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

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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.

Cover photograph by Steve Delaney, EPA.

EPA/310-R-95-017

EPA Office of Compliance Sector Notebook Project

Profile of the Stone, Clay, Glass, and Concrete Products Industry

September 1995

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

Sector Notebook Contacts

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

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

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

Document Number	Industry	Contact	Phone (202)
EPA/310-R-95-001.	Dry Cleaning Industry	Joyce Chandler	564-7073
EPA/310-R-95-002.	Electronics and Computer Industry*	Steve Hoover	564-7007
EPA/310-R-95-003.	Wood Furniture and Fixtures Industry	Bob Marshall	564-7021
EPA/310-R-95-004.	Inorganic Chemical Industry*	Walter DeRieux	564-7067
EPA/310-R-95-005.	Iron and Steel Industry	Maria Malave	564-7027
EPA/310-R-95-006.	Lumber and Wood Products Industry	Seth Heminway	564-7017
EPA/310-R-95-007.	Fabricated Metal Products Industry*	Scott Throwe	564-7013
EPA/310-R-95-008.	Metal Mining Industry	Jane Engert	564-5021
EPA/310-R-95-009.	Motor Vehicle Assembly Industry	Anthony Raia	564-6045
EPA/310-R-95-010.	Nonferrous Metals Industry	Jane Engert	564-5021
EPA/310-R-95-011.	Non-Fuel, Non-Metal Mining Industry	Rob Lischinsky	564-2628
EPA/310-R-95-012.	Organic Chemical Industry*	Walter DeRieux	564-7067
EPA/310-R-95-013.	Petroleum Refining Industry	Tom Ripp	564-7003
EPA/310-R-95-014.	Printing Industry	Ginger Gotliffe	564-7072
EPA/310-R-95-015.	Pulp and Paper Industry	Seth Heminway	564-7017
EPA/310-R-95-016.	Rubber and Plastic Industry	Maria Malave	564-7027
EPA/310-R-95-017.	Stone, Clay, Glass, and Concrete Industry	Scott Throwe	564-7013
EPA/310-R-95-018.	Transportation Equipment Cleaning Ind.	Virginia Lathrop	564-7057
EPA/310-R-97-001.	Air Transportation Industry	Virginia Lathrop	564-7057
EPA/310-R-97-002.	Ground Transportation Industry	Virginia Lathrop	564-7057
EPA/310-R-97-003.	Water Transportation Industry	Virginia Lathrop	564-7057
EPA/310-R-97-004.	Metal Casting Industry	Jane Engert	564-5021
EPA/310-R-97-005.	Pharmaceuticals Industry	Emily Chow	564-7071
EPA/310-R-97-006.	Plastic Resin and Man-made Fiber Ind.	Sally Sasnett	564-7074
EPA/310-R-97-007.	Fossil Fuel Electric Power Generation Ind.	Rafael Sanchez	564-7028
EPA/310-R-97-008.	Shipbuilding and Repair Industry	Anthony Raia	564-6045
EPA/310-R-97-009.	Textile Industry	Belinda Breidenbach	564-7022
EPA/310-R-97-010.	Sector Notebook Data Refresh-1997	Seth Heminway	564-7017
EPA/310-R-98-001.	Aerospace Industry	Anthony Raia	564-6045
EPA/310-R-98-002.	Agricultural Chemical, Pesticide, and Fertilizer Industry	Amy Porter	564-4149
EPA/310-R-98-003.	Agricultural Crop Production Industry	Ginah Mortensen	(913)551-7864
EPA/310-R-98-004.	Agricultural Livestock Production Ind.	Ginah Mortensen	(913)551-7864
EPA/310-R-98-005.	Oil and Gas Exploration and Production Industry	Dan Chadwick	564-7054
EPA/310-R-98-008.	Local Government Operations	John Dombrowski	564-7036

*Spanish translations available.

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STONE, CLAY, GLASS, AND CONCRETE PRODUCTS
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)

STONE, CLAY, GLASS, AND CONCRETE PRODUCTS
LIST OF ACRONYMS (CONT'D)

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

STONE, CLAY, GLASS, AND CONCRETE PRODUCTS (SIC 32)

I. INTRODUCTION TO THE SECTOR NOTEBOOK PROJECT

I.A. Summary of the Sector Notebook Project

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

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

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

I.B. Additional Information

Providing Comments

OECA's Office of Compliance plans to periodically review and update the notebooks and will make these updates available both in hard copy and electronically. If you have any comments on the existing notebook, or if you would like to provide additional information, please send a hard copy and computer disk to the EPA Office of Compliance, Sector Notebook Project, 401 M St., SW (2223-A), Washington, DC 20460. Comments can also be uploaded to the 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 STONE, CLAY, GLASS, AND CONCRETE PRODUCTS INDUSTRY

This section provides background information on the size, geographic distribution, employment, production, sales, and economic condition of the Stone, Clay, Glass, and Concrete Products industry. The type of facilities described within the document are also described in terms of their Standard Industrial Classification (SIC) codes.

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

This profile pertains to the Stone, Clay, Glass, and Concrete Products Industry as classified within Standard Industrial Classification (SIC) code 32. The Bureau of Census delineates the industrial groups within SIC code 32 as follows:

SIC 321 - Flat Glass
SIC 322 - Glass and Glassware, Pressed or Blown
SIC 323 - Glass Products, made of Purchased Glass
SIC 324 - Cement, Hydraulic
SIC 325 - Structural Clay Products
SIC 326 - Pottery and Related Products
SIC 327 - Concrete, Gypsum, and Plaster Products
SIC 328 - Cut Stone and Stone Products
SIC 329 - Abrasive, Asbestos, and Miscellaneous Nonmetallic Mineral Products.

The intent of this profile is to provide an overview of the Stone, Clay, Glass, and Concrete Products Industry, providing data on its size and distribution and highlighting production processes and associated pollution outputs, and to address environmental compliance and enforcement issues associated with the industry. The profile does not provide a rigorous analysis of each industrial group within SIC code 32. Greater emphasis is placed on the stone, clay, glass, and concrete industries due to their size and environmental impacts. This profile does not address mining of the raw materials used to manufacture stone, clay, glass, and concrete products. Refer to the separate Sector Notebook entitled *Profile of the Non-Fuel, Non-Metal Mining Industry* for additional information on mineral extraction.

II.B. Characterization of the Stone, Clay, Glass, and Concrete Products Industry

The firms within SIC code 32 are quite diverse in terms of geographic distribution, facility size, and the types of products manufactured. Firms within the Stone, Clay, Glass, and Concrete Products Industry are dispersed across the United States. All rely on mined materials (such as stone, clay, and sand) for production inputs, but the means of production and the types of products produced vary substantially, from glass candlesticks to marble monuments. The general characteristics of the industry are illustrated by the following four subsections.

II.B.1. Industry Size and Geographic Distribution

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

Industry Size

The Stone, Clay, Glass, and Concrete Products Industry consists of approximately 16,000 establishments and employs nearly 470,000 people. It ranks 16th among the major industrial groups (SIC codes 20-39) in terms of total number of employees and 8th in terms of total number of establishments.

Exhibit 1 illustrates the facility size distribution for the industry based on the latest complete U.S. Census Bureau data (1992).

Exhibit 1
Facility Size Distribution of Industry

Industry	SIC Code	Total Employees	Total Number of Facilities	Employees per Facility
Flat Glass	321	11,900	44	270
Glass and Glassware, Pressed or Blown	322	66,200	543	122
Products of Purchased Glass	323	55,500	1,558	36
Cement, Hydraulic	324	17,000	237	72
Structural Clay Products	325	31,100	587	53
Pottery and Related Products	326	35,900	1,084	33

Exhibit 1 (cont'd)
Facility Size Distribution of Industry

Industry	SIC Code	Total Employees	Total Number of Facilities	Employees per Facility
Concrete, Gypsum, and Plaster Products	327	174,200	9,653	18
Cut Stone and Stone Products	328	12,000	917	13
Miscellaneous Nonmetallic Mineral Products	329	65,900	1,662	40
Totals	32	469,900	16,285	29

Source: Compiled from official 1992 statistics of the U.S. Bureau of the Census.

Cut Stone and Stone Products: The Bureau of Census reports 12,000 employees in the Cut Stone and Stone Products Industry in 1992, down one percent from 12,500 in 1987. According to the U.S. Bureau of Mines, the Dimension Stone industry employed 14,000 people in 1993, including 10,900 engaged in finishing operations, which fall within the Cut Stone and Stone Products industry.

Structural Clay Products: Employment in the Structural Clay Products sector fell 10 percent between 1987 and 1992, from 34,100 to 31,100. The greatest decreases occurred within the Brick and Structural Clay Tile and the Structural Clay Products subgroups, where employment fell 14 percent and 19 percent, respectively (Bureau of Census).

Glass: In the U.S., the glass container industry consists of 70 facilities and more than 30,000 employees. According to the Glass Packaging Institute, the industry is experiencing downsizing. The industry produces 41 billion glass containers in the U.S. annually; 64 percent are clear, 23 percent are amber, and 13 percent are green (Glass Packaging Institute, 1995). According to Dr. Blake of the Glass Technical Institute, container glass holds the largest market in the glass industry. The U.S. Flat Glass industry is one of the world's four largest producers of flat glass, along with France, Japan, and the United Kingdom. The U.S. Flat Glass Industry consisted of an estimated 1,100 companies, 1,300 establishments, and 56,000 employees in 1993, according to the U.S. International Trade Commission. An estimated 35 percent of flat glass industry shipments are from firms that produce flat glass by melting raw materials (primary producers). The remaining 65 percent of shipments are from firms that produce flat glass from purchased glass (secondary producers) (1993).

Concrete, Gypsum, and Plaster Products: The Concrete, Gypsum, and Plaster Products Industry employed 174,200 people in 1992, down 14 percent from 203,000 in 1987.

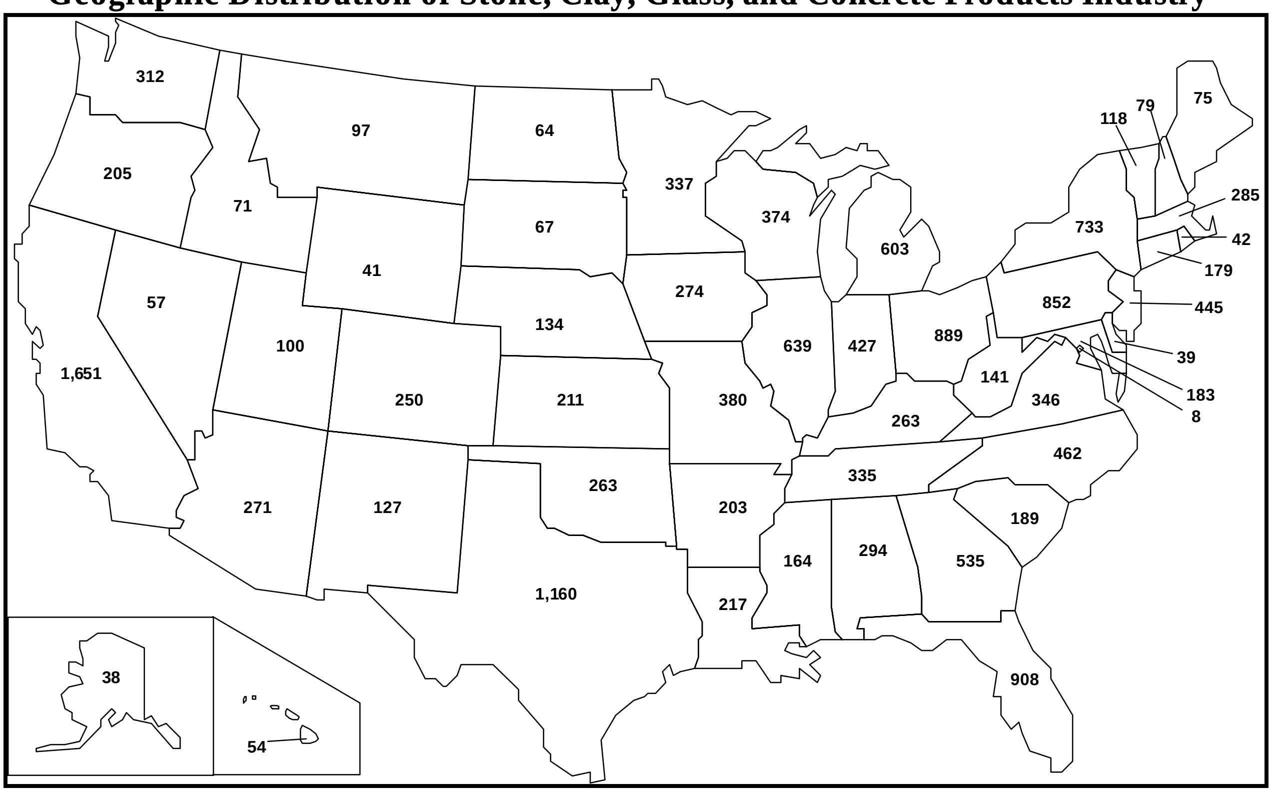
Cement: Based on 1992 industry data, the Cement Industry was composed of 237 establishments, including 120 cement-producing plants (Cement, 1992). Multiplant operations were being run by 18 companies. Total employment in the cement industry was 17,000, down from 19,100 in 1992 (Bureau of Census).

Geographic Distribution

According to U.S. Census data for 1987, the Stone, Clay, Glass, and Concrete Products industry is widely dispersed, with every State reporting the existence of an industry establishment. The five largest States in terms of number of establishments are California (1,651), Texas (1,160), Florida (908), Ohio (889), and Pennsylvania (852).

Exhibit 2 illustrates the number of industry establishments per State as recorded by the U.S. Census for 1987.

Exhibit 2
Geographic Distribution of Stone, Clay, Glass, and Concrete Products Industry



Source: Compiled from official 1987 statistics of the U.S. Bureau of the Census.

Cut Stone and Stone Products: The U.S. Bureau of Mines reports that in 1993, dimension stone was produced by 162 companies in 35 States, including Puerto Rico. Leading States in terms of tonnage were Georgia, Indiana, and Massachusetts, together accounting for 39 percent of the U.S. total. States with the largest number of employees in the Dimension Stone Industry were Georgia with 2,100, Vermont with 1,700, Minnesota with 1,250, North Carolina with 850, Texas with 700, and Indiana with 650.

Structural Clay Products: Establishments engaged in the manufacture of structural clay products are widely dispersed, however, a few States account for the majority of the industry's employment. Leading States include California, Ohio, Pennsylvania, and Texas.

Glass: Glass container manufacturing facilities are located in 27 States in the U.S., including California, Illinois, Pennsylvania, and New Jersey (Glass Packaging Institute, 1995). Production facilities for flat glass exist throughout the U.S. to minimize the shipping costs of raw materials and finished products. California, Michigan, North Carolina, Ohio, and Pennsylvania are the major production areas of flat glass. The primary-producer industry (glass products from manufactured glass) is relatively concentrated, with 13 of 84 establishments accounting for 76 percent of U.S. shipments. The secondary-producer industry (glass products from purchased glass) is less concentrated, with 17 of 1,429 establishments accounting for 28 percent of U.S. shipments (U.S. International Trade Commission, 1993).

Concrete: Concrete production is relatively concentrated within the United States. In 1993, 49 percent of domestic concrete production came from the following six States in descending order: California, Texas, Pennsylvania, Michigan, Missouri, and Alabama (U.S. Bureau of Mines).

Cement: The cement industry consists of 49 companies which operate cement-producing plants in 38 States and Puerto Rico. States that rank among the top cement producers are California, Texas, Pennsylvania, Michigan, Missouri, and Alabama (U.S. Bureau of Mines).

II.B.2. Product Characterization

The Stone, Clay, Glass, and Concrete Products Industry generates a broad array of products, primarily through physical modification of mined materials. The industry includes establishments engaged in the manufacturing of flat glass and other glass products, cement, structural clay products, pottery, concrete and gypsum products, cut stone, abrasive and asbestos products, and other products. The following is an overview of the characteristics of stone, clay, glass, and concrete products.

