeled as hazardous waste and dated at the time that accumulation begins.
- Hazardous Waste Shipments (40 CFR §262.20) - A Uniform Hazardous Waste Manifest must be completed and accompany the shipment. Wastes must be sent to a RCRA C permitted facility. An exception report must be filed with the relevant regulatory agency if the manifest copy is not received within 45 days of shipment. Also, an exemption is allowed for small quantity generators from the

manifest requirement if their waste is shipped under contract, records are maintained for three years, and the vehicle used to haul the waste is owned by the reclaimer.

- Land Disposal Restrictions (40 CFR §268.7) - Additional notification must be sent along with each manifest to the destination facility.
- Biennial Reporting (40 CFR §262.41) - Large quantity generators must submit a report of hazardous waste generation and management activities by March 1 of every even-numbered year.
- Record Keeping (40 CFR §268.7) - Copies of each manifest, biennial report (if a large quantity generator), exception report, test analysis, and inspection log must be kept for three years.
- Training (40 CFR §262.34 (a)(4),(d)(5)(iii)) - Facilities storing waste for longer than the 90-180 day threshold must ensure that employees are familiar with hazardous waste handling procedures or provide training.
- Release or Threat of Release Reporting (40 CFR §262.34) - In case of a release to the environment, the generator must contact the National Response Center.

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

- Emergency Planning (§302(A)) - Businesses that produce, use, or store "hazardous chemicals" at or above "threshold planning quantities" must submit: 1) material safety data sheets or the equivalent and 2) Tier I/Tier II annual inventory report forms to the appropriate local emergency planning commission. Those handling "extremely hazardous substances" are also required to submit a one-time notice to the state emergency response commission.
- Emergency Notification of Extremely Hazardous Substance Release (§304) - A business that unintentionally releases a reportable quantity of an extremely hazardous substance must report that release to the state emergency planning commission and the local emergency planning commission.
- Release Reporting (§313) - Manufacturing businesses with ten or more employees that manufactured, processed, or otherwise used a listed toxic chemical in excess of the "established threshold" must file annually a Toxic Chemical Release form with EPA and the state. Approximately 318 printers nationwide submitted forms summarizing their chemical releases in 1993. Documentation supporting release estimates must be kept for three years.

Clean Water Act (CWA)

- Discharges to a POTW (40 Part 403) - Facilities discharging wastewater to a sewer are often subject to restrictions required under the Clean Water Act and established by the local sewerage authority to prevent significant interference with the treatment facility or pass-through of pollutants not removed by treatment. The specific requirements include: notifying the POTW of discharges that could cause problems at the POTW, monitoring and recordkeeping as established by the POTW, and a one-time notice of the discharge of hazardous waste, specifically, if more than 33 pounds/month.
- Direct discharges (40 CFR Parts 116 and 117) - Facilities discharging hazardous substances are required to notify the federal government (33 §153.203) when discharges meet or exceed the reportable quantity.
- The Storm Water Rule (40 §122.26(b)(14) subpart (xi)) requires that printing facilities falling within any of 11 categories defined in 40 CFR 122.26 is subject to storm water permit application regulations.

Occupational Health and Safety Administration (OSHA)

A more up-to-date summary of OSHA regulations may be available from OSHA. The following is a summary taken from industry literature.

Exposure Monitoring (29 CFR §1910.1045) standard requires initial and periodic monitoring when an employer suspects exposure levels could exceed Permissible Exposure Limits (PELs). Also requires employee notification and recordkeeping.

Permissible Exposure Limits (PELs) (29 CFR §1910.1000) for chemicals released during printing operations, such as glycol ethers, toluene and methylene chloride.

Respiratory Protective Equipment (29 CFR §1910.134) established new standards for protective equipment.

Methods of Compliance (29 CFR §1910.1000 and §1910.134) allows the use of a respirator in lieu of administrative or engineering controls during installation of engineering controls or upset conditions.

State Statutes

A 1992 Source Reduction Review Project (SRRP) review of state air regulations found that **thirty states** (AL, CO, CT, DE, DC, FL, GA, AL, KS,

KY, LA, MD, MA, MI, MO, NH, NJ, NY, NC, OH, OK, OR, PA, RI, SC, TN, UT, VA, WA and WI) regulate volatile organic compounds emitted from printing and publishing operations. In general, all employ the same type of standards with potential release triggers of 50,000 pounds/year to 500 pounds/day. Typical standards include: 1) specifying a maximum volatile fraction (e.g., 25 percent by volume) of ink; 2) a minimum water volume (e.g., 75 percent or a "waterborne ink"); or 3) a minimum nonvolatile fraction (e.g., "high solids inks"). In addition, control technologies (i.e., carbon adsorption, incineration, or comparable alternative) are required to reduce or destroy VOCs. Specific efficiencies are established for gravure and flexographic printing.

Illinois, although not included in the 1992 SRRP, is known to have air regulations similar to those described above.