Stone

The term stone is applied to rock that is cut, shaped, broken, crushed, or otherwise physically modified for commercial use. Establishments covered under SIC code 328 (Cut Stone and Stone Products) are those engaged primarily in cutting, shaping, and finishing stone for building and other miscellaneous uses. The cutting of stones at the quarry (when not associated with further physical modifications) is classified as mining, and is not covered within SIC code 32 or this profile.

The primary type of stone covered within SIC code 32 is dimension stone. Dimension stone refers to blocks of rock that are cut and milled to specified sizes, shapes, and surface finishes. Only a small fraction of rock occurrences have the qualities demanded for dimension stone. The stone must be obtainable in large, sound blocks, free from blemishes, and generally must have a uniform texture. The principle types of dimension stone used in construction are granite, marble, limestone, slate, and sandstone. Flagging is a type of dimension stone used for stepping stones, walkways, and terraces. Soapstone is used for acid proof laboratory equipment, aquariums, and chemical tank linings. Slate differs from other dimension stone because it can be split into thin sheets of any thickness. Slate is used in roofing, blackboards, and floor tile. Of the total dimension stone produced in 1993, 49 percent was granite, 29 percent was limestone, 11 percent was sandstone, three percent was slate, three percent was marble, and five percent was other. In 1993, dimension stone was used in ashlar (dressed stone for facing a wall of rubble or brick), 17 percent; curbing, 15 percent; rough blocks for monuments, 13 percent; rough blocks for building and construction, 12 percent; dressed monumental stone, 12 percent; and other uses, 31 percent (U.S. Bureau of Mines).

Clay

Clay consists of the finest-grain particles in a sediment, soil, or rock, and a rock or a deposit containing a large component of clay-size material. Clay can be composed of any inorganic materials, such as clay minerals, allophane, quartz, feldspar, zeolites, and iron hydroxides, that possess a sufficiently fine grain size. Along with organic matter, water, and air, clays are one of the four main components of soil. Physical properties of clay include plasticity when wet, the ability to form colloidal suspensions when dispersed in water, and the tendency to clump together (flocculate) and settle out in saline water.

Establishments that fall within the Structural Clay Products Industry (SIC code 325) are primarily engaged in using different types of clay and other additives to manufacture brick and structural clay tile, ceramic wall and floor tile, clay firebrick and other heat-resisting products, and clay sewer pipe. The mining of clay used to make structural clay products is not included within SIC code 32.

The U.S. Bureau of Mines categorizes clay into six groups: ball clay; bentonite; common clay and shale; fire clay; fuller's earth; and kaolin. Ball clay is a plastic, white-firing clay that has a high degree of strength as well as plasticity. Principal ball clay markets in 1992 were pottery, floor and wall tile, and sanitary ware. Bentonite is a clay composed mainly of smectite minerals. The three major uses of bentonite in 1992 were drilling mud, foundry sand, and iron ore pelletizing. Common clay and shale contain mixtures of differing proportions of clay, including illite, chlorite, kaolinite, and montmorillonite, plus other nonclay materials. The largest user of these clays is the structural clay products industry, which manufactures brick, drain tile, sewer pipe, conduit tile, glazed tile, and terra cotta. Fire clays can withstand very high temperatures and consist mainly of kaolinite. These clays are used in commercial refractory products such as firebrick and block. Fuller's earth, either the attapulgite-type or montmorillonite-type, is used in pet waste absorbents, oil and grease absorbents, and pesticide carriers. Kaolin has many industrial applications because it has good covering or hiding power when used as a pigment, is soft and nonabrasive, has low conductivity of heat and electricity, and is inexpensive. Major domestic uses for kaolin in 1992 were paper coating, paper filling, fiberglass, paint, rubber, brick, and portland cement.

Glass

Glass is defined as a material made by cooling certain molten materials so that they do not crystallize but remain in an uncrystallized state, their viscosity increasing to such high values that, for all practical purposes, they are solid. Materials having this ability to cool without crystallizing are relatively rare, silica being the most common example.

The glass industry covered under SIC code 32 consists of a wide variety of manufacturing establishments, including firms engaged in primary glass manufacturing and others which create products from purchased glass.

Container glass, flat glass, and fiberglass manufacturers are among the most economically significant firms in the primary glass industry.

The glass container industry produces three major products: food, beer, and beverage containers. Other markets for glass containers include: liquor; wine; medicine and health; toiletries and cosmetics; and chemical, household, and industrial products (U.S. Department of Commerce, May 1995).

The flat glass industry (SIC code 321) produces four main products: tempered glass, laminated glass, glass mirrors, and insulating units. Tempered glass is a type of safety glass typically produced by the thermal process, in which heating and subsequent rapid cooling produce surface and interior stresses in the glass that make it stronger than ordinary glass. Laminated glass consists of two or more layers of glass separated by, and bonded to, thin sheets of plastic that prevent the glass from shattering when broken. The automobile industry is the largest market for laminated glass. Glass mirrors are produced by cleaning the glass and coating it on one side with an adhesive, reflective, and binding compound. Insulating units consist of two or more parallel separated panes of glass joined at the edges by metal seals or by fusing the edges, with the space between the panes either evacuated or filled with dry air or another gas. Insulating units are used to reduce surface condensation, to reduce sound transmission, and for thermal insulation.

The fiberglass industry (SIC code 3296) produces two main products: textile fiberglass (electrical glass), and insulation fiberglass. Textile fiberglass is used in the production of fireproof cloth, and insulation fiberglass is used in thermal and acoustical insulation. SIC code 32 also covers glass and glassware establishments which produce bowls, goblets, lenses, jars, tableware, and other products which are pressed, blown, or shaped from glass produced in the same establishment (SIC code 322). Facilities which manufacture products made of purchased glass, such as furniture, mirrors, windows, table tops, and laboratory glassware, fall under SIC code 323.

Concrete

The term concrete refers to a product formed from two principle components: aggregate and paste. Aggregate, which can be either natural or man made, consists of various grades of sand, gravel, crushed stone, or slag. The paste is composed of cement, water, and sometimes entrained air. The cement paste makes up approximately 25 to 40 percent by volume of concrete. Some concrete mixtures include hydrochloric acid, acetone, styrene, glycol ethers, or butyl benzyl phtalate as additives. Manufacturers utilize different combinations of pastes and aggregates to produce grades of concrete which vary in terms of cost, strength, durability, and rigidity. The successful use of concrete in structures has come about from the addition of steel reinforcements. Reinforced concrete is now one of the most common materials from which structures (such as buildings and bridges) are built.

The many types of products fashioned from concrete include brick, architectural blocks, chimneys, columns, paving materials, foundations, curbing, and storage tanks. Firms within SIC code 327 both produce ready-mixed concrete, which is unhardened concrete material, and fashion a multitude of concrete products, such as those listed above.

One subcategory of the concrete, gypsum, and plaster products industry is lime manufacturing. Lime is the product of high temperature calcination of limestone. Major uses of lime are metallurgical (steel, copper, gold, aluminum, and silver), environmental (flute gas desulfurization, water softening and pH control, sewage-sludge stabilization, hazardous waste treatment, and acid neutralization), and construction (soil stabilization, asphalt additive, and masonry lime).

Cement

Cement is a powder produced from a variety of materials, including alumina, silica, limestone, clay, and iron oxides. It is used as a binding agent, most often as a component of mortar or concrete.

Manufacturers within SIC code 324 produce several types of cement. Among the most common types are portland cement, white cement, and masonry cement. Approximately 97 percent of the cement used in the manufacture of concrete is portland cement, which consists primarily of a kiln-fired, fused powder, known as clinker, that is ground and combined with small amounts of gypsum or a similar material. Portland cement is produced in five grades designed to lend certain properties to the concrete. White cement, which is made from iron-free materials of exceptional purity, usually limestone, china clay or kaolin, and silica, is primarily used to manufacture decorative concrete. Masonry cement, produced by adding limestone to portland cement, is a hydraulic cement used as a component of mortar for masonry construction.

II.B.3. Economic Trends

This section highlights economic trends in the Stone, Clay, Glass, and Concrete Products Industry based on a comparison of 1992 and 1987 Bureau of Census data (unless otherwise noted). The term "value added" as used in the following descriptions is a measure of manufacturing activity derived by subtracting total variable costs (such as cost of raw materials, supplies, fuel, etc.) from the total value of shipments for a given industrial sector. Value added is considered to be the best value measure available for comparing the relative economic importance of manufacturing across industries and geographic areas.

Cut Stone and Stone Products: The value added by cut stone and stone products manufacturers increased by 33 percent between 1987 and 1992, from $450 million to $600 million. In addition, total wages and total value of shipments increased, by approximately 17 and 16 percent, respectively.

Since 1980, a movement back to the use of stone in buildings has occurred because of the rising energy costs associated with stone substitutes, such as concrete, glass, brick, stainless steel, aluminum, and plastics. Consumption of dimension stone increased slightly between 1992 and 1993 to 1.24 million tons, valued at $217 million. Over the same period, the average price for dimension stone decreased from $182 to $176 per ton (U.S. Bureau of Mines).

Clay and Structural Clay Products: The value of shipments from the Structural Clay Products Industry climbed moderately from 1987 to 1992, from $2.81 to $2.86 billion, while the value added by manufacturers held at $740 million.

Glass: According to the *1993 Industrial Outlook*, glass container manufacturing is a five billion dollar industry.

The total value of shipments from the Flat Glass Industry fell over 38 percent between 1987 and 1992, while the value added by flat glass manufacturers declined by over 22 percent. Employment and total wages also declined significantly over this period.

Prices of flat glass and flat glass products fell each year from 1988 until 1992. However, the decline was only one percent from 1991 to 1992, compared with two to six percent in previous years. During the first part of 1993, prices rose two percent compared with 1992. It is expected that prices will remain constant, with minor downward adjustments as manufacturers engage in price competition to increase gross sales and retain market share.

The high transportation costs associated with glass products mitigate against extensive trade. U.S. companies are able to expand into foreign markets by acquiring or establishing foreign plants, thus reducing transportation costs (U.S. International Trade Commission).

Concrete, Gypsum, and Plaster Products: Value added by concrete, gypsum, and plaster products manufacturers fell over seven percent from 1987 to 1992, from close to $11.8 billion to just under $11 billion. The value of shipments, number of employees, and total wages also sagged during this five-year period.

Cement: Between 1987 and 1992, the value added by the Hydraulic Cement Industry fell close to eight percent while total wages held steady, according to Bureau of Census data. According to the U.S. Department of Interior Bureau of Mines Industry Surveys, U.S. cement shipments in 1993 totaled about 86.4 million short tons, up from about 82.7 million short tons in 1992. Cement consumption in 1994 was expected to increase approximately ten percent to roughly 94 million short tons, largely because of increased highway and other public works construction.

III. INDUSTRIAL PROCESS DESCRIPTION

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

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

III.A. Industrial Processes in the Stone, Clay, Glass, and Concrete Products Industry

The processes used to create stone, clay, glass, and concrete products primarily involve physical conversion of earthen materials by sorting, mixing, grinding, heating, and cooling. This section provides an overview of commonly-employed processes within the industry, broken down by product categories (stone, clay, glass, and concrete) rather than by specific industries within SIC code 32. The mining of the raw materials, while integrally related to the manufacture of stone, clay, glass, and concrete products, is outside the scope of this profile and is not addressed in the following discussion.

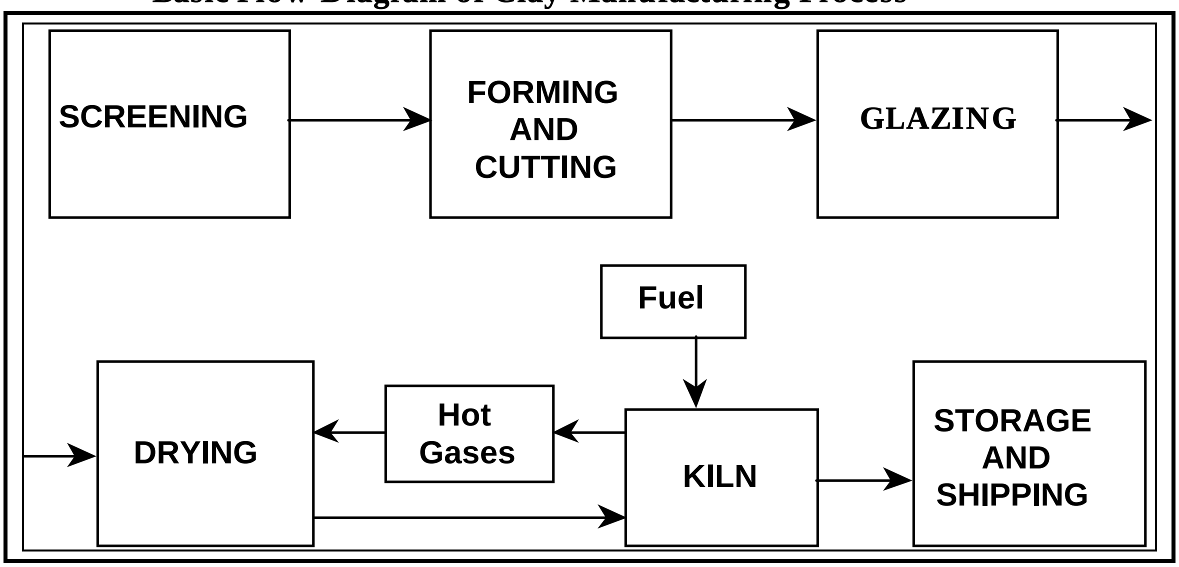
Stone

The manufacture of stone products involves cutting and finishing granite, limestone, marble, slate, sandstone, and other materials obtained from the quarry. Dimension stone is prepared for its various uses in mills equipped with saws, polishing machines, and other equipment similar to that found in metal and woodworking shops. Stone-sawing equipment includes large circular saws three meters or more in diameter, some with diamond inserts and others with abrasives; diamond circular saws of smaller size, and reciprocating diamond-bladed or loose-abrasive gang saws. Various types of diamond and other equipment are used for smoothing, polishing, edging, and decorating the finished stone products (U.S. Bureau of Mines).

Clay

The manufacture of clay products involves the conditioning of basic clay ores by a series of processes. These include separation and concentration of clay minerals by screening, floating, wet and dry grinding, and blending of desired ore varieties; followed by forming; cutting or shaping; drying or curing; and firing of the final product. In general, processing clay does not alter its chemical or mineralogical characteristics. Exhibit 3 illustrates the fundamental stages of the clay manufacturing process.

Exhibit 3
Basic Flow Diagram of Clay Manufacturing Process



Source: AP-42, 1986.

Clay manufacturers use different techniques to produce clay products, such as brick, other structural clay products, pottery products, and ceramic tiles. Bricks and related clay products, such as building tiles, paving brick, and chimney blocks, are produced from a clay/water mixture. The three principle processes for manufacturing brick are the stiff mud, soft mud, and dry press methods. In the stiff mud process, water is added to give the clay plasticity, and the bricks are formed by forcing the clay through a wire die. All structural tile and most types of brick are formed by the stiff mud process. The soft mud process utilizes clay with a high moisture content. The clay is mixed with water and the bricks are then formed in molds. In the dry press process, clay is mixed with a small amount of water and formed in steel molds by applying pressure of 500 to 1500 pounds per square inch (AP-42, 1986).

The dominant process in manufacturing structural clay products is extrusion. The three stages of extrusion are pugging, tearing, and extrusion. The dry material is fed into a trough, sprayed with water, and cut and kneaded (pugged) by rotating knives into a homogeneous mixture. The resulting plastic mass is forced into a de-airing chamber where a vacuum is maintained. Following de-airing, the material is forced through a die having the appropriate cross section (extrusion) and cut into correct lengths. The structural clay products are then thermally treated in a tunnel kiln and cooled with fans.