California has emergency planning requirements similar to those established by EPCRA but the state's lower thresholds result in smaller operations being subject to the planning requirements.

California's **South Coastal Air Quality Management District** and the Air Pollution Control District for the County of San Diego have issued regulations affecting graphic arts operations. These regulations establish standards for the VOC content of inks, cleaning solvents, fountain solutions, as well as work practices and record-keeping.

VI.C. Pending and Proposed Regulatory Requirements

Several regulatory requirements are currently pending that will potentially affect printers. The Clean Air Act Amendments of 1990 and RCRA are both potential sources of new regulatory requirements.

Clean Air Act Amendments of 1990 (CAAA)

The Clean Air Act Amendments of 1990 included a number of provisions for which the Agency will develop regulations likely to affect printers directly. A draft lithography Control Technology Guidance (CTG) was announced in the Federal Register in November of 1993 to be used by state and Regional air programs as the basis for controls of VOCs released from lithographic printing operations in ozone nonattainment areas. In June of 1994, a lithography Alternative Control Technology (ACT) was issued in response to the comments received regarding the CTG.

Title I - Provisions for Attainment and Maintenance of the National Ambient Air Quality Standards (NAAQS):

- Ozone nonattainment areas are classified as: marginal, moderate, serious, severe, or extreme. "Major" stationary sources are defined as having potential emissions of 50 tons of VOCs per year in serious areas; 25 tons per year in severe areas; and 10 tons or more in extreme areas. For all other areas, a major source is one that releases 100 tons of VOCs per year.
- An Alternative Control Techniques Guideline (ACT) was developed for offset lithographic printing which will affect formulations of fountain solutions and cleaning solvents. (Contact: Dave Salman 919-541-0859)
- Printers not subject to a CTG but designated a major source are subject to Reasonably Available Control Technology (RACT) requirements. The state must develop and adopt non-CTG RACT rules for such sources.

Title III - National Emissions Standards for Hazardous Air Pollutants (NESHAP):

- Maximum Achievable Control Technology (MACT) standards are scheduled for a list of 189 Hazardous Air Pollutants (HAPs) listed in §112. MACT standards for the commercial printing industry are scheduled for 1994. The Agency is studying the feasibility and benefits of MACT standards for publication and packaging gravure and wide web flexographic sources. (Contact: Bob Blaszczak 919-541-5432)

Resource Conservation and Recovery Act (RCRA)

- While developed for wastes such as batteries, simplified recordkeeping and manifesting for a number of waste streams with hazardous constituents, such as rags and wipes containing inks and solvents may apply to printers. (Contact: Ronald Josephson 202-260-6715)

- Additional RCRA listings of solvents and chemicals used by printers are also under investigation.

VII. COMPLIANCE AND ENFORCEMENT HISTORY

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.

Compliance and Enforcement Profile Description

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

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

Following this introduction is a list defining each data column presented within this section. These values represent a retrospective summary of inspections or enforcement actions, and solely reflect EPA, state and local compliance assurance activity 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.[e] 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.

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”

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

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 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 three enforcement actions counts as one). 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 three enforcement actions counts as three).

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 United States Environmental Protection Agency. 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. Reported 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 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 may 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. Printing and Publishing Industry Compliance History

Exhibit 20 provides an overview of the reported compliance and enforcement data for the printing industry over the past five years (August 1990 to August 1995). These data are also broken out by EPA Region thereby permitting geographical comparisons. A few points evident from the data are listed below.

- The number of different printing facilities inspected was only slightly more than one quarter of those identified in the IDEA search. Also, these facilities were inspected on average only every four years.

- A significantly smaller proportion of facilities had enforcement actions brought against them than were inspected. On average 17 percent of those facilities inspected faced enforcement actions.

- Those facilities with one or more enforcement actions had, on average, over the five year period, almost three enforcement actions brought against them.

Exhibit 20: Five-Year Enforcement and Compliance Summary for Printing

A	B	C	D	E	F	G	H	I	J
Region	Facilities in Search	Facilities Inspected	Number of Inspections	Average Months Between Inspections	Facilities with 1 or More Enforcement Actions	Total Enforcement Actions	Percent State Lead Actions	Percent Federal Lead Actions	Enforcement to Inspection Rate
I	440	106	303	87	10	22	86%	14%	0.07
II	268	125	515	31	30	114	93%	7%	0.22
III	568	138	805	44	28	70	87%	13%	0.09
IV	1,057	262	1,569	40	36	161	96%	4%	0.10
V	369	213	796	28	30	39	74%	26%	0.05
VI	596	51	172	208	17	49	78%	22%	0.28
VII	422	81	360	70	16	36	44%	56%	0.10
VIII	36	7	17	127	2	3	67%	33%	0.18
IX	185	36	143	78	5	13	62%	38%	0.09
X	147	17	43	205	2	7	69%	31%	0.17
TOTAL	4,106	1,035	4,723	52	176	514	85%	15%	0.11

VII.B. Comparison of Enforcement Activity Between Selected Industries

Exhibits 21 and 22 allow the compliance history of the printing sector to be compared to the other industries covered by the industry sector notebooks. Comparisons between Exhibits 21 and 22 permit the identification of trends in compliance and enforcement records of the industry by comparing data covering the last five years to that of the past year. Some points evident from the data are listed below.