Pottery products, such as stoneware, earthenware, and garden pottery, are made of crude clay. To manufacture pottery products, soft plastic forming is used to process plastic clays with 20-30 percent water and certain additives, which may include barium compounds and aluminum oxide. Jiggering is a soft plastic process used to form ware with symmetrical circular cross sections. The raw materials are prepared by blunging and filter pressing. They are mixed in a blunger, which is a vertical cylindrical tank with horizontal blades or paddles attached to a vertical shaft. The homogeneous mixture, called a slip, is then filter pressed to remove excess water prior to soft plastic forming. The slip is then de-aired, forced through a die with the desired cross section, and cut into slugs. The slug is placed in a mold of either the inside or outside of the ware and pressed onto the mold. High-pressure air is used to separate the ware from the mold. The product is then thermally treated using a tunnel kiln, and slowly cooled with fans.

Ceramic tile manufacturing involves the conditioning of two basic raw materials: kaolinite and montmorillonite. These clays are refined by separation and bleaching, and are then blended, formed, and kiln-dried.

Glass

Nearly all glass produced commercially is one of five basic types: soda-lime, lead, fused silica, borosilicate, and 96 percent silica. Silica forms the basis of most commercially important glasses. Silica by itself makes a good glass, but its high melting point (3133°F or 1723°C) and its high viscosity in the liquid state make it difficult to melt and work. Soda is therefore added to silica, in such forms as sodium carbonate or nitrate, to lower its melting temperature to a more convenient level. Unfortunately, the resulting glass has no chemical durability and is soluble even in water. Lime is added to increase glass durability, thus yielding the basic soda-lime-silica glass composition used for most common glass articles.

Production of glass involves five main procedures: mixing, melting, forming, annealing, and finishing. These procedures generally apply to all types of commercial glass formation. The two principle kinds of mixing are wet mixing and batch agglomeration. Glass with a large silicon dioxide content is wet mixed in a pan-type mixer, which is first dry-blended and then wet-blended by adding small amounts of water. Glasses with high lead oxide are mixed by batch agglomeration, whereby batch particles are coated with each other using the smearing action of a Muller-type mixer. The mixed batch is delivered to a melting unit through a feeder. Wet mixing and batch agglomeration are attractive mixing methods because they prevent dusting, control air pollution, ensure homogeneity, and increase melting efficiency and glass quality.

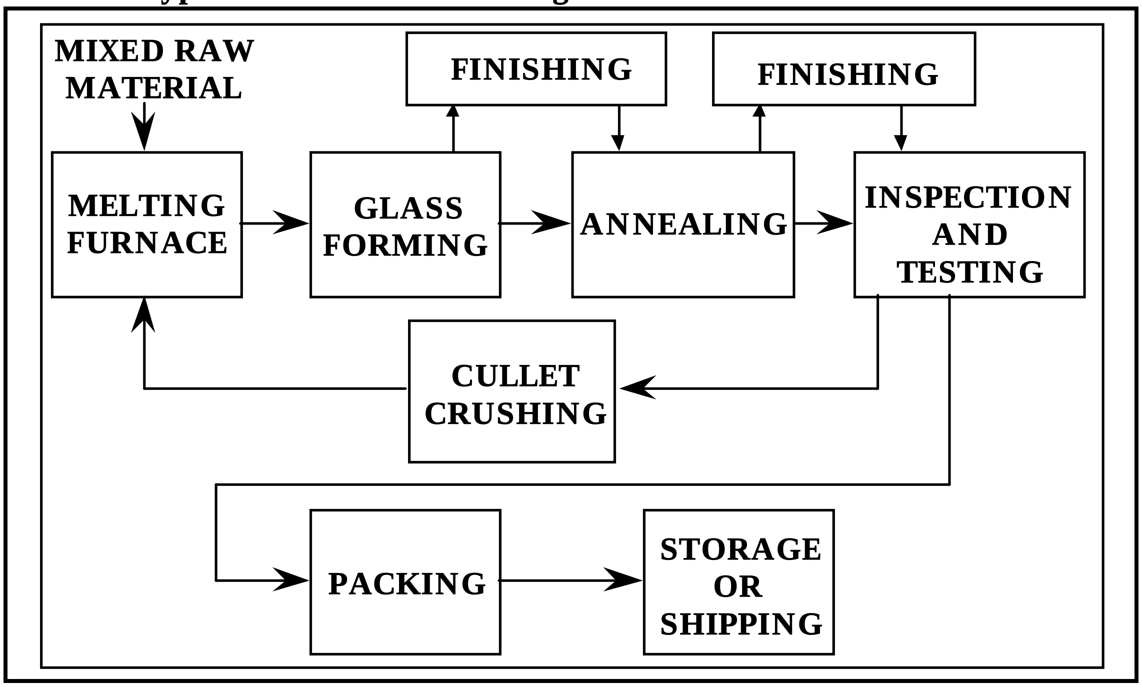
The type of melting unit employed depends on the quantity and quality of glass to be processed. For small production and special glass, melting is performed in pot furnaces or crucibles containing up to two tons of glass. In large factories, a dozen or so pot furnaces may be heated by one central furnace. Larger batches are melted in large covered furnaces or tanks to which heat is supplied by a flame. For high quality glass, small continuous melting tanks are used to process low volumes of material. Large quantities of high quality glass are melted in continuous regenerative furnaces that recover waste heat from burned gases. Flat glass furnaces provide a larger amount of quality glass and are longer than furnaces used by glass container manufacturers. Although glass tanks are fired by gas or oil, auxiliary heating with electricity is common in the United States. After the glass has melted, the molten glass is taken from the tanks to the forming operation.

Forming is different for each type of glass product. Container glass products such as glass bottles and jars are sometimes mouth blown, but are typically formed with automatic machines. In automatic processes, a stream of glass is cut by shears into individual gobs, which are fed to a blank mold. The gob is then formed into a rough blank, or parison, by either a plunger or compressed air; at this stage the bottle opening is shaped. The blank mold opens and is then transferred to the final or blow mold, where it is blown into shape using an air compressor. Pressing is used to form flat items such as lenses and plates by pressing the glass between a plunger and a mold. Drawing and casting are forming processes which involve pouring molten glass into a mold. The molds for the glass containers resemble the containers (Glass Packaging Institute, 1995).

Once formed, all glass articles need to be slowly cooled or annealed, usually in a long oven called a lehr. The purpose of annealing is to reduce the internal stresses which can crack the glass during cooling. Internal stresses are created because of temperature variations throughout the piece; different parts of the glass become rigid at different times.

The two types of finishing processes are mechanical and chemical. Mechanical processes include cutting, drilling, grinding, and polishing. Chemical treatments are used to alter the strength, appearance, and durability of the product. Acid-polishing is performed with a mixture of hydrofluoric and sulfuric acids to alter the strength or durability of the glass. Chemically strengthened glass is formed by immersing the product into a potassium nitrate bath. The larger potassium ion replaces the sodium ion which produces a surface compression layer. Chemical strengthening is an expensive process which is most often used in the production of large screen television faceplates. Frosting and etching are performed with dilute hydrofluoric acid. Commercial glass contains oxides, such as aluminum and magnesium oxides, and other ingredients to help in oxidizing, finishing, or decolorizing. For example, Pyrex glass contains boron oxide which allows it to withstand rapid temperature changes, optical glass contains lead oxide which gives it a high index of refraction, and stained glass is colored by adding metallic oxides to the molten glass. Once finished, the glass products are cleaned using several agents, including aqueous solvents (chromic and sulfuric acid mixtures, detergent solutions), organic solvents (used alone or mixed with commercial cleansers), and hydrocarbon or halocarbon solvents (removal of nonpolar organic compounds).

Exhibit 4
Typical Glass Manufacturing Process



Source: AP-42, 1986.

Flat glass is typically made by the float process. The raw materials used in this process include silica sand, soda ash, limestone, dolomite, cullet (scrap glass), and small amounts of other materials. These materials are proportioned to meet certain physical characteristics, mixed, and fed into the melting tank, where temperatures of about 1,600°C reduce the material to glass. Coloring agents may be added at this time to produce differing degrees of translucence. The molten glass is then fed as a continuous ribbon from the furnace into a bath of molten tin where it floats (glass is lighter than tin) and is fire polished. The ribbon of glass leaves the float bath and enters the annealing lehr where it is gradually cooled to prevent flaw-causing stresses. The glass is then cut. At this point, the glass may be packaged and sent to a customer, immediately subjected to further processing, or sent to storage for inventory or future processing. Additional processing often involves coating glass with thin layers of metal or chemical compounds that absorb infrared light or improve the reflecting qualities of the glass.

Glass fiber manufacturing involves the high-temperature conversion of raw materials into a homogeneous melt, followed by the fabrication of this melt into glass fibers. The two basic types of glass fiber products, textile and wool, are created by similar processes. Glass fiber production can be separated into three phases: raw materials handling, glass melting and refining, and glass fiber forming and finishing. The primary component of glass fiber is sand, but it also includes varying quantities of feldspar, sodium sulfate, boric acid, and other materials. These materials are conveyed to and from storage piles by belts, screws, and bucket elevators. In the glass melting furnace, the raw materials are heated and transformed through a series of chemical reactions into molten glass. Glass fibers are made from the molten glass by one of two methods. In the rotary spin process, which dominates the fiberglass industry, centrifugal force causes molten glass to flow through small holes in the wall of a rapidly rotating cylinder to create fibers that are broken into pieces by an air stream. The flame attenuation process utilizes gravity to force molten glass through small orifices to create threads which are attenuated, or stretched to the point of breaking by hot air and/or flame. After the glass fibers are created (by either process), they are sprayed with a chemical resin to hold them together, collected on a conveyor belt in the form of a mat, cured, and packaged (AP-42, 1986).

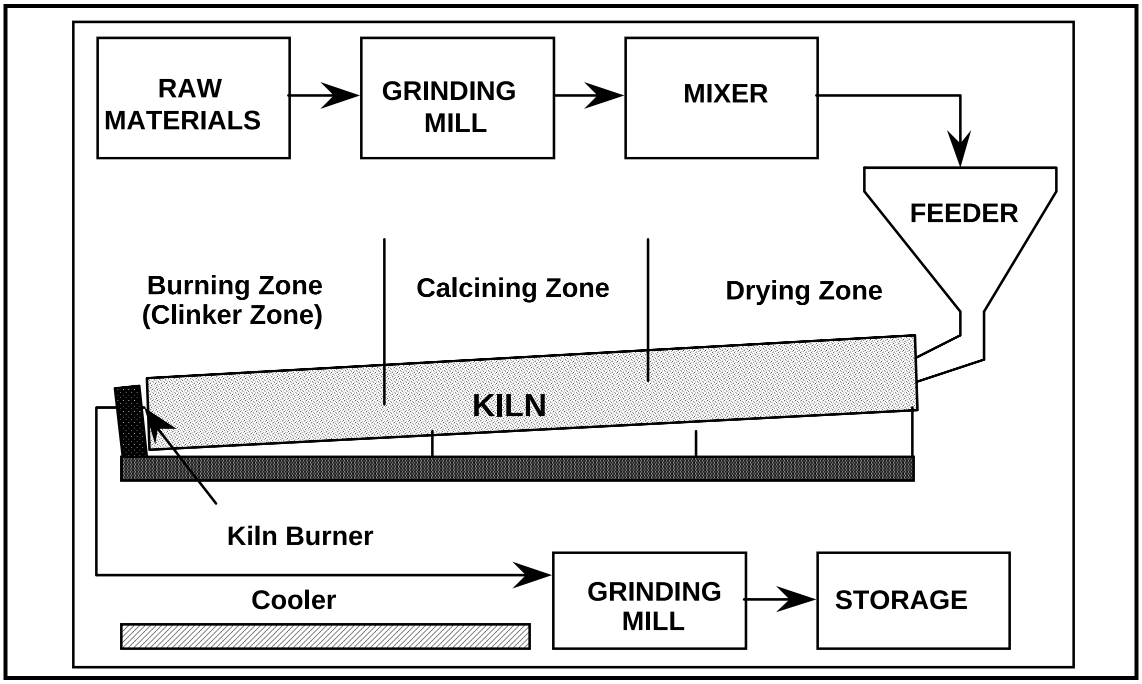
Concrete and Cement

Concrete is formed by mixing hydraulic cement, water, and aggregate materials (sand, gravel, or crushed stone). At concrete batching plants, the cement is elevated to storage silos pneumatically or by bucket elevator. The sand and coarse aggregate are transferred to elevated bins by front-end loader, crane, conveyor belt, or bucket elevator. From these elevated bins, the cement and aggregate are fed by gravity or screw conveyor to weigh hoppers which combine the proper amounts of each material. Concrete batching plants then store, convey, measure, and discharge the ready-mixed concrete into trucks for transport to a job site (AP-42, 1986).

The distribution of the aggregate particle sizes and the relative proportion of cement, aggregate, and water determine the workability and durability of concrete. The most important variables affecting the strength of concrete at a given age are the water/cement ratio and the degree of compaction.

Hydraulic cement, one of the principle components of concrete, is generally made from aluminum and silica as found in clay or shale and from a calcareous material such as limestone or chalk. To make hydraulic cement, the raw materials are ground, mixed, heated, and fused in a rotary kiln, cooled, and finally reduced to a fine powder. Exhibit 5 illustrates the typical cement production process.

Exhibit 5
Basic Cement Production Process



Source: Report to Congress on Cement Kiln Dust, 1993.

Cement is manufactured in five kiln types: wet process, dry process, preheater, precalciner, and semidry process kilns. The same raw materials are used in wet and dry process kilns, however, the moisture content and processing techniques differ, as do the kiln designs. Wet process kilns must be longer in order to dry the wet mix, or slurry, which is fed into the kiln. Dry process kilns produce high temperature exit gases which can be use to generate electrical power. Preheater, precalciner, and semidry process kilns are less common devices, and differ from wet and dry process kilns in terms of kiln length, process inputs, operating temperature, fuel efficiency, and other factors. Processes that take place within each type of kiln include drying and preheating, which includes evaporation of free water and dehydration of clay minerals; calcining, which is the process of decomposing carbon compounds; and burning, which fuses the calcined materials.

The fused cement nodule formed within a cement kiln is known as clinker. The most common method of cooling the clinker is a traveling grate which is cooled by the ambient air. The cooled clinker is transferred to storage or mixed with four to six percent gypsum. This gypsum/clinker mixture is then ground to produce a homogeneous cement powder which is typically sent to a bulk storage area and then shipped by truck or rail.

Most of the hydraulic cement produced in the U.S. is portland cement, a crystalline compound formed primarily of metallic oxides such as calcium carbonate and aluminum, iron, and silicon oxides. Portland cement is produced in an inclined rotary kiln. The mix enters the kiln at the elevated end, opposite from the burner. Materials are moved slowly and continuously to the lower end as they are heated, and different chemical reactions occur as the temperature increases. Portland cement is then produced by grinding the clinker with approximately five percent gypsum to a fine powder. At this stage, various additives may be introduced to produce specialty portland cements, such as masonry cement.

III.B. Raw Material Inputs and Pollution Outputs

Although the stone, clay, glass, and concrete products industry produces a wide array of products, the pollution outputs for this industry are generally limited to particulate emissions, certain solid wastes associated with raw material handling and plant maintenance, and wastewater resulting from the mixing, melting, and refining of raw materials, and the finishing of the final product. Processes in this industry often entail the heating and mixing of materials in a kiln and the use of water as a cooling agent or as an ingredient in making the final product. The fuel used to operate a kiln is itself a source of pollution. The following subsections describe the types of pollution outputs generated in manufacturing of products made of stone, clay, glass, and concrete (See Exhibit 7).