- Of those sectors listed, the printing industry has been one of the least frequently inspected industries over the past five years based upon its high number of months between inspections.
- State lead actions have dominated the total number of enforcement actions taken against the printing industry.
- Over the past five years, the printing industry has had one of the lowest rates of enforcement actions per inspection of the sectors listed, and the rate has remained constant over the past year.

Exhibits 23 and 24 provide a more in-depth comparison between the printing industry and other sectors by breaking out the compliance and enforcement data by environmental statute. As in the previous Exhibits (Exhibits 21 and 22), the data cover the last five years (Exhibit 23) and the last one year (Exhibit 24) to facilitate the identification of recent trends. A few points evident from the data are listed below.

- The number of inspections carried out under the Clean Air Act and RCRA over the past five years account for over ninety percent of inspections and of total enforcement actions within the sample. This figure has remained constant over the past year.
- Proportional to the number of inspections conducted under each statute, significantly more enforcement actions are taken under RCRA (with an enforcement to inspection rate of 0.15) than under CAA (with an enforcement to inspection rate 0.05)

Exhibit 21: 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 Months Between Inspections**	**Facilities with 1 or More Enforcement Actions**	**Total Enforcement Actions**	**Percent State Lead Actions**	**Percent Federal Lead Actions**	**Enforcement to Inspection Rate**
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
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
Fabricated Metal	2,346	1,340	5,509	26	280	840	80%	20%	0.15
Nonferrous Metal	844	474	3,097	16	145	470	76%	24%	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

Exhibit 22: One-Year Inspection and Enforcement Summary for Selected Industries

A	B	C	D	E		F		G	H
				Facilities with 1 or More Violations		Facilities with 1 or more Enforcement Actions			
Industry Sector	**Facilities in Search**	**Facilities Inspected**	**Number of Inspections**	**Number**	**Percent**	**Number**	**Percent**	**Total Enforcement Actions**	**Enforcement to Inspection Rate**
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
Metal Mining	873	114	194	82	72%	16	114%	24	0.13
Non-metallic Mineral Mining	1,143	253	425	75	30%	28	11%	54	0.13
Lumber and Wood	464	142	268	109	77%	18	13%	42	0.58
Furniture	293	160	113	66	41%	3	2%	5	0.55
Rubber and Plastic	1,665	271	435	289	107%	19	7%	59	0.14
Stone, Clay, and Glass	468	146	330	116	79%	20	14%	66	0.20
Nonferrous Metals	844	202	402	282	140%	22	11%	72	0.18
Fabricated Metal	2,346	477	746	525	110%	46	10%	114	0.15
Electronics	405	60	87	80	133%	8	13%	21	0.24

Exhibit 23: Five-Year Inspection and Enforcement Summary by Statute for Selected Industries

Industry Sector	Facilities Inspected	Total Inspections	Total 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
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	298	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%	0%	1%
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%	0%	4%
Lumber and Wood	301	1,891	232	31%	21%	8%	7%	59%	67%	2%	5%
Furniture	293	1,534	91	52%	27%	1%	1%	45%	64%	1%	8%
Rubber and Plastic	739	3,386	391	39%	15%	13%	7%	44%	68%	3%	10%
Stone, Clay, and Glass	268	2,475	301	45%	39%	15%	5%	39%	51%	2%	5%
Nonferrous Metals	474	3,097	470	36%	22%	22%	13%	38%	54%	4%	10%
Fabricated Metal	1,340	5,509	840	25%	11%	15%	6%	56%	76%	4%	7%
Electronics	222	777	212	16%	2%	14%	3%	66%	90%	3%	5%
Automobiles	390	2,216	240	35%	15%	9%	4%	54%	75%	2%	6%

Exhibit 24: One-Year Inspection and Enforcement Summary by Statute for Selected Industries

Industry Sector	Facilities Inspected	Total Inspections	Total 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
Pulp and Paper	189	576	88	56%	69%	35%	21%	10%	7%	0%	3%
Printing	**397**	**676**	**72**	**50%**	**27%**	**5%**	**3%**	**44%**	**66%**	**0%**	**4%**
Inorganic Chemicals	158	427	49	26%	38%	29%	21%	45%	36%	0%	6%
Organic Chemicals	195	545	118	36%	34%	13%	16%	50%	49%	1%	1%
Petroleum Refining	109	437	114	50%	31%	19%	16%	30%	47%	1%	6%
Iron and Steel	167	488	46	29%	18%	35%	26%	36%	50%	0%	6%
Dry Cleaning	80	111	11	21%	4%	1%	22%	78%	67%	0%	7%
Metal Mining	114	194	24	47%	42%	43%	34%	10%	6%	0%	19%
Non-metallic Mineral Mining	253	425	54	69%	58%	26%	16%	5%	16%	0%	11%
Lumber and Wood	142	268	42	29%	20%	8%	13%	63%	61%	0%	6%
Furniture	293	160	5	58%	67%	1%	10%	41%	10%	0%	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%	0%	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%	0%	2%
Electronics	60	87	21	17%	2%	14%	7%	69%	87%	0%	4%
Automobiles	169	284	28	34%	16%	10%	9%	56%	69%	1%	6%

VII.C. Review of Major Legal Actions

This section provides summary information about major cases that have affected this sector, and 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.

VII.C.1. Review of Major Cases

The Office of Regulatory Enforcement does not regularly compile information related to major cases and pending litigation within an industry sector. The staff are willing to pass along such information to Agency staff as requests are made. (Contact: Office of Enforcement Capacity and Outreach, 202-260-4140) In addition, summaries of completed enforcement actions are published each fiscal year in the *Enforcement Accomplishments Report*; the summaries are not organized by industry sector. (Contact: Office of Enforcement Capacity and Outreach, 202-260-4140)

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

Supplemental environmental projects (SEPs) are enforcement options that require the non-compliant facility to complete specific projects. Regional summaries of SEPs undertaken in federal fiscal year 1993 and 1994 were reviewed. Two SEPs were undertaken that involved printing facilities, as shown in the following table.

EPCRA violations engendered one SEP and RCRA violations engendered the other SEP. Due to differences in regional descriptions, the specifics of the original violations are not known. Both of the projects resulted in a reduction in the use or release of volatile organic chemicals (VOCs). Implementation costs were over $1.7 million for one of the projects involving major process changes or capital investments in equipment. The second project cost $26,150 and consisted of a process chemical change.

Both of the SEPs were done in Region VII. However, Region VII has only six percent of U.S. printing facilities (third lowest of all Regions) and only eight percent of all inspections (fifth in rank of all Regions). The small number of facilities and inspections suggests a possible regional priority on

Exhibit 25: FY-1993-1994 Supplemental Environmental Projects Overview: Printing

General SEP Information			Violation Information					Pollutant Reduction		
FY	**Company Name**	**State/ Region**	**Type**	**Initial Penalty**	**Final Penalty**	**SEP Credit**	**SEP Cost to Company**	**Pollutant of Concern**	**Pollutant Reduction**	**Supplemental Environmental Project Description**
93	Z-International	MO	EPCRA	N/A	$7,700	N/A	$26,150	Solvents	N/A	Solvent-based ink reduction by 50% and substitute OPTI-SOL for tetrachloroethylene in platewashing operations, also new plate de-tacking installed
93	Hallmark Cards	MO	RCRA	N/A	$30,000	N/A	$1,740,000	Solvents	80% reduction in VOCs and RCRA Wastes	Solvent-based inks converted to water-based inks at gravure printing facility

Violation Information Terms

Initial penalty: Initial proposed cash penalty for violation
Final penalty: Total penalty after SEP negotiation
SEP credit: Cash credit given for SEP so that, Final penalty - SEP credit = Final cash penalty
SEP cost to company: Actual cost to company of SEP implementation

NOTE: Due to differences in terminology and level of detail between regional SEP information, in some cases the figure listed as Final penalty may be the Final cash penalty after deduction for SEP credit

N/A: Information not available at time of printing.

VIII. COMPLIANCE ACTIVITIES AND INITIATIVES

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

VIII.A. Sector-related Environmental Programs and Activities

Design for the Environment (DfE) Printing Industry Project

The Design for the Environment (DfE) Printing Industry Project (Contact: Stephanie Bergman 202-260-1821) is a joint and cooperative project between the EPA and participating printing industry sectors (screen, lithographic, and flexographic printing). Its purpose is to provide printers cost, risk, and performance information of various chemical, technology, and work practice substitutes to enable them to make informed decisions about incorporating lower risk chemicals into their production processes.
The draft Cleaner Technologies Substitutes Assessment (CTSA) for screen reclamation products and technologies (used in screen printing) was published in September 1994 and was circulated for comment through January 1995. It summarizes the comparative risk, performance, and costs of eleven substitute product systems used to reclaim screens as well as substitute work practices and technologies. A draft CTSA for lithographic blanket washes will be available in 1995.

Pollution prevention case studies and other outreach materials (e.g., videos, software packages, training workshops, and other information products) will be disseminated to printers by various means including a network of volunteer printers. The state of Washington is working with U.S. EPA Region X to disseminate DfE materials and integrate DfE efforts with the state's own "snapshots" initiative (Contact: U.S. EPA Region X - Jayne Carlin 206-553-4762).