Stone

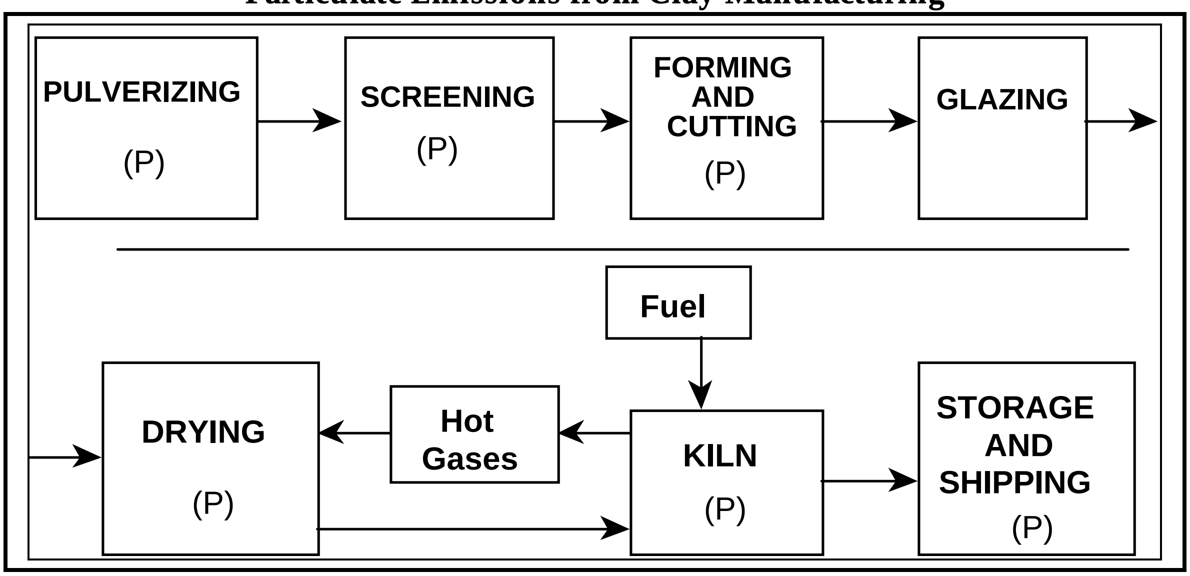
The manufacture of cut stone and stone products generates fugitive dusts, wastewater, and plant maintenance waste. To create products made of stone, the shape of the stone must be altered through cutting, shaping, and finishing, which can release fugitive dust. For a given type of stone, the chemical composition of the dust generated tends to be rather homogeneous, since its ancestry is the rock formation from which the stone was taken. Process wastewater is also generated through its use as cooling water during the cutting process. Plant maintenance wastes include waste oil from stone processing equipment.

Clay

The wastes generated from manufacturing structural clay products result mainly from handling raw materials, particulate emissions, plant maintenance, and pollution control equipment. Raw materials become wastes when they are spilled, off-spec, or out of date. Significant processing losses occur with kaolin and fuller's earth. About 40 percent of the kaolin and 30 percent of the fuller's earth delivered to the processing plants is discarded. Waste material from processing consists mostly of off-grade clays and small quantities of feldspar, iron-bearing minerals, mica, and quartz.

Various phases of the clay production process generate particulate emissions. The main source of dust is the materials handling process, which includes pulverizing, screening, and storing the raw material. Exhibit 6 illustrates the phases of the clay manufacturing process, during which major particulate emissions occur.

Exhibit 6
Particulate Emissions from Clay Manufacturing



(P) indicates a major source of particulate emissions.
Source: AP-42, 1986.

Pollution control wastes from the clay industry include dust accumulated in baghouses and the solid residues from wet scrubbers used to treat nitrogen oxide emissions. Plant maintenance waste consists primarily of waste oil, which is generated from many types of mechanical equipment.

Wastes generated during the manufacturing of pottery products comes mainly from the use of paints, glazes, and finishes. These materials may be solvent- or water-based, with varying heavy metal content. Where solvent-based finishes are used, solvents are used to clean the paint line and application equipment. The sludge waste generated from this cleaning is typically managed off-site by a solvent recycler or is recovered for fuel blending. When water-based finishes are used, the paint line and equipment are cleaned with water. Depending on the location of the plant and content of this waste, the wastewater discharge may be subject to regulation due to the presence of heavy metals. In addition, the sludge accumulated prior to discharge may be a hazardous waste due to heavy metal content (sludges generated in the pottery industry commonly contain traces of glaze which may contain lead, mercury, and boron).

Certain pottery manufacturers also generate dry powder waste from pollution control equipment. The sludge generated from equipment washing is commonly from glaze lines, glaze mills, glaze tanks and containers, and wet filters. About 10 percent (by weight) of the glaze used ends up in sludges. It is estimated that for each square meter of tile surfaced glazed, 100 grams of glaze waste is generated.

Manufacturers of clay products often use sintering to drive off entrained volatile matter from the clay. Because it is desirable for the clay to contain a sufficient amount of volatile matter so that the resultant aggregate will not be too heavy, it is sometimes necessary to mix the clay with finely pulverized coke prior to sintering. The addition of pulverized coke presents an emissions problem because sintering coke-impregnated clay produces more particulate emissions than the sintering of natural clay.

Glass

Waste generated in the glass industry can be categorized into three groups: 1) materials handling waste, 2) pollution control equipment waste, and 3) plant maintenance waste. Materials handling waste includes the waste generated during the receiving and transfer of raw materials at the facility for storage or processing, including raw materials that are rendered unusable when spilled during receiving or transfer.

Emissions control equipment at glass manufacturing plants generates waste residues from the pollutants produced and captured during the melting, forming, and finishing steps of the manufacturing process. The melting of raw materials to produce glass creates air emissions consisting of particulates, nitrogen oxides, and sulfur oxides generated from the combustion of fuel and the evaporation or dissociation of raw materials. Emissions are also generated during the forming and finishing of glass products as a result of thermal decomposition of lubricants.

Glass plants may also remove pollutants through the use of aqueous media, filters, and precipitators. A quench reactor, which reacts sulfur dioxide from furnace emissions with water and sodium carbonate, is an example of an aqueous emission control device. When the water evaporates upon contact with flue gases, a solid residue results. The residue may contain selenium, chromium, cadmium, cobalt, lead, and sodium sulfate. Arsenic, which is used in glass manufacturing for glass decolorizing, and stannic acid, a lubricant used to coat glass bottles to prevent breakage and which produces hydrochloric acid when it thermally decomposes, are usually removed by reaction with aqueous media, or physically captured by filters or precipitators. Glass manufacturers may use baghouse filters to capture particulate emissions. Baghouse dust residue can often be recycled back into the manufacturing process. To control nitrogen oxide emissions, a method called selective noncatalytic reduction (SNCR) has been used. SNCR reduces flue gas nitrogen oxide through a reaction with ammonia in a temperature range of 1700-1900°F. The ammonia may be supplied as anhydrous ammonia, aqueous ammonia, or urea. At temperatures above 1900°F, the oxidation of ammonia and nitrogen oxide increases and SNCR may actually increase levels of nitrogen oxide. At temperatures below 1700°F, nitrogen oxide reduction falls off and ammonia breakthrough increases, leading to the potential for a visible ammonium-chloride plume.

Glass plant maintenance wastes include waste oil and solvents generated in the forming process, furnace slag, and refractory wastes. During the forming process, oil is used in the forming machines and often contaminates the water that keeps the machines cool. TCA (1,1,1-trichloroethane) may also be used during the forming process to remove a thin layer of graphite coating that is applied to the glass forms or molds. When the coating is too thick or lumpy, the mold is sprayed with TCA, which readily dissolves and removes the graphite coating and evaporates. Furnace slag consists of chunks of unused molten glass which collect in the incinerator portion of the furnace. The composition of the slag is primarily magnesium oxide and sodium sulfate. Another type of plant maintenance waste is water-based glue, which is applied with a gun to glass packaging boxes. The water used to clean the glue guns is typically discharged to the plant’s sewer system. Glue that has solidified in its container typically goes to a municipal landfill.

Fiberglass manufacturers also produce materials handling waste, pollution control waste, and plant maintenance waste. As in other glass manufacturing, the major air emission problem associated with fiberglass production is related to the melting and refining furnace operation. The emissions from this operation include fine particulates, including calcium carbonate, sodium fluoride, sodium fluorosilicate, silica, calcium fluoride, aluminum silicate, sodium sulfate, and boron oxides. Gases emitted include fluorides, sulfur oxides, nitrogen oxides, boric acid, carbon dioxide, and water vapor.

Much of the glass in the waste stream is not generated during the manufacturing process, but results from disposal of used glass products. Approximately 13.2 million tons of glass waste are generated annually. Food and beverage containers make up over 90 percent of this amount; the remaining 10 percent comes from products like cookware and glassware, home furnishings, and plate glass. Glass constitutes 6.7 percent of the municipal solid waste stream.

Concrete

Concrete batching generates particulate emissions, paint wastes, and plant maintenance wastes. Particulate emissions which occur in concrete batching consist primarily of cement dust, but some sand and gravel dust emissions also occur. Dust emissions most often occur during the unloading and conveying of concrete and aggregates at manufacturing plants and during the loading of dry-batched concrete mix. Another source of particulate emissions is the traffic of heavy equipment over unpaved or dusty surfaces in and around the plant. Particulate control techniques include the enclosure of dumping and loading areas and of conveyors and elevators, the use of filters on storage bin vents, and the use of water sprays to prevent dust from occurring.

Manufacturers who apply finishes to concrete products generate various paint wastes. When solvent-based paints are used, the spray guns and application equipment must be cleaned with solvent, producing spent solvent waste. The type of coating system used determines the type of solvent used. For example, if the coating system uses TCA, TCA must also be used to clean the equipment. When water-based coatings are used, wastewater from equipment cleaning will be generated. Other wastes generated by concrete plants include equipment and repair wastes, including waste oil generated from vehicle maintenance operations.

The production of lime results in several types of pollutants. Air emissions associated with lime manufacturing include particulate matter from crushing, screening, and calcining of the limestone and combustion products from the kilns. Nitrogen oxides, carbon monoxide, and sulfur dioxide are all produced in lime kilns. Methods of emission control include wet scrubbers (particle control using liquid such as water), baghouses (particle control using filtration fabric), cyclones (particles forced into a cyclone-shaped vortex), and electrostatic precipitators (particle control using electrical forces).

Cement

Pollution outputs from cement manufacturing plants include process waste, primarily cement kiln dust; air emissions; wastewater; plant maintenance waste, such as waste oil from equipment lubrication; and research and laboratory waste. Cement kiln dust is the largest waste stream from cement plants. It is commonly collected in baghouses installed in the grinders and is disposed of as non-hazardous waste. To provide a factual basis for determining the appropriate future regulatory status of cement kiln dust, EPA has conducted extensive research into the characteristics of cement kilns and presented its findings in a 1993 Report to Congress on Cement Kiln Dust. EPA determined that the major constituents of cement kiln dust are alumina, silica, metallic oxides, and clay (the primary constituents of cement itself). Cement kiln dust may also contain trace amounts of organic chemicals, such as dioxins and furans; heavy metals, such as cadmium, lead, and selenium; and certain radionuclides.

Cement plants also generate particulate and gaseous air emissions. Sources of particulate emissions include raw material storage, grinding and blending, clinker production, finish grinding, and packaging. The largest emission source within cement plants is the kiln operation, which includes the feed system, the fuel firing system, and the clinker cooling and hauling system. The kiln generates nitrogen oxides, sulfur oxides, carbon monoxide, and hydrocarbons as part of the normal combustion of fuel used to supply heat for cement kilns and drying operations. Cement kilns also emit particulate matter, trace metals, and certain organic compounds (AP-42, 1991).

The cement manufacturing process also generates wastewater from the cooling of process equipment and from the recovery of cement kiln dust through wet scrubbing of kiln stack emissions. The pollutants contained in raw wastewater are principally dissolved solids (potassium and sodium hydroxide, chlorides, and sulfates), suspended solids (calcium carbonate), and waste heat. The main control and treatment methods for wastewater involve recycling and reusing wastewater. The devices employed include cooling towers or ponds, settling ponds, containment ponds, and clarifiers. Cooling towers or ponds are used to reduce the temperature of water used in cooling process equipment. Settling ponds are used to reduce the concentration of suspended solids. Containment ponds are used to dispose of waste kiln dust. Clarifiers are used to separate solids.

Plant maintenance waste at cement plants comes from machinery used in production of the clinker and finishing and grinding operations. This machinery generates a variety of waste oils and other lubrication waste. Certain cement manufacturers have in-house laboratories to conduct product testing and research, which may produce solid and/or hazardous wastes.

Exhibit 7
Process Material Input/Pollutant Output

Process	Material Input	Air Emissions	Process Wastes	Other Waste
Concrete Product Manufacturing	Cement, sand, gravel, limestone, aggregate material	Cement dust, sand and gravel dust, constituents from burning of fuel	Total dissolved solids (potassium and sodium hydroxide), total suspended solids (calcium carbonate), pH, waste heat	Equipment and repair waste, paint wastes
Cement Manufacturing	Lime, silica sand, alumina, iron, gypsum, by-products (fly ash, metal smelting slags, mill scale)	Cement kiln dust, constituents from burning of fuel, particulate matter, sulfur dioxide, trace metals, organic compounds	Total dissolved solids (potassium and sodium hydroxide), total suspended solids (calcium carbonate), pH, waste heat	Cement kiln dust, waste oil, laboratory wastes, waste oil
Glass Product Manufacturing	Silica sand, soda ash, limestone, cullet, oxides	Particulates, fluorides, fugitive dust, sulfur dioxide	Total dissolved solids, total suspended solids, pH, heavy metals	Materials handling waste, furnace slag, waste oil
Clay Product Manufacturing	Kaolinite clay, montmorillonite clay, glazes containing heavy metals	Particulates, fluorides, acid gases	Total dissolved solids, total suspended solids, pH	Materials handling waste, fired and unfired scrap, waste oil, paint wastes
Stone Product Manufacturing	Dimension stone	Particulate emissions	Wastewater containing dust	Waste rock, waste oil

Sources: Compiled from Environmental Sources and Emissions Handbook, Air Pollution Engineering Manual, and McGraw-Hill Encyclopedia of Science & Technology.

III.C. Management of Chemicals in Wastestream

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

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

Exhibit 8 shows that the stone, clay, and concrete products industry managed about 1.18 billion pounds of production-related waste (total quantity of TRI chemicals in the waste from routine production operations) in 1993 (column B). Column C reveals that of this production-related waste, 2.3% was either transferred off-site or released to the environment. Column C is calculated by dividing the total TRI transfers and releases by the total quantity of production-related waste. In other words, about 96% of the industry's TRI wastes were managed on-site through recycling, energy recovery, or treatment as shown in columns D, E and F, respectively. The majority of waste that is released or transferred off-site can be divided into portions that are recycled off-site, recovered for energy off-site, or treated off-site as shown in columns G, H, and I, respectively. The remaining portion of the production-related wastes (2.2%), shown in column J, is either released to the environment through direct discharges to air, land, water, and underground injection, or it is disposed off-site.

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

Exhibit 8
Source Reduction and Recycling Activity for SIC 32

A	B	C	D	E	F	G	H	I	J
Year	**Production Related Waste Volume (10^6lbs.)***	% Reported as Released and Transferred	**On-Site** % Recycled	**On-Site** % Energy Recovery	**On-Site** % Treated	**Off-Site** % Recycled	**Off-Site** % Energy Recovery	**Off-Site** % Treated	**Remaining Releases and Disposal**
1992	1,259	3.6%	7.52%	73.83%	15.65%	0.21%	0.33%	0.34%	2.21%
1993	1,186	2.3%	8.59%	67.14%	20.76%	0.26%	0.52%	0.50%	2.23%
1994	1,212	—	8.55%	68.40%	20.37%	0.19%	0.16%	0.23%	2.10%
1995	1,449	—	7.38%	73.23%	17.16%	0.15%	0.24%	0.13%	1.72%

IV. CHEMICAL RELEASE AND TRANSFER PROFILE

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

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

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

TRI Data Limitations

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

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

Definitions Associated With Section IV Data Tables

General Definitions

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

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

Data Table Column Heading Definitions

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

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

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

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

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

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

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

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

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

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

Transfers to Treatment -- are wastes moved off-site for either neutralization, incineration, biological destruction, or physical separation.

In some cases, the chemicals are not destroyed but prepared for further waste management.