The DfE Program has also developed a number of background documents, including the following: Printing Industry and Use Cluster Profile; Federal Environmental Regulations Potentially Affecting the Commercial Printing Industry; and Summary of Focus Group Discussions with Screen Printers and Lithographers for the Design for the Environment Printing Project. For more information about these documents or to request copies of these documents, please contact the Pollution Prevention Information Clearinghouse at 202-260-1023.

Common Sense Initiative

The EPA's Common Sense Initiative was formally announced by Administrator Browner in July of 1994 to encourage sector-based regulatory policy in six pilot industrial sectors including: iron and steel, electronics, metal plating and finishing, automobiles, printing, and oil refining. The program shifts regulatory focus from concentrating on individual pollutants and media, to industry-wide approaches to environmental problems. An EPA team is involved with other stakeholders from industry, environmental groups, environmental justice groups, labor, and state and local government agencies to identify opportunities to coordinate rulemaking and to streamline record-keeping and permitting requirements. The teams will also work with industry to identify innovative approaches in pollution prevention and environmental technology, and compliance and enforcement.

EPA CSI contacts for printing are as follows:

Ginger Gotliffe, Agency Lead (OECA) 202-564-7072
Brian Holtrop (OW) 202-260-6814
Dave Salman (OAR) 919-541-0859
Stephanie Bergman (OPPTS) 202-260-1821
Jim O'Leary (OSWER) 202-260-0724
Adam Saslow (OPPE) 202-260-2857
Paul Shapiro (ORD) 202-260-4969
Jim Curtin (OGC) 703-235-5304

The Great Printers Project

The Great Printers Project, co-sponsored by the Environmental Defense Fund (EDF), Printing Industries of America (PIA), and Council of Great Lakes Governors (CGLC), is investigating potential improvements in regulatory implementation and environmental protection. CGLC, PIA, U.S. EPA, Great Lakes state regulatory agencies, and EDF have examined the possibility of re-orienting both regulatory activities and technical support for lithographic printers toward a whole-facility approach. One of the first efforts was an investigation of the regulatory requirements currently facing printing facilities so that proposals for consolidated permitting can be developed. Great Printers Project participants published their first report in July 1994, "The Great Printers Project: Recommendations to Make Pollution Prevention a Standard Practice in the Printing Industry," which covers issues from regulatory design to technical outreach. (Contact: Kevin Mills 202-387-3500)

Environmental Leadership Program

In FY94, the Agency's Environmental Leadership Program (ELP) solicited proposals for innovative approaches to environmental management and compliance at the facility level. Forty proposals were received from companies, trade associations, and federal facilities representing many manufacturing and service sector facilities. In ELP, the EPA will work with individual facilities to study and evaluate the implementation of a variety of proposed pilot programs. The information collected from the pilot ELP programs will be used to develop a full-scale ELP program. The John Roberts Company was one of 12 proposals selected to participate in the pilot program. The John Roberts Company is a medium sized commercial lithographic printer located in Minneapolis Minnesota, who will work on developing the concept of mentoring as an environmental auditing tool to proactively and voluntarily verify compliance effectiveness. Other proposals are available for review from the Environmental Leadership Program. (Contact: Tai-ming Chang, ELP Director, 202-564-5081)

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.

Waste Reduction Innovation Technology Evaluation

EPA's Office of Research and Development has supported a variety of Waste Reduction Innovative Technology Evaluation (WRITE) projects related to printing operations including evaluations of water-based inks for wide-web flexographic printing (Erie County, NY) and soy-based inks for lithographic printers (IL) (Contact: Paul Randall 513-569-7673)

Region I

Region I's Waste Management Division is giving a grant to Vermont to establish model facilities illustrating compliance and pollution prevention, which may include a printing facility. A grant to the Printing Industries of New England (PINE), also a DfE participant, provides for on-site compliance outreach, pollution prevention assistance and hazardous waste management assistance to roughly 75 facilities in the Commonwealth of Massachusetts. (Contacts: Abby Swaine - Region I, 617-565-4523 or Mark Mahoney - Region I, 617-565-1155)

Connecticut

The Connecticut Department of Environmental Protection has developed a site assessment tool for printers.

Region IV

Region IV's VOC Initiative is in the planning stages. Once developed, it may impact printers. (Contact: Bill Klutz, Air Enforcement Branch 404-347-2904)

Region VIII

Pollution prevention training for printing and metal finishing industries will be open to municipalities with approved pretreatment programs.

Region IX

Geographic Initiative focused in Southern California will target many industries.

Printing, Lithographic and Photo Processing Initiative (Washington State)

The Washington Department of Ecology's Hazardous Waste and Toxics Reduction Program is targeting the printing and photo processing industry as one of a series of single industry initiatives. The assistance is being funded with an EPA pollution prevention grant. The assistance includes: outreach training, seminars and publications, responses to inquiries, hotline and/or on-site assistance to individual facilities. Local governments and industry trade associations in King County-Metro are participants. (Contacts: U.S. EPA Region X - Nancy Helm 206-553-8659 or Jayne Carlin 206-553-4762; WADEC - Darrin Rice 206-407-6743)

Oregon Printing Industry Initiative

The Oregon Department of Environmental Quality (DEQ) is providing compliance assistance to printing, lithographic, and photo processing facilities in the state. Assistance will be provided through training, seminars and publications. (Contacts: Region X - Jayne Carlin 206-553-4762 or Kris Colt 206-553-8577; Oregon DEQ - Marianne Fitzgerald 503-229-5946)

State Pollution Prevention Roundtable

The State Pollution Prevention Roundtable will soon be publishing a member survey which will summarize state-level expertise and initiatives according to industry.