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

IV.A. EPA Toxic Release Inventory for the Stone, Clay, Glass, and Concrete Products Sector

Facilities within SIC 32 reported releases of over 100 toxic chemicals in 1993, including solvents, acids, heavy metals, and other compounds. The concrete and cement industries reported high volumes of solvent releases. Trichloroethylene and 1,1,1,-trichloroethane together accounted for more than a third of total releases from the concrete industry. The flat glass industry reported a relatively low level of releases, with sulfuric acid accounting for more than two-thirds of the industry total. Releases from the fiberglass industry included significant amounts of acids, heavy metals, and solvents.

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 9. Exhibit 10 contains additional facilities that have reported the SIC code covered within this report, and one or more SIC codes that are not within the scope of this notebook. Therefore, Exhibit 10 includes facilities that conduct multiple operations — some that are under the scope of this notebook, and some that are not. Currently, the facility-level data do not allow pollutant releases to be broken apart by industrial process. Exhibit 11 presents TRI reporting data for 1993 for SIC 32 by state. Exhibit 12-13 present SIC 32 TRI releases and transfers for 1993.

Exhibit 9
Top 10 TRI Releasing Stone, Clay, Glass, and Concrete Facilities (SIC 32)

Rank	Total TRI Releases in Pounds	Facility Name	City	State
1	6,528,036	Engelhard Corp.	Jackson	MS
2	1,336,954	Corning Inc., Canton Plant	Canton	NY
3	1,309,956	Owens-Corning	Newark	OH
4	1,244,025	Knauf Fiber Glass	Shelbyville	IN
5	760,050	Owens-Corning Fiberglass Corp.	Kansas City	KS
6	659,598	Dana Corp., Victor Products Div.	Robinson	IL
7	641,598	Schuller Intl. Inc., Plant 08	Defiance	OH
8	556,811	Lockheed Aeronautical Sys. Co.	Marietta	GA
9	497,630	Owens-Corning Fiberglass	Amarillo	TX
10	426,470	Schuller Intl. Inc.	Winder	GA

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

Exhibit 10
Top 10 TRI Releasing Stone, Clay, Glass and Concrete Products Facilities

SIC Codes	Total TRI Releases in Pounds	Facility Name	City	State
3321, 3274	10,618,719	Inland Steel Co.	East Chicago	IN
3295	6,528,036	Engelhard Corp.	Jackson	MS
3295, 3274, 3559	2,135,035	Marine Shale Processors Inc.	Amelia	LA
3714, 3231	1,727,400	Harman Automotive Inc.	Bolivar	TN
3861, 3291, 2672	1,389,650	3M Medical Imaging Sys.	White City	OR
3229	1,336,954	Corning Inc. Canton Plant	Canton	NY
3296	1,309,956	Owens-Corning	Newark	OH
3296	1,244,025	Knauf Fiber Glass	Shelbyville	IN
3296	760,050	Owens-Corning Fiberglass Corp. KC	Kansas City	KS
3293	659,598	Dana Corp. Victor Products Div.	Robinson	IL

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

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

Exhibit 11
TRI Reporting Stone, Clay, Glass, and Concrete Products Facilities (SIC 32) by State

State	Number of Facilities	State	Number of Facilities
AL	18	ND	1
AR	14	NE	3
AZ	4	NH	2
CA	45	NJ	16
CO	13	NY	32
CT	4	OH	69
FL	9	OK	12
GA	20	OR	3
IA	7	PA	52
ID	1	PR	2
IL	24	RI	1
IN	25	SC	12
KS	12	SD	2
KY	17	TN	18
LA	6	TX	40
MA	4	UT	5
MD	5	VA	15
ME	2	VT	2
MI	28	WA	10
MN	8	WI	7
MO	16	WV	10
MS	10	WY	1
NC	27		

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

Exhibit 12
Releases for Stone, Clay, Glass, and Concrete Products Facilities (SIC 32) in TRI, by Number of Facilities (Releases Reported in Pounds/Year)

Chemical Name	#/Facilities Reporting Chemical	Fugitive Air	Point Air	Water Discharges	Under-ground Injection	Land Disposal	Total Releases	Average Releases per Facility
Chromium Compounds	107	15815	14747	2734	0	89301	122597	1146
Barium Compounds	96	14492	167275	1733	0	45198	228698	2382
Manganese Compounds	91	9382	2846	765	0	254194	267187	2936
Sulfuric Acid	63	1969	369701	0	6521124	130000	7022794	111473
Ammonia	61	346223	5155539	102816	0	71150	5675728	93045
Zinc Compounds	56	6620	19231	39019	0	186150	251020	4483
Lead Compounds	51	5245	69270	1895	0	233617	310027	6079
Formaldehyde	49	198841	2426028	4774	0	111488	2741131	55941
Hydrochloric Acid	48	17520	2049039	207	45000	64860	2176626	45346
Phenol	43	27935	912472	10760	0	14112	965279	22448
Chromium	41	1352	3005	5	0	47397	51759	1262
Phosphoric Acid	41	1351	3620	1160	0	29838	35969	877
Styrene	41	423151	63833	0	0	81000	567984	13853
Acetone	39	204221	130784	0	0	0	335005	8590
Dichloromethane	38	157173	179356	0	0	0	336529	8856
Xylene (Mixed Isomers)	38	253985	224303	250	0	0	478538	12593
Methyl Ethyl Ketone	37	76042	151035	0	0	0	227077	6137
Toluene	37	196552	816648	0	0	0	1013200	27384
Manganese	32	5013	4406	250	0	272018	281687	8803
Ethylene Glycol	30	1015	41851	0	0	31915	74781	2493
Glycol Ethers	30	4626	106982	0	0	8858	120466	4016
Methanol	27	262825	481616	0	0	23000	767441	28424
Hydrogen Fluoride	25	3780	504539	113	0	20	508452	20338
Methyl Isobutyl Ketone	23	2677	55029	0	0	0	57706	2509
Ethylbenzene	21	3779	6844	0	0	0	10623	506
Tetrachloroethylene	19	31699	65310	5	0	0	97014	5106
1,1,1-Trichloroethane	19	73917	310431	0	0	0	384348	20229
Lead	18	1382	8627	41	0	20901	30951	1720
Antimony Compounds	16	1491	4684	702	0	0	6877	430
Ammonium Sulfate (Solution)	15	106	66781	0	0	9555	76442	5096
Barium	14	250	14110	260	0	5	14625	1045
Aluminum (Fume Or Dust)	11	500	761	0	0	750	2011	183
Nickel Compounds	11	790	1623	297	0	82636	85346	7759
Chlorine	10	1850	40990	21004	0	0	63844	6384
Methylenebis (Phenylisocyanate)	9	1	0	0	0	1390	1391	155
	8	44744	16562	5	0	2411	63722	7965
Nickel	8	532	860	0	0	8053	9445	1181
Nitric Acid	8	27760	20615	250	0	0	48625	6078
1,2,4-Trimethylbenzene	8	7330	13187	0	0	0	20517	2565
Benzene	7	369	195	0	0	0	564	81
Copper Compounds	7	5033	1007	279	0	2821	9140	1306
N-Butyl Alcohol	7	19036	17700	0	0	0	36736	5248
Trichloroethylene	7	6431	396368	0	0	0	402799	57543

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

Exhibit 12 (cont'd)
Releases for Stone, Clay, Glass, and Concrete Products Facilities (SIC 32) in TRI, by Number of Facilities (Releases Reported in Pounds/Year)

Chemical Name	#/Facilities Reporting Chemical	Fugitive Air	Point Air	Water Discharges	Under-ground Injection	Land Disposal	Total Releases	Average Releases per Facility
Aluminum Oxide (Fibrous Form)	6	590	500	250	0	250	1590	265
Arsenic Compounds	6	360	10969	422	0	5	11756	1959
Diethanolamine	6	1250	47375	0	0	12039	60664	10111
Ammonium Nitrate (Solution)	5	121126	5	0	0	0	121131	24226
Cadmium Compounds	5	13	13	93	0	0	119	24
Cobalt Compounds	5	5	1832	0	0	0	1837	367
O-Xylene	5	2915	3315	0	0	0	6230	1246
Chloroform	4	264	73	0	0	0	337	84
Cobalt	4	27	0	0	0	0	27	7
Copper	4	252	512	254	0	306	1324	331
Di(2-Ethylhexyl) Phthalate	4	0	275	0	0	0	275	69
Methyl Methacrylate	4	654	70	0	0	0	724	181
1,4-Dichlorobenzene	4	850	81590	0	0	0	82440	20610
Asbestos (Friable)	3	265	938	250	0	67367	68820	22940
Butyl Benzyl Phthalate	3	250	1750	0	0	0	2000	667
Creosote	3	5	240	0	0	0	245	82
Naphthalene	3	3650	70625	0	0	0	74275	24758
Sec-Butyl Alcohol	3	4371	468	0	0	0	4839	1613
Zinc (Fume Or Dust)	3	0	255	0	0	0	255	85
2-Ethoxyethanol	3	1205	55805	0	0	0	57010	19003
Antimony	2	5	5	6	0	0	16	8
Biphenyl	2	50	1	0	0	0	51	26
Chlorobenzene	2	11	115	0	0	0	126	63
Cumene	2	33	32	0	0	0	65	33
Cyclohexane	2	250	255	0	0	0	505	253
Decabromodiphenyl Oxide	2	5	5	45	0	0	55	28
Freon 113	2	30642	0	0	0	0	30642	15321
Isopropyl Alcohol (Manufacturing	0	933	673	260	0	0	S	2
M-Xylene	2	4005	750	0	0	0	4755	2378
Propylene	2	5	5	0	0	0	10	5
Titanium Tetrachloride	2	23	0	0	0	0	23	12
1,2-Butylene Oxide	2	565	100	0	0	0	665	333
1,4-Dioxane	2	250	254	0	0	0	504	252
2-Methoxyethanol	2	5	230	0	0	0	235	118
Acetonitrile	1	1500	260	0	0	0	1760	1760
Aliphatic Alcohol	1	0	320	0	0	0	320	320
Allyl Alcohol	1	5	5	0	0	0	10	10
Aniline	1	0	0	0	0	0	0	0
Anthracene	1	5	0	0	0	250	255	255
Butyl Acrylate	1	0	250	0	0	0	250	250
Butyraldehyde	1	0	0	0	0	0	0	0
Cresol (Mixed Isomers)	1	113	108	0	0	0	221	221
Cyanide Compounds	1	5	0	0	0	0	5	5

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

Exhibit 12 (cont'd)
Releases for Stone, Clay, Glass, and Concrete Products Facilities (SIC 32) in TRI, by Number of Facilities (Releases Reported in Pounds/Year)

Chemical Name	#/Facilities Reporting Chemical	Fugitive Air	Point Air	Water Discharges	Under-ground Injection	Land Disposal	Total Releases	Average Releases per Facility
Diaminotoluene (Mixed Isomers)	1	4	4	0	0	0	8	8
Dibutyl Phthalate	1	0	0	0	0	750	750	750
Dichlorobenzene (Mixed Isomers)	1	6	106	0	0	0	112	112
Diethyl Phthalate	1	0	1	0	0	0	1	1
Dimethyl Phthalate	1	180	1	0	0	0	181	181
Ethyl Acrylate	1	5	5	0	0	0	10	10
Ethylene Oxide	1	5	0	0	0	0	5	5
Fluometuron	1	5	5	0	0	0	10	10
Isobutyraldehyde	1	5	5	0	0	0	10	10
M-Cresol	1	0	1	0	0	0	1	1
Methyl Acrylate	1	0	0	0	0	0	0	0
Methyl Tert-Butyl Ether	1	5	5	0	0	0	10	10
Nitrobenzene	1	6	100	0	0	0	106	106
P-Xylene	1	3400	920	0	0	0	4320	4320
Polychlorinated Biphenyls	1	0	0	0	0	0	0	0
Pyridine	1	1	1	0	0	0	2	2
Selenium	1	0	0	0	0	0	0	0
Selenium Compounds	1	0	32149	0	0	0	32149	32149
Tert-Butyl Alcohol	1	250	5	0	0	0	255	255
Toluenediisocyanate (Mixed Isomers)	1	3	2	0	0	0	5	
Trichlorofluoromethane	1	4439	0	0	0	0	4439	4439
Vinyl Acetate	1	5	5	0	0	0	10	10
Totals	**634**	**2,649,586**	**15,253,103**	**190904**	**6,566,124**	**1903,605**	**26,561,456**	**41,895**

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

Exhibit 13
Transfers for Stone, Clay, Glass, and Concrete Products Facilities (SIC 32) in TRI, by Number of Facilities (Transfers Reported in Pounds/Year)

Chemical Name	# Facilities Reporting Chemical	POTW Disharges	Disposal	Recycling	Treatment	Energy Recovery	Total Transfers	Average Transfers per Facility
Chromium Compounds	1612846	2082	692929	883908	33927	.	107	15073
Barium Compounds	1568224	11856	1495116	52133	9119	.	96	16336
Manganese Compounds	64675	11458	51111	204	1902	.	91	711
Sulfuric Acid	77905	17791	.	.	60114	.	63	1237
Ammonia	239910	207712	30481	.	1715	2	61	3933
Zinc Compounds	1202327	5543	879399	149844	167291	.	56	21470
Lead Compounds	3584112	2818	2455421	965797	137787	22289	51	70277
Formaldehyde	137551	72215	39068	.	20348	5920	49	2807
Hydrochloric Acid	201595	64335	.	.	137260	.	48	4200
Phenol	86292	11194	43648	.	19619	11831	43	2007
Chromium	2443465	0	1907814	519021	16630	.	41	59597
Phosphoric Acid	60849	9718	51131	.	.	.	41	1484

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

Exhibit 13 (cont'd)
Transfers for Stone, Clay, Glass, and Concrete Products Facilities (SIC 32) in TRI, by Number of Facilities (Transfers Reported in Pounds/Year)

Chemical Name	# Facilities Reporting Chemical	POTW Disharges	Disposal	Recycling	Treatment	Energy Recovery	Total Transfers	Average Transfers per Facility
Styrene	41	12000	7203	5100	14725	8965	47993	1171
Acetone	39	0	250	2575	154131	487072	644028	16514
Dichloromethane	38	0	250	54918	9640	42517	107325	2824
Xylene (Mixed Isomers)	38	3700	131	38896	185661	1592754	1821142	47925
Methyl Ethyl Ketone	37	0	46250	7626	166934	828414	1049224	28357
Toluene	37	0	6	61276	343010	1856567	2263683	61181
Manganese	32	250	276723	3157	87940	.	368070	11502
Ethylene Glycol	30	33693	10283	5027	8426	11191	68620	2287
Glycol Ethers	30	1020	1290	.	12806	40530	55646	1855
Methanol	27	3318	600	24	114027	145100	263069	9743
Hydrogen Fluoride	25	183906	30	.	182858	.	366794	14672
Methyl Isobutyl Ketone	23	0	.	20	27409	267053	294482	12804
Ethylbenzene	21	0	.	58	4545	332311	336914	16044
Tetrachloroethylene	19	0	.	.	29111	33800	62911	3311
1,1,1-Trichloroethane	19	0	.	80082	29302	42931	152315	8017
Lead	18	32	26079	81063	7579	212	114965	6387
Antimony Compounds	16	2334	192940	1655	360	.	197289	12331
Ammonium Sulfate (Solution)	15	3428	14631	.	.	.	18059	1204
Barium	14	1790	61352	14255	220	.	77617	5544
Aluminum (Fume Or Dust)	11	0	196	.	250	.	451	41
Nickel Compounds	11	500	5633	10277	.	.	16410	1492
Chlorine	10	0	.	2733	2455	.	5188	519
Methylenebis(Phenylisocyanate)	9	0	21300	2301	692	6217	30510	3390
	8	5	.	.	372486	.	372491	46561
Nickel	8	0	6500	24000	.	.	30500	3813
Nitric Acid	8	325	9000	.	738130	.	747455	93432
1,2,4-Trimethylbenzene	8	0	.	.	1531	4880	6411	801
Benzene	7	0	0	2863	250	25453	28566	4081
Copper Compounds	7	250	5098	19500	2300	.	27148	3878
N-Butyl Alcohol	7	3400	11	.	5142	3188	11741	1677
Trichloroethylene	7	0	19550	25771	7000	18492	70813	10116
Aluminum Oxide (Fibrous Form)	6	500	105477	.	.	.	105977	17663
Arsenic Compounds	6	105	89444	47056	16	.	136621	22770
Diethanolamine	6	0	2460	.	.	1333	3793	632
Ammonium Nitrate (Solution)	5	0	.	.	.	.	0	0
Cadmium Compounds	5	0	51555	0	414	.	51969	10394
Cobalt Compounds	5	48	1287	16992	4357	.	22684	4537
O-Xylene	5	0	.	.	46	54974	55020	11004
Chloroform	4	0	0	.	10000	9500	19500	4875
Cobalt	4	0	30	37651	12700	.	50381	12595
Copper	4	0	1280	287828	5	.	289113	72278