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 seventeen 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 out to participants meeting their 1992 goals. The list of chemicals includes seventeen high-use chemicals reported in the Toxics Release Inventory.

Of the target chemicals, toluene, methyl ethyl ketone, xylenes, and 1,1,1-trichloroethane are released and transferred most frequently by the printing and publishing industry. These four toxic chemicals account for roughly 86 percent of TRI releases and transfers for printing facilities. Twenty-five companies listed under SIC 27 (printing and publishing) are currently participating in the 33/50 program. They account for 12 percent of the 206 TRI reporting companies under SIC 27, which is approximately the average level of participation for all industries (14 percent). (For more information, contact: Mike Burns, U.S. EPA, 202-260-6394 or 33/50 Program 202-260-6907.)

WasteWi$e Program

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

Climate Wise Recognition Program

The Climate Change Action Plan was initiated in response to the U.S. commitment to reduce greenhouse gas emissions in accordance with the Climate Change Convention of the 1990 Earth Summit. As part of the Climate Change Action Plan, the Climate Wise Recognition Program is a partnership initiative run jointly by EPA and the Department of Energy. The voluntary 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). 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. Summary of Trade Associations

The trade and professional organizations serving the printing industry are divided along printing processes as well as type of product produced. For example, there are several trade groups for lithographers as well as the American Newspaper Publishers Association, which typically print using lithographic presses. The large number of small facilities in this industry results in two important characteristics of the trade associations. First, a large number of facilities are not affiliated with any trade associations. Second, a significant portion of the industry research is conducted through trade associations and/or technical foundations which serve the needs of the many smaller members who would otherwise have limited or indirect access to research.

Printing industry membership in trade organizations is approximately 50 percent. The majority of printers not associated with trade groups are small printers with fewer than ten employees. Outreach efforts to unaffiliated small printing shops have been problematic for the printing industry trade associations. The In-Plant Management Association's membership, however, includes in-house operations that would otherwise be difficult to identify or contact as the main business is not printing. Industry officials reported that the trade press, which may be read by nonmembers, and suppliers of equipment and chemicals, offer two vehicles for reaching unaffiliated small printers.

LITHOGRAPHY

Printing Industries of America
100 Daingerfield Rd.
Alexandria, VA 22314
Phone: (703) 519-8100
Fax: (703) 548-3227

Members: 13,200
Staff: 70
Budget: $12,000,000
Contact: Tom Purcell

Since its inception in 1887, Printing Industries of America (PIA) has grown to be the largest trade group for the printing sector, with the largest membership and budget. PIA focuses on lithographic printing, although their membership includes other printing processes and suppliers. Technical service and support to members occurs through more than 30 strong regional organizations. PIA publishes a variety of periodicals including *The Capital Letter*, a monthly dedicated to government regulatory issues. They are involved in the DfE Printing Industry Project, the Common Sense Initiative, and the Great Printers Project and have developed a voluntary environmental management program for printers. Affiliated trade associations are located throughout the United States.

Graphic Arts Technical Foundation
4615 Forbes Ave.
Pittsburgh, PA 15213
Phone: (412) 621-6941
Fax: (412) 621-3049

Members: 7,000
Staff: 72
Budget: $6,000,000
Contact: Gary Jones

Graphic Arts Technical Foundation (GATF), established in 1924, is a scientific, technical and educational organization serving the graphic communications industries. Members represent printers, packagers, binders, publishers, design houses, and suppliers. They provide in-facility technical support and training to members as well as evaluations of and educational outreach for advancing technologies. GATF performed laboratory testing of alternative lithographic blanket washes for the DfE Printing Industry Project.

National Association of Printers and Lithographers
780 Palisade Ave.
Teaneck, NJ 07666
Phone: (201) 342-0700
Fax: (201) 692-0286

Members: 3,700
Staff: 38
Budget: $5,000,000

The National Association of Printers and Lithographers (NAPL), founded in 1933, is actively engaged in presenting conferences, seminars, and workshops on management topics for lithographic printers. It holds over 50 such functions each year. NAPL focuses on business and management planning rather than technical support for the shop-level employee. They publish the *Environmental Advisor* newsletter and *Printing Manager* magazine. NAPL officials also participate in the DfE Printing Industry Project.