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

Exhibit 13 (cont'd)
Transfers for Stone, Clay, Glass, and Concrete Products Facilities (SIC 32) in TRI, by Number of Facilities (Transfers Reported in Pounds/Year)

Chemical Name	# Facilities Reporting Chemical	POTW Disharges	Disposal	Recycling	Treatment	Energy Recovery	Total Transfers	Average Transfers per Facility
Di(2-Ethylhexyl) Phthalate	4	1060	7270	.	3000	.	11330	2833
Methyl Methacrylate	4	0	.	.	.	.	0	0
1,4-Dichlorobenzene	4	0	.	.	.	.	0	0
Asbestos (Friable)	3	7	45000	.	.	.	45007	15002
Butyl Benzyl Phthalate	3	2116	64688	9258	1000	.	77062	25687
Creosote	3	0	5450	.	750	.	6200	2067
Naphthalene	3	0	.	.	.	.	0	0
Sec-Butyl Alcohol	3	0	.	.	1200	.	1200	400
Zinc (Fume Or Dust)	3	250	13273	.	.	.	13523	4508
2-Ethoxyethanol	3	630	.	.	14560	33300	48490	16163
Antimony	2	0	.	750	.	.	750	375
Biphenyl	2	0	.	.	.	.	0	0
Chlorobenzene	2	0	.	.	12000	13400	25400	12700
Cumene	2	0	.	.	.	.	0	0
Cyclohexane	2	0	.	.	.	.	0	0
Decabromodiphenyl Oxide	2	0	0	.	1068	.	1068	534
Freon 113	2	0	.	.	.	.	0	0
Isopropyl Alcohol (Manufacturing	2	0	.	.	5740	3868	9608	4804
M-Xylene	2	0	.	.	44	48415	48459	24230
Propylene	2	0	.	.	.	.	0	0
Titanium Tetrachloride	2	0	.	.	.	.	0	0
1,2-Butylene Oxide	2	0	.	.	6	.	6	3
1,4-Dioxane	2	0	.	.	.	.	0	0
2-Methoxyethanol	2	0	.	.	285	940	1225	613
Acetonitrile	1	0	.	.	.	.	0	0
Aliphatic Alcohol	1	0	.	.	.	.	0	0
Allyl Alcohol	1	0	.	.	.	.	0	0
Aniline	1	0	.	.	.	.	0	0
Anthracene	1	0	.	.	.	.	0	0
Butyl Acrylate	1	0	.	.	.	.	0	0
Butyraldehyde	1	0	.	.	.	.	0	0
Cresol (Mixed Isomers)	1	0	.	.	.	.	0	0
Cyanide Compounds	1	0	.	.	.	.	0	0
Totals	**634**	**671,389**	**8,738,638**	**12,152,257**	**3,181,823**	**5,953,419**	**21,961,967**	**3,500**

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

IV.B. Summary of Selected Chemicals Released

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

The brief descriptions provided below were taken from the *1993 Toxics Release Inventory Public Data Release* (EPA, 1994), the Hazardous Substances Data Bank (HSDB), and the Integrated Risk Information System (IRIS), both accessed via TOXNET[1]. The information contained below is based upon exposure assumptions that have been conducted using standard scientific procedures. The effects listed below must be taken in context of these exposure assumptions that are more fully explained within the full chemical profiles in HSDB.

[1] TOXNET is a computer system run by the National Library of Medicine that includes a number of toxicological databases managed by EPA, National Cancer Institute, and the National Institute for Occupational Safety and Health. For more information on TOXNET, contact the TOXNET help line at 1-800-231-3766. Databases included in TOXNET are: CCRIS (Chemical Carcinogenesis Research Information System), DART (Developmental and Reproductive Toxicity Database), DBIR (Directory of Biotechnology Information Resources), EMICBACK (Environmental Mutagen Information Center Backfile), GENE-TOX (Genetic Toxicology), HSDB (Hazardous Substances Data Bank), IRIS (Integrated Risk Information System), RTECS (Registry of Toxic Effects of Chemical Substances), and TRI (Toxic Chemical Release Inventory). HSDB contains chemical-specific information on manufacturing and use, chemical and physical properties, safety and handling, toxicity and biomedical effects, pharmacology, environmental fate and exposure potential, exposure standards and regulations, monitoring and analysis methods, and additional references.

The top ten chemicals released by the Stone, Clay, Glass, and Concrete Products Industry in 1993 were:

Ammonia
Formaldehyde
Hydrochloric acid
Hydrogen fluoride
Methanol
Phenol
Styrene
Sulfuric acid
Toluene
Xylene (mixed isomers)

Summaries of some of the health and environmental impacts of several of these chemicals follows:

Ammonia

Toxicity. Anhydrous ammonia is irritating to the skin, eyes, nose, throat, and upper respiratory system.

Ecologically, ammonia is a source of nitrogen (an essential element for aquatic plant growth), and may therefore contribute to eutrophication of standing or slow-moving surface water, particularly in nitrogen-limited waters such as the Chesapeake Bay. In addition, aqueous ammonia is moderately toxic to aquatic organisms.

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

Environmental Fate. Ammonia combines with sulfate ions in the atmosphere and is washed out by rainfall, resulting in rapid return of ammonia to the soil and surface waters.

Ammonia is a central compound in the environmental cycling of nitrogen. Ammonia in lakes, rivers, and streams is converted to nitrate.

Physical Properties. Ammonia is a corrosive and severely irritating gas with a pungent odor.

Formaldehyde

Toxicity. Ingestion of formaldehyde leads to damage to the mucous membranes of mouth, throat, and intestinal tract; severe pain, vomiting, and diarrhea result. Inhalation of low concentrations can lead to irritation of the eyes, nose, and respiratory tract. Inhalation of high concentrations of formaldehyde causes severe damage to the respiratory system and to the heart, and may even lead to death. Other symptoms from exposure to formaldehyde include: headache, weakness, rapid heartbeat, symptoms of shock, gastroenteritis, central nervous system depression, vertigo, stupor, reduced body temperature, and coma. Repeated contact with skin promotes allergic reactions, dermatitis, irritation, and hardening. Contact with eyes causes injuries ranging from minor, transient injury to permanent blindness, depending on the concentration of the formaldehyde solution. In addition, menstrual disorders and secondary sterility have been reported in women exposed to formaldehyde.

Carcinogenicity. Formaldehyde is a probable human carcinogen via both inhalation and oral exposure, based on limited evidence in humans and sufficient evidence in animals.

Environmental Fate. Most formaldehyde is released to the environment as a gas, and is rapidly broken down by sunlight and reactions with atmospheric ions. Its initial oxidation product, formic acid, is a component of acid rain. The rest of the atmospheric formaldehyde is removed via dry deposition, rain or dissolution into surface waters. Biodegradation of formaldehyde in water takes place in a few days. Volatilization of formaldehyde dissolved in water is low. Bioaccumulation of formaldehyde does not occur.

When released onto the soil, aqueous solutions containing formaldehyde will leach through the soil. While formaldehyde is biodegradable under both aerobic and anaerobic conditions, its fate in soil and groundwater is unknown.

Although formaldehyde is found in remote areas, it is probably not transported there, but rather is likely a result of the local generation of formaldehyde from longer-lived precursors which have been transported there.

Hydrochloric Acid

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

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

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

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

Physical Properties. Concentrated hydrochloric acid is highly corrosive.

Methanol

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

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

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

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

Physical Properties. Methanol is highly flammable.

Sulfuric Acid

Toxicity. Concentrated sulfuric acid is corrosive. In its aerosol form, sulfuric acid has been implicated in causing and exacerbating a variety of respiratory ailments.

Ecologically, accidental releases of solution forms of sulfuric acid may adversely affect aquatic life by inducing a transient lowering of the pH (i.e., increasing the acidity) of surface waters. In addition, sulfuric acid in its aerosol form is also a component of acid rain. Acid rain can cause serious damage to crops and forests.

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

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

In the atmosphere, aerosol forms of sulfuric acid contribute to acid rain. These aerosol forms can travel large distances from the point of release before the acid is deposited on land and surface waters in the form of rain.

Toluene

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

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

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

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

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

Physical Properties. Toluene is a volatile organic chemical.

Xylene (Mixed Isomers)

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

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

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

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

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

IV.C. Other Data Sources

The Aerometric Information Retrieval System (AIRS) contains a wide range of information related to stationary sources of air pollution, including the emissions of a number of air pollutants which may be of concern within a particular industry. With the exception of volatile organic compounds (VOCs), there is little overlap with the TRI chemicals reported above. Exhibit 14 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 14
Pollutant Releases (Short Tons/Year)

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

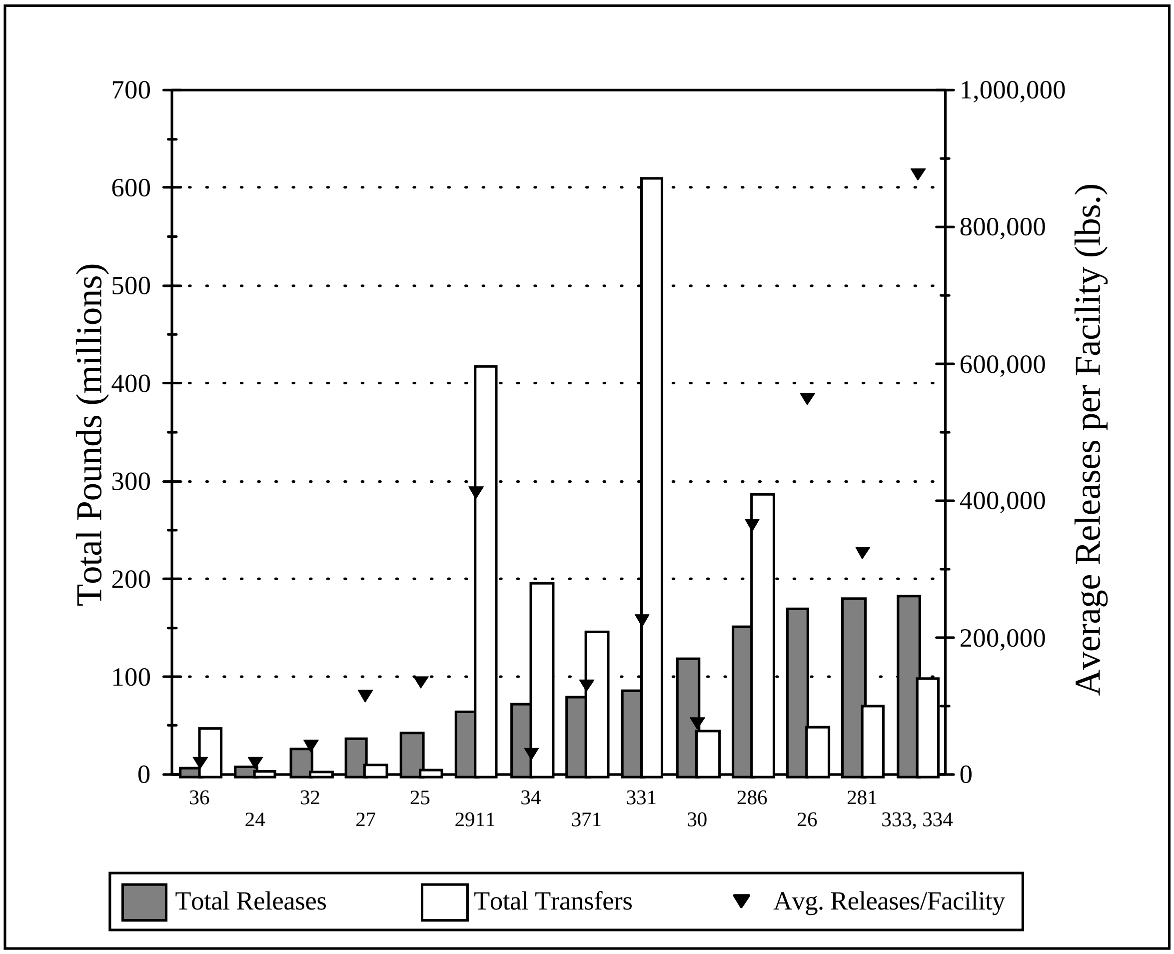
Source U.S. EPA Office of Air and Radiation, Airs Database, May 1995.

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

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

Exhibit 15 is a graphical representation of a summary of the 1993 TRI data for the Stone, Clay, Glass and Concrete Products industry and the other sectors profiled in separate notebooks. The bar graph presents the total TRI releases and total transfers on the left axis and the triangle points show the average releases per facility on the right axis. Industry sectors are presented in the order of increasing total TRI releases. The graph is based on the data shown in Exhibit 16 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 Stone, Clay, Glass and Concrete Products industry, the 1993 TRI data presented here covers 634 facilities. These facilities listed SIC 32 Stone, Clay, Glass and Concrete Products industry as a primary SIC code.

Exhibit 15- bar graph
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 16 TRI Cross Industry
Toxic Release Inventory Data for Selected Industries

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

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

V. POLLUTION PREVENTION OPPORTUNITIES

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

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

Pollution prevention techniques available to this industry can be classified into the following categories: 1) source reduction, 2) recycling and reuse, and 3) improved operating practices.

The first pollution prevention technique, source reduction, includes chemical substitution and process modification options that can reduce or eliminate the use of hazardous substances and the resulting generation of hazardous waste and other environmental releases. Source reduction also includes technological improvements and process modifications to reduce or eliminate waste generation. The second pollution prevention technique, recycling and reuse, returns a waste to the manufacturing process as a raw material. The third technique, improved operating processes, relies on changes made to the way products are manufactured in order to reduce waste. The following are pollution prevention techniques for this industry.

V.A. Glass

Recycling and Reuse

In the glass manufacturing industry, one opportunity for pollution prevention is increasing the use of waste glass, or cullet, as a feedstock. The primary environmental benefit of increasing cullet use is the reduction of the amount of cullet requiring disposal. Currently, about 67 percent of all cullet is landfilled or stockpiled. Glass manufacturers typically use 30 percent cullet along with raw materials to make new glass. Increasing the use of cullet reduces energy consumption, since it requires less energy to melt cullet than to melt other raw materials. One problem with using cullet is that the composition of the cullet may vary widely from the virgin batch, leading to product quality problems. Waste glass which is not reused on site can be used in the production of road materials (known as glasphalt).

Refractory scrap from glass facilities can also be recycled. Spent refractory brick can be used as a feedstock by brick manufacturers without affecting the quality of the final product. Since refractory bricks only have to be replaced approximately every ten years, recycling of this materials is a relatively minor pollution prevention opportunity.

Glass container recycling has been increasing, from over 20 percent in 1988 to 37 percent in 1994. This recycling rate reflects the percentage of container actually recycled by manufacturers, not just the percentage collected. Recycled container glass is used in the production of new bottles and jars as well as in secondary markets such as fiberglass and glasphalt (Glass Packaging Institute, May 1995).

Improved Operating Practices

A major quantity of hazardous waste generated from glass making is generated in the receiving and delivery areas. Improvements such as clean-up and maintenance in receiving areas can minimize this waste. Keeping the receiving areas clean would allow material spills to be collected and added to the raw materials. Also, by paving receiving areas, collection and clean-up becomes much more efficient and effective and allows spilled material to be identified and separated for recycling back into the process.

Air pollution control technologies used in the glass industry commonly transfer contaminants from one media (air) to another (water or hazardous waste). Process improvements can help reduce total waste generation and improve manufacturing efficiency. One available process improvement is called "Rapid Melting Systems," which involves preheating the batch prior to melting. This practice reduces process time, energy consumption, and air emissions. The substitution of oxygen for combustion air is another process improvement which can reduce nitrogen oxide and particulate emissions. The drawbacks of using pure oxygen rather than air are its high cost and localized hot spots during combustion.

V.B. Concrete

Source Reduction

Source reduction in the concrete industry can be achieved through raw material substitution. For example, many concrete product manufacturers have moved from volatile organic compound (VOC)-mold release agents to trichloroethane (TCA)-based agents due to air quality restrictions on VOC material. However, TCA has been added to the list of ozone depleting substances and will be phased out by 2002. Concrete product manufacturers that use TCA as a mold release are working with mold release manufacturers to develop alternatives, such as water-based mold-releases.

Improved Operating Practices

Alternative cement finishing processes, including the use of water-based and powder coatings, can reduce the amount of paint-related wastes generated by manufacturers of cement products. Water-based coatings can be applied by conventional spray, airless, or air assisted airless guns. Since water has a higher density than organic solvents, overspray is reduced and transfer efficiency is improved. Powder coatings, made by mixing resins with a hardener, pigments, and other additives, are 100 percent solids that are applied to parts of various shapes, sizes, and materials of construction. Transfer efficiencies in powder coating application are high, and no solvents are used in manufacturing or applying the coatings. Paint that does not adhere to the workpiece is collected and reused. Consequently, there are virtually no emissions and very little waste from powder coating systems. Powder coating systems require new application equipment, which can be a major capital cost for some companies.

V.C. Cement

Cement kiln dust is the largest waste stream produced by cement manufacturers. The following discussion therefore focuses primarily on pollution prevention opportunities in the cement industry as they relate to cement kiln dust. Pollution prevention opportunities discussed below reflect EPA's findings in the 1993 Report to Congress on Cement Kiln Dust.

Source Reduction

One approach to pollution prevention in the cement industry is to minimize the production of cement kiln dust. There are three primary means to decrease the amount of dust generated by a kiln. Dust can be minimized by reducing gas turbulence in the kiln and avoiding excessive flow velocities. The use of chains near the cool end of the kiln can also minimize dust by trapping the dust before it is released in the kiln exhaust. Most kilns are already equipped with such cool-end chain sections. The use of fuels with a low ash content, such as liquid hazardous wastes, can also reduce the amount of cement kiln dust generated.

Recycling and Reuse

Cement kiln dust generated from the baghouse dust collectors can be reused both on-site and off-site. Direct return of dust to the kiln is a common recycling practice. The dust may be returned to the hot end, to the middle of the kiln, or to the feed material. However, cement kiln dust can only be reused if contaminant concentrations fall within specified limits, because clinker quality can be affected by the presence of certain constituents. Alkali metals, such as lithium, sodium, and potassium, are of primary concern. The raw materials used to produce clinker and the kiln fuel influence the chemical composition of the dust generated, and thus may affect recycling rates.

Cement kiln dust that contains alkalis or possesses other undesirable characteristics may be treated so that it can be returned to the kiln system. Treatment techniques include pelletizing, leaching with water or a potassium chloride solution to remove alkali salts, alkali volatilization, recovery scrubbing (also known as flue gas desulfurization), and fluid bed dust recovery.

In addition to reintroduction to the kiln, cement kiln dust can be reused beneficially in a variety of ways. Cement kiln dust has been sold by some plants for sewage sludge solidification. It has also been reused as an adsorbent for desulfurization, particularly in the cement plant's air pollution control equipment; as a neutralization agent for acidic materials; as a soil stabilizer; and as an ingredient in various agricultural and construction products. Material accumulated from desulfurization can be ground and reused as an additive and/or retarding additive to the clinker to make cement.

Wastes generated from other industries can be recycled at cement kilns as fuels and raw material substitutes. The recycling of wastes in cement kilns as fuel offers a cost-effective, safe, and environmentally sound method of resource recovery for some hazardous and non-hazardous waste materials. Currently used hazardous wastes are waste oils and spent organic solvents, sludges, and solids from the paint and coatings, auto and truck assembly, and petroleum industries. Some non-hazardous wastes, including foundry sand and contaminated soils, have high concentrations of the conventional components of cement, such as silicon, aluminum, and iron. These wastes, therefore, can be used in place of the conventional raw materials.

Improved Operating Practices

Cement manufacturers who have laboratories in-house to conduct product testing and research often generate hazardous wastes as a result of laboratory testing and research. Approximately 40 percent of the hazardous wastes generated in a lab are due to unused and off-spec reagent chemicals. Traditionally, reagents are purchased in large quantities, but laboratory technicians prefer to use fresh reagents for experiments, and therefore tend not to use reagents in previously opened containers. This leads to large quantities of unused reagents. Implementing a purchasing and inventory control, surplus chemicals exchange, and experiment modification system at laboratories would reduce the amount of unused reagents that need to be disposed of as wastes. Purchasing only the required amounts or smaller container sizes of reagents will also reduce reagent waste and disposal costs.

Gaseous emissions from cement manufacturing plants are mainly nitrogen oxides and sulfur dioxide. Process controls, including balancing the alkali content in raw materials and fuels, increasing oxygen partial pressure, increasing dust load, and reducing kiln volume load, can reduce sulfur emissions in the process. Process controls to reduce nitrogen oxide emissions include avoiding excessive sintering temperatures and staged combustion in the calciner. Other measures may reduce emissions, including the use of ammonia to control nitrogen oxide emissions.

V.D. Structural Clay Products

Recycling and Reuse

Reuse of wastes generated by air pollution control equipment is one pollution prevention opportunity available to facilities which produce structural clay products. Clay product manufacturers commonly use wet scrubbing to treat particulate emissions. The waste generated by wet scrubbers can often be returned to the production process as a raw material substitute to replace clay or other alkaline additives.

Improved Operating Practices

Waste generated during raw materials receiving can be eliminated by modifying the equipment and operating practices. For example, paved receiving areas prevent spilled raw materials from contaminating soil, allowing spilled materials to be recaptured for use.

V.E. Pottery Products

Source Reduction

Product substitution is one means of reducing paint waste generated by plants engaged in finishing of pottery products. Water-based finishes, including paints and enamels, can be substituted for solvent-based finishes, reducing the amount of volatile emissions from finishing processes. The use of water-based finishes may, however, result in hazardous waste generation and waste water discharges.

Recycling and Reuse

Pottery manufacturers can recycle wastes recovered from pollution control devices. The dry powder waste recovered from air pollution control equipment is virtually identical in composition to the tile/ceramic product itself, and therefore may be recycled as raw materials into the body preparation process. The overspray dust gathered in dust collectors can also be recovered. Enamel overspray from finishing operations can also be reused if not contaminated. Enamel overspray is often washed down and collected in settling pits, where it can be reclaimed and re-introduced as a raw material.

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

VI.A. General Description of Major Statutes

Resource Conservation And Recovery Act

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

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

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

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

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

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

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

- **Land Disposal Restrictions** (LDRs) are regulations prohibiting the disposal of hazardous waste on land without prior treatment. Under the LDRs (40 CFR 268), materials must meet land disposal restriction (LDR) treatment standards prior to placement in a RCRA land disposal unit (landfill, land treatment unit, waste pile, or surface impoundment). Wastes subject to the LDRs include solvents, electroplating wastes, heavy metals, and acids. Generators of waste subject to the LDRs must provide notification of such to the designated TSD facility to ensure proper treatment prior to disposal.

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

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

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

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

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

Comprehensive Environmental Response, Compensation, And Liability Act

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

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

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

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

Emergency Planning And Community Right-To-Know Act

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

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

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

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

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

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

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

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

Clean Water Act

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

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

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

Storm Water Discharges

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

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

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

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

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

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

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

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

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

Category vii: Steam electric power generating facilities.

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

Category ix: Sewage treatment works.

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

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

Pretreatment Program

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

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

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

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

Safe Drinking Water Act

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

EPA has developed primary and secondary drinking water standards under its SDWA authority. EPA and authorized States enforce the primary drinking water standards, which are, contaminant-specific concentration limits that apply to certain public drinking water supplies. Primary drinking water standards consist of maximum contaminant level goals (MCLGs), which are non-enforceable health-based goals, and maximum contaminant levels (MCLs), which are enforceable limits set as close to MCLGs as possible, considering cost and feasibility of attainment.

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

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

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

Toxic Substances Control Act

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

TSCA standards may apply at any point during a chemical's life cycle. Under TSCA §5, EPA has established an inventory of chemical substances. If a chemical is not already on the inventory, and has not been excluded by TSCA, a premanufacture notice (PMN) must be submitted to EPA prior to manufacture or import. The PMN must identify the chemical and provide available information on health and environmental effects. If available data are not sufficient to evaluate the chemical's effects, EPA can impose restrictions pending the development of information on its health and environmental effects. EPA can also restrict significant new uses of chemicals based upon factors such as the projected volume and use of the chemical.

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

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

Clean Air Act

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

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

Title I also authorizes EPA to establish New Source Performance Standards (NSPSs), which are nationally uniform emission standards for new stationary sources falling within particular industrial categories. NSPSs are based on the pollution control technology available to that category of industrial source but allow the affected industries the flexibility to devise a cost-effective means of reducing emissions.

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

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

Title IV establishes a sulfur dioxide emissions program designed to reduce the formation of acid rain. Reduction of sulfur dioxide releases will be obtained by granting to certain sources limited emissions allowances, which, beginning in 1995, will be set below previous levels of sulfur dioxide releases.
Title V of the CAAA of 1990 created a permit program for all "major sources" (and certain other sources) regulated under the CAA. One purpose of the operating permit is to include in a single document all air emissions requirements that apply to a given facility. States are developing the permit programs in accordance with guidance and regulations from EPA. Once a State program is approved by EPA, permits will be issued and monitored by that State.

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

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

VI.B. Industry-Specific Regulations

Clean Air Act (CAA)

In addition to the general applicable requirements of the CAA, the industries covered by SIC 32 are subject to the following specific regulatory requirements:

- Standards of Performance for Portland Cement Plants (40 CFR 60.60 Subpart F) which regulates emissions of particulate matter through the operation of a kiln, clinker cooler, raw mill system, finish mill system, raw mill dryer, raw material storage, clinker storage, finished product storage, conveyor transfer points, bagging and bulk loading and unloading systems.

- Standards of Performance for Asphalt Concrete Plants (40 CFR 60.90 Subpart I) which regulates emissions of particulate matter.

- Standards of Performance for Glass Manufacturing Plants (40 CFR 60.290 Subpart CC) which regulates emissions of particulate matter from glass melting furnaces.

- Standards of Performance for Lime Manufacturing Plants (40 CFR 60.340 Subpart HH) which regulates emissions of particulate matter from rotary lime kilns.

- Standards of Performance for Asphalt Processing and Asphalt Roofing Manufacture (40 CFR 60.470 Subpart UU) which regulates emissions of particulate matter by each saturator and each mineral handling and storage facility at asphalt roofing plants; and each asphalt storage tank and each blowing still at asphalt processing plants, petroleum refineries, and asphalt roofing plants.

- Standard of Performance for Wool Fiberglass Insulation Manufacturing Plants (40 CFR 60.680 Subpart PPP) which regulates emissions of particulate matter by rotary spin wool fiberglass insulation manufacturers.

- Standards of Performance for Polymeric Coating of Supporting Substrates Facilities (40 CFR 60.740 Subpart VVV) which regulates emissions of volatile organic compounds.

- National Emission Standard for Inorganic Arsenic Emissions from Glass Manufacturing Plants (40 CFR 61.160 Subpart N) which regulates emissions of arsenic. This subpart applies to glass melting furnaces that use commercial arsenic as a raw material.

The performance standards set out above also impose specific emissions monitoring, testing methods and procedures, recordkeeping, and reporting requirements.

Clean Water Act (CWA)

In addition to the general applicable requirements of the CWA, the industries covered by SIC 32 are subject to the following specific regulatory requirements:

- EPA Effluent Guidelines and Standards for Cement Manufacturing (40 CFR 411) regulate discharges resulting from the process in which several mineral ingredients are used in manufacturing cement and in which: 1) kiln dust is not contracted with water as an integral part of the process and water is not used in wet scrubbers to control kiln stack emissions (non-leaching plants); and 2) kiln dust is contracted with water as an integral part of the process and water is used in wet scrubbers to control kiln stack emissions (leaching plants).

- EPA Effluent Guidelines and Standards for Glass Manufacturing, Insulation Fiberglass Subcategory (40 CFR 426) which regulates the discharge of process wastewater as a result of the manufacture of insulation fiberglass.

- EPA Effluent Guidelines and Standards for Asbestos Manufacturing (40 CFR 427) which regulate discharges of asbestos in process wastewater resulting from the manufacture of asbestos products including: asbestos-cement pipe, asbestos-cement sheet, asbestos paper with starch binder, asbestos paper with elastomeric binder, asbestos millboard, asbestos roofing products, and asbestos floor tile.

- EPA Effluent Guidelines and Standards for Paving and Roofing Materials (Tars and Asphalt) (40 CFR 443) which regulate discharges of wastewater within the asphalt emulsion, asphalt concrete, linoleum and printed asphalt felt, and paving and roofing materials (tars and asphalt) subcategories of the paving and roofing materials (tars and asphalt) category of point sources.

The effluent guidelines set out above contain pretreatment standards based upon application of best practicable control technology or best available control technology.

VI.C. Pending and Proposed Regulatory Requirements

Clean Air Act Amendments of 1990 (CAAA)

EPA is required to publish an initial list of all categories of major and area sources of the hazardous air pollutants (HAPs) listed in Section 112(b) of the CAAA, establish dates for the promulgation of emission standards for each of the listed categories of HAP emission sources, and develop emission standards for each source of HAPs such that the schedule is met. The standards are to be technology-based and are to require the maximum degree of emission reduction determined to be achievable by the Administrator. The Agency has determined that the mineral wool production industry and the portland cement manufacturing industry may be anticipated to emit several of the 189 HAPs listed in Section 112(b) of the CAAA. As a consequence, these source categories are included on the initial list of HAP-emitting categories scheduled for standards promulgation within seven years of enactment of the CAAA.

Report to Congress and Final Regulatory Determination on Cement Kiln Dust (RCRA)

RCRA 8002(o) requires that EPA study and report to Congress on the sources and volumes of cement kiln dust, current and alternative waste management practices and their costs and economic impacts, documented damages to human health and the environment from cement kiln dust disposal, and existing State and Federal regulation of these wastes. The Agency published the Report to Congress on Cement Kiln Dust in December 1993, and concluded in February 1995 that additional control of cement kiln dust is warranted to protect human health and the environment (60 FR 7366; February 7, 1995). EPA intends to address regulation of cement kiln dust through a “common sense” approach by developing RCRA disposal requirements to protect groundwater and by regulating fugitive emissions under the CAA. Until such regulations are implemented, cement kiln dust will retain its status as non-hazardous waste.

VII. COMPLIANCE AND ENFORCEMENT PROFILE

Background

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

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

Compliance and Enforcement Profile Description

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

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

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

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

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,

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

compliance, enforcement, and pollutant release data for any given regulated facility.