Printing and Graphic Communications Association
7 West Tower
1333 H Street, NW
Washington, DC 2005
Phone: (202) 682-3001

GRAVURE

Gravure Association of America
1200-A Scottsville Rd.
Rochester, NY 14624
Phone: (716) 436-2150

Members: 250
Staff: 20

The Gravure Association of America (GAA), founded in 1987, promotes the use of gravure printing in publications and the general advancement of gravure printing techniques. The GAA compiles statistics about the gravure industry, collects/analyzes/disseminates current and historical information on environmental issues, government regulations, marketing, and gravure technology, and runs a seminar/lecture series. The Rochester Institute of Technology provides GAA and its members with academic research, testing facilities and personnel training. It is unique in that all types of suppliers (e.g., waste management vendors, chemical and equipment suppliers) are members and are active participants in many GAA activities. The GAA publishes *GAA Today*, which covers environmental regulations, ink and solvent testing, as well as other topics.

FLEXOGRAPHY

Flexographic Technical Association
900 Marconi Ave.
Ronkonkoma, NY 11779
Phone: (516) 737-6020

Members: 1,400
Staff: 20

Founded in 1958, the Flexographic Technical Association (FTA) is the major industry trade group for the flexographic process. FTA's stated purpose is to "advance the art and science of flexographic printing and assist and recommend developments in flexography." Membership includes suppliers as well as printers. The FTA leads regional workshops for production, supervisory, and management personnel and publishes a monthly magazine entitled *Flexo*, which has a circulation of 9,200.

SCREEN PRINTING

Screenprinting and Graphic Imaging
Association International (SGIA)
10015 Main Street
Fairfax, VA 22031
Phone: (703) 385-1335
Fax: (703) 273-0456

Members: 3,000
Staff: 29
Budget: $2,900,000
Contact: Marcia Kinter

Founded in 1948, the Screenprinting and Graphic Imaging Association International (SGIA) represents the interests of the screen printing industry throughout the world. SGIA offers technical assistance on all matters concerning the screen printing and graphic imaging industry; conducts educational programming for the industry; compiles industry statistics; and offers a wide variety of management and government related services.

SGIA was the industry partner in the DfE assessment of screen reclamation products. The Association is closely associated with the Screen Printing Technical Foundation (SPTF). SPTF conducts research into the screen printing process. The foundation also participated in the DfE screen printing project by providing the laboratory evaluation of alternative screen reclamation products submitted to the project.

OTHER ASSOCIATIONS

In-Plant Management Association
1205 W. College Ave.
Liberty, MO 64068
Phone: (816) 781-1111

Members: 2,700
Staff: 5

Founded in 1964, the In-Plant Management Association represents managers of in-plant printing and graphics operations. Members are most frequently located within academic institutions (20 percent) and insurance companies (12 percent). They offer training, educational, and certification programs. IPMA conducts research, surveys and studies on industrial and technological trends.

National Association of Quick Printers
401 N. Michigan Ave.
Chicago, IL 60611
Phone: (312) 644-6610

Members: 3,400
Staff: 4

Founded in 1975, the National Association of Quick Printers (NAQP) serves printers that offer "printing-while-you-wait" as well as suppliers. Many of their members are franchise operators. The technology is typically turnkey, xerographic printing, but there is increased use of small lithographic presses in the industry.

Environmental Conservation Board
of the Graphic Communications Industries
1899 Preston White Drive
Reston, VA 22091-4367
Phone: (703) 648-3218

Contact: Mark Nuzzaco

The Environmental Conservation Board (ECB) was founded in 1972 to provide a unified and coordinated approach to environmental issues affecting the graphic communications industry. ECB is an intra-industry organization for environmental affairs for the printing, publishing, newspaper, packaging, and metal decorating industries and their suppliers. Members are predominantly other trade associations, not individual companies. Work is conducted by subcommittees convened to address specific issues. Current projects include: review of draft CTG for lithography, participation in DfE Core Group and in the Common Sense Initiative, information dissemination at trade shows, ECB Environmental Conference, and a newsletter and information database.

National Association of Printing Ink Manufacturers
47 Halstead Ave.
Harrison, NY 10528
Phone: (914) 835-5650

Members: 140
Staff: 5

The National Association of Printing Ink Manufacturers (NAPIM) was founded in 1914 and represents manufacturers of all types of printing inks. NAPIM publications include *Printing Ink Handbook*, *Raw Materials Data Handbooks*, as well as bulletins and booklets.

IX. CONTACTS/ACKNOWLEDGMENTS/RESOURCE MATERIALS/REFERENCES [f]

For further information on selected topics within the petroleum refining industry a list of contacts and publications are provided below:

Contacts

Name	Organization	Telephone	Subject
Ginger Gotliffe	EPA/OECA	(202) 564-7072	Regulatory requirements and compliance assistance. CSI lead.
David Salman	EPA/OAR	(919) 541-0859	Industrial processes and regulatory requirements (Air)
Ron Josephson	EPA/OSW	(202) 260-6715	Industrial processes and regulatory requirements (RCRA)
Stephanie Bergman	EPA/DfE	(202) 26-1821	Nonregulatory initiatives and DfE.