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

Data Table Column Heading Definitions

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

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

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

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

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

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

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

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

Enforcement to Inspection Rate -- expresses how often enforcement actions result from inspections. This value is a ratio of enforcement actions to inspections, and is presented for comparative purposes only. This measure is a rough indicator of the relationship between inspections and enforcement. This measure simply indicates historically how many enforcement actions can be attributed to inspection activity. Related inspections and enforcement actions under the Clean Water Act (PCS), the Clean Air Act (AFS) and the Resource Conservation and Recovery Act (RCRA) are included in this ratio. Inspections and actions from the TSCA/FIFRA/EPCRA database are not factored into this ratio because most of the actions taken under these programs are not the result of facility inspections. This ratio does not account for enforcement actions arising from non-inspection compliance monitoring activities (e.g., self-reported water discharges) that can result in enforcement action within the CAA, CWA and RCRA.

Facilities with One or More Violations Identified -- indicates the number and percentage of <u>inspected</u> facilities having a violation identified in one of the following data categories: In Violation or

Significant Violation Status (CAA); Reportable Noncompliance, Current Year Noncompliance, Significant Noncompliance (CWA); Noncompliance and Significant Noncompliance (FIFRA, TSCA, and EPCRA); Unresolved Violation and Unresolved High Priority Violation (RCRA). The values presented for this column reflect the extent of noncompliance within the measured time frame, but do not distinguish between the severity of the noncompliance. Percentages within this column can exceed 100% 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. Stone, Clay, Glass, and Concrete Products Industry Compliance History

Exhibits 17-21 illustrate recent enforcement activity within the Stone, Clay, Glass, and Concrete Products Industry and other industries in the manufacturing sector. Of the 2,475 inspections conducted at stone, clay, glass, and concrete products facilities over a five year period, 268, or 11 percent, resulted in enforcement actions. Approximately 11 percent of inspections in the manufacturing sector as whole resulted in enforcement actions. States took the lead in 70 percent of the enforcement actions at stone, clay, glass, and concrete products facilities, which was below the average of 74 percent for the covered manufacturing sector. The exhibits also show that RCRA and CAA inspections occurred more frequently than CWA inspections within most industries, including those covered under SIC 32.

VII.B. Comparison of Enforcement Activity Between Selected Industries

The following exhibits present inspection and enforcement information across numerous manufacturing sector industries including the stone, clay, glass, and concrete industry.

Exhibit 17
Five Year Enforcement and Compliance Summary by Statute for the Stone, Clay, Glass and Concrete Industry

A	B	C	D	E	F	G	H	I	J
Stone, Clay, and Glass SIC 32	Facilities in Search	Facilities Inspected	Number of Inspections	Average Number of Months Between Inspections	Facilities w/one or more Enforcement Actions	Total Enforcement Actions	State Lead Actions	Federal Lead Actions	Enforcement to Inspection Rate
Region I	8	11	32	16	1	1	100%	0%	0.03
Region II	30	35	280	7	9	54	87%	13%	0.19
Region III	58	55	435	8	12	99	88%	12%	0.23
Region IV	106	90	828	8	21	117	75%	25%	0.14
Region V	105	86	464	14	13	24	63%	38%	0.05
Region VI	57	32	208	17	11	36	81%	19%	0.17
Region VII	29	28	223	8	12	33	24%	76%	0.15
Region VIII	19	11	40	30	2	2	50%	50%	0.05
Region IX	40	18	74	34	4	11	82%	18%	0.15
Region X	10	5	13	48	1	1	—	100%	0.08
Total/Average	462	371	2,597	11	86	378	75%	25%	0.15

Exhibit 18
Five Year Enforcement and Compliance Summary for Selected Industries

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

Exhibit 19
One Year Enforcement and Compliance Summary for Selected Industries

A	B	C	D	E		F		G	H
Industry Sector	Facilities in Search	Facilities Inspected	Number of Inspections	Facilities w/One or More Violations		Facilities w/One or More Enforcement Actions		Total Enforcement Actions	Enforcement to Inspection Rate
				Number	Percent*	Number	Percent*		
Metal Mining	873	114	194	82	72%	16	14%	24	0.13
Non-metallic Mineral Mining	1,143	253	425	75	30%	28	11%	54	0.13
Lumber and Wood	464	142	268	109	77%	18	13%	42	0.15
Furniture	293	160	113	66	41%	3	2%	5	0.04
Rubber and Plastic	1,665	271	435	289	107%	19	7%	59	0.14
Stone, Clay, and Glass	468	146	330	116	79%	20	14%	66	0.20
Nonferrous Metals	844	202	402	282	140%	22	11%	72	0.18
Fabricated Metal	2,346	477	746	525	110%	46	10%	114	0.15
Electronics/Computers	405	60	87	80	133%	8	13%	21	0.24
Motor Vehicle Assembly	598	169	284	162	96%	14	8%	28	0.10
Pulp and Paper	306	189	576	162	86%	28	15%	88	0.15
Printing	4,106	397	676	251	63%	25	6%	72	0.11
Inorganic Chemicals	548	158	427	167	106%	19	12%	49	0.12
Organic Chemicals	412	195	545	197	101%	39	20%	118	0.22
Petroleum Refining	156	109	437	109	100%	39	36%	114	0.26
Iron and Steel	374	167	488	165	99%	20	12%	46	0.09
Dry Cleaning	933	80	111	21	26%	5	6%	11	0.10

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

Exhibit 20
Five Year Inspection and Enforcement Summary by Statute for Selected Industries

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

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

Exhibit 21
One Year Inspection and Enforcement Summary by Statute for Selected Industries

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

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

VII.C. Review of Major Legal Actions

VII.C.1 Review of Major Cases

This section provides summary information about major cases that have affected this sector. As indicated in EPA's Enforcement Accomplishments Report, FY 1991, FY 1992, FY 1993 publications, six significant enforcement actions were resolved between 1991 and 1993 for the stone, clay, glass, and concrete products industry. Of the companies against which actions were brought, two were glass manufacturing companies and four were cement manufacturing companies. For the glass industry, CAA violations were involved in one action concerning inorganic arsenic, with the other case involving RCRA/CERCLA violations concerning the disposal of lead sludge. All cement manufacturing cases involved the operation of cement manufacturing kilns. CAA violations comprised two of the cement industry cases, along with one CERCLA and one RCRA violation.

All six enforcement actions involved the improvement of processes or technologies, or required some action to increase future compliance. Three of the six cases also involved the assessment of a penalty, including both glass company cases. Penalties ranged from $250,000 to $1,825,000. In U.S. v. Corning Inc., Asahi, Asahi Glass America, Inc. and Corning Ashahi Video Products (1992), the company was required to pay $1,825,000 in civil penalties in this inorganic arsenic National Emissions Standards for Hazardous Air Pollutants (NESHAP) case, in addition to upgrading the electrostatic precipitators serving its glass manufacturing furnaces, developing and implementing an operation and maintenance plan, and conducting stack tests and repairs. This civil penalty is the largest ever obtained in an inorganic arsenic NESHAP case, and is one of the largest civil penalties obtained in any NESHAP case.

Cement industry enforcement actions dealt mainly with cement kiln dust disposal or cement kiln dust emissions. In a case involving the Lehigh Portland Cement Company (1992), EPA issued an Administrative Order directing the company to perform a specified remedial design and remedial action to deal with large quantities of cement kiln dust that had been disposed of on the site surface and in abandoned limestone quarries. The dust disposed at the site is the source of elevated creek pH levels and increased heavy metal concentrations at the site. The estimated cost of the remedy is $5,000,000.

There was one enforcement case involving the burning of hazardous waste for energy recovery using cement kilns located in Kansas and

Missouri. Each facility entered into operating agreements under the Boiler and Industrial Furnace (BIF) regulations, promulgated pursuant to RCRA.

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

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

In December, 1993, the Regions were asked by EPA's Office of Enforcement and Compliance Assurance to provide information on the number and type of SEPs entered into by the Regions. Exhibit 22 contains a representative sample of the Regional responses addressing the stone, clay, glass, and concrete products industry. The information contained in the chart is not comprehensive and provides only a sample of the types of SEPs developed for the stone, clay, glass, and concrete products industry.

Exhibit 22
Supplemental Environmental Projects
Stone, Glass, and Cement Products (SIC 32)

Case Name	EPA Region	Statute/ Type of Action	Type of SEP	Estimated Cost to Company	Expected Environmental Benefits	Final Assessed Penalty	Final Penalty After Mitigation
Florida Tile Industry	4		Pollution Prevention	$ 333,930	Reduce zinc oxide in glazes. Implement zero discharge stormwater management.	$ 493,070	Information Not Available
Louie Glass Company, Inc. Weston, WV	3	EPCRA	Equipment Donation	$ 14,126	Donate money for a spill response trailer and equipment; delivery of the spill response trailer and equipment; and purchase of a mapping diskette.	$ 42,000	Information Not Available

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

Alpine Technology of Eugene, Oregon, has developed a technology that will enable glass manufacturers to effectively reuse glass. This technology, called optical ceramic sortation technology, uses optical sensors and compressed air to remove ceramic and other contaminants from waste glass. Development of this innovative technology has been made possible through a grant from the Department of Energy (DOE) and the EPA. (Contact: Bill Ives, DOE Golden Colorado Office, 303-275-4755)

The U.S. Bureau of Mines (USBM) Environmental Program is providing technology to prevent environmental pollution and to provide a healthy working environment. In the environmental health area, USBM is developing controls for airborne contaminants in mines and mineral processing operations. The projects have applications to plants that process stone, sand, glass, and concrete products. (Contact: Dr. J. Harrison Daniel, Research Staff, USBM, (202) 501-9309)

The California Environmental Protection Agency Department of Toxic Substances Control (Contact: Melissa Salinas 916-322-7636) keeps track of the generation, transportation, treatment, and disposal of all hazardous wastes within the State through the use of the Uniform Hazardous Waste Manifests (Manifest). The Manifest requires that large generators certify that they "have a program in place to minimize the volume and toxicity of waste generated . . . determined to be economically practicable" and that they have selected the "practicable method of treatment, storage, or disposal currently available . . . which minimizes the present and future threat to human health and the environment." Small quantity generators must certify that they have made a "good faith effort to minimize . . . waste generation" and have selected the best affordable waste management method available. The Department maintains a warehouse of information related to pollution prevention, including publications such as "Waste Audit Study: Stone, Clay, Glass, and Concrete Products

Industries" and "Hazardous Waste Minimization Checklist and Assessment Manual for the Ceramic Products Industry."

VIII.B. EPA Voluntary Programs

EPA 33/50 Program

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

For the stone, clay, glass, and concrete products industry, of the 20 TRI reported chemicals with the highest levels of releases and transfers, six are on EPA's 33/50 program list of targeted chemicals. These chemicals are chromium compounds, lead compounds, methyl ethyl ketone, toluene, 1,1,1-trichloroethane, and xylene.

Exhibit 23 lists those companies participating in the 33/50 program that reported under SIC code 32 to TRI. Many of the participating companies listed multiple SIC codes (in no particular order), and are therefore likely to conduct operations in addition to stone, clay, glass, and concrete Products. The table shows the number of facilities within each company that are participating in the 33/50 program; each company's total 1993 releases and transfers of 33/50 chemicals; and the percent reduction in these chemicals since 1988.

Fifty-one companies listed under SIC 32 (stone, clay, glass, and concrete industries) are currently participating in the 33/50 program. They account for 28 percent of the 178 companies under SIC 32, which is double the average for all industries of 14 percent participation. (Contact: Mike Burns 202-260-6394 or the 33/50 Program 202-260-6907)

Exhibit 23
Stone, Clay, Glass, and Concrete Products Facilities Participating in the 33/50 Program

Parent Facility name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
3m Minnesota Mining & Mfg Co	St. Paul	MN	2834, 3842, 2695, 8731, 3291, 2672	11	16,481,098	70
Adolph Coors Company	Golden	CO	3264	2	158,792	59
Allied Mineral Products Inc	Columbus	OH	3297	1	404	***
Allied-Signal Inc	Morristown	NJ	3292, 2821	1	2,080,501	50
Ameron Inc Delaware	Pasadena	CA	3272, 3317, 3443, 3479	2	184,882	**
Apogee Enterprises Inc	Minneapolis	MN	3231	1	423,862	15
Armstrong World Industries	Lancaster	PA	3251	4	1,109,350	*
Ball Corporation	Muncie	IN	3221	5	721,859	86
Bp America Inc	Cleveland	OH	3297	1	1,597,404	24
Certainteed Corporation	Valley Forge	PA	3296	4	15,429	50
Chrysler Corporation	Highland Park	MI	3231	1	3,623,717	80
Corning Inc	Corning	NY	3231	8	1,521,528	14
Dal-Tile Group Inc	Dallas	TX	3253	2	1,721	97
Dana Corporation	Toledo	OH	3293	1	1,652,123	**
Dresser Industries Inc	Dallas	TX	3255	1	127,187	42
Duncan Financial Corporation	Fresno	CA	3269, 3299, 2851	1	6,139	50
Fair Rite Products Corp	Wallkill	NY	3264	2	2,250	***
Ford Motor Company	Dearborn	MI	3211	3	15,368,032	15
Fritz Industries Inc	Mesquite	TX	3272	1	10,000	77
Gaf Corporation	Wayne	NJ	3295	3	944,730	44
General Electric Company	Fairfield	CT	3291, 3545	4	5,010,856	50
Haeger Industries Inc	Dundee	IL	3269	2	2,106	4
Hm Anglo-American Ltd	New York	NY	3241	1	1,265,741	2
Inland Steel Industries Inc	Chicago	IL	3312, 3274	1	733,786	48
Knauf Fiber Glass Gmbh	Shelbyville	IN	3296	1	6,171	*
Leco Corporation	Saint Joseph	MI	3826, 3471, 3229	1	6,800	14
Lockheed Corporation	Calabasas	CA	3271	3	982,611	35
Martin Marietta Corporation	Bethesda	MD	3297, 3295	2	223,286	73
Morgan Stanley Leveraged Fund	New York	NY	3274	4	2,166,420	13
Motorola Inc	Schaumburg	IL	3679, 3299	1	226,357	50
Newell Co	Freeport	IL	3229	1	324,283	23
North American Philips Corp	New York	NY	3229	1	1,281,928	50
Norton Company	Worcester	MA	3291	4	40,831	63
Oregon Steel Mills Inc	Portland	OR	3312, 3295	1	14,533	12
Owens-Corning Fiberglas Corp	Toledo	OH	3229, 2821	7	141,203	50
Owens-Illinois Inc	Toledo	OH	3221	19	412,573	***

Exhibit 23 (cont'd)
Stone, Clay, Glass, and Concrete Products Facilities Participating in the 33/50 Program

Parent Facility name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
Pfizer Inc	New York	NY	3297	2	2,176,460	50
Ppg Industries Inc	Pittsburgh	PA	3231	5	2,772,331	50
Refractory Sales & Service Co.	Bessemer	AL	3297, 3272	1	1,000	50
Schuller Corporation	Denver	CO	3229	5	24,694	***
St. George Crystal Ltd	Jeannette	PA	3229	1	510	*
Stanley Works	New Britain	CT	3231, 3089, 2499	1	508,199	50
Summitville Tiles Inc	Summitville	OH	3253	2	10	*
Sunnen Products Company	Maplewood	MO	3291, 3541, 3545	1	2,928	42
Superior Graphite Co	Chicago	IL	3295	1	2,102	10
T & N Inc	Ann Arbor	MI	3292, 3714	1	670,624	**
Talley Industries Inc	Phoenix	AZ	3264	1	3,804	***
Tdk Ferrites Corp.	Shawnee	OK	3264, 3679	1	8,339	50
Texas Industries Inc	Dallas	TX	3241	1	20,964	*
Thomson Consumer Electronics	Indianapolis	IN	3229	1	2,110,314	43
Veba Corporation	Houston	TX	3299	1	24,254	10

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

Environmental Leadership Program

The Environmental Leadership Program (ELP) is a national initiative piloted by EPA and State agencies in which facilities have volunteered to demonstrate innovative approaches to environmental management and compliance. EPA has selected 12 pilot projects at industrial facilities and Federal installations which will demonstrate the principles of the ELP program. These principles include: environmental management systems, multimedia compliance assurance, third-party verification of compliance, public measures of accountability, community involvement, and mentoring programs. In return for participating, pilot