OECA: Office of Enforcement and Compliance Assistance
OAR: Office of Air and Radiation
OSWER: Office of Solid Waste and Emergency Response
DfE: Design for the Environment Program

General Profile

Printing Industry and Use Cluster Profile, U.S. EPA. June 1994. EPA 744-R94-003.

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

Graphics Arts Monthly: The Magazine of the Printing Industry, 249 W. 17th St. New York, NY 10011 (212) 463-6834

Bruno, Michael H. 1991. *Michael H. Bruno's Status of Printing, 1991 Update: A State of the Art Report*. Salem, NH: GAMA Communications.

Lewis, A.F. 1991. *Blue Book Marketing Information Reports: Graphic Arts Industry Analysis by Plant Size, Equipment, Product Specialties*. New York, NY: A.F. Lewis & Co., Inc.

[f] 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.

PIRA (Packaging, Paper, Printing and Publishing, and Nonwovens Abstracts) database, available through the DIALOG Information Retrieval Service. PIRA provides coverage of the literature of the pulp and paper, packaging, printing, publishing, and nonwovens industries.

See summary of trade associations (Section III.C.4) for periodicals targeted to establishments using specific printing processes.

Process Descriptions and Chemical Use Profiles

Printing Industry and Use Cluster Profile, U.S. EPA. June 1994. EPA 744-R94-003.

Cleaner Technologies Substitutes Assessment for Screen Printing: Screen Reclamation, U.S. EPA, DfE Printing Industry Project, Draft September 1994.

Draft National Emission Standards for the Printing and Publishing Industry - Background Information Document, U.S. EPA, OAR - OAQPS.

Regulatory Profile

Federal Environmental Regulations Possibly Affecting the Commercial Printing Industry, U.S. EPA, DfE Printing Industry Project, EPA744B-94-001, March 1994.

The Great Printers Project: Recommendations to Make Pollution Prevention a Standard Practice in the Printing Industry, Council of Great Lakes Governors, Printing Industries of America, and Environmental Defense Fund, July 1994.

For a listing of all state environmental agency contacts relevant to the printing industry, refer to the March, 1995 issue of *Graphic Arts Monthly*.

Pollution Prevention

Guides to Pollution Prevention: The Commercial Printing Industry, EPA/625/7-90/008, U.S. EPA, August 1990.

Technical Information Publication PRINTING, New Jersey Department of Environmental Protection.

Blanket Wash Technology Study: An Evaluation of Commercially Available Blanket Washes, The Massachusetts Toxics Use Reduction Institute, Technical Report No. 16, 1994.

Cleaner Technologies Substitutes Assessment for Screen Printing: Screen Reclamation, U.S. EPA, DfE Printing Industry Project, Draft September 1994.

Replacement of Hazardous Material in Wide Web Flexographic Printing Process, Kranz, P., Williamson, T., and Randall, P., funded by Risk Reduction Engineering Laboratory, U.S. EPA.

Guides to Pollution Prevention: The Photoprocessing Industry, EPA/625/7-91/012, U.S. EPA, October 1991.

Innovative Clean Technologies Case Studies, EPA/600/R-93/175, U.S. EPA, August 1993.

Innovative Clean Technologies Case Studies Second Year Project Report, EPA/600/R-94/169, U.S. EPA, April 1994.

Waste Reduction Evaluation of Soy-Based Ink at a Sheet-Fed Offset Printer, EPA/600/SR-94/144, U.S. EPA, September 1994.

On-site Waste Ink Recycling, EPA/600/SR-92/251, U.S. EPA, February 1993.

Ink and Cleaner Waste Reduction Evaluation for Flexographic Printers, EPA/600/SR-93/086, U.S. EPA, July 1993.

Several of the documents listed above can be obtained from the Pollution Prevention Information Clearinghouse (PPIC) at (202) 260-1023.

References

1. U.S. Department of Commerce, Bureau of the Census. 1987 Census of Manufacturers.

2. Bruno, Michael H. *Michael H. Bruno's Status of Printing, 1991 Update: A State-of-the-Art Report*. Salem, NH: GAMA Communications, 1991.

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8. SRI. *Printing 2000*. Prepared by SRI International, Menlo Park, CA for the Printing 2000 Task Force, Printing Industries of America, Alexandria, VA. 1990.

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18. University of Northern Iowa Waste Reduction Center. Pollution Prevention Manual for Lithographic Printers, 1995.

19. EPA, *Control Techniques Guideline for Offset Lithographic Printing*. July 12, 1993.

20. EPA, *Printing Industry and Use Cluster Profile*. June 1994. EPA 744-R94-003.

21. Telecon. Keenan, Cheryl, Abt Associates Inc., Cambridge, MA, with Flexographic Technical Association. July 1994.

22. EPA, *Printing Industry and Use Cluster Profile*. June 1994. EPA 744-R94-003.

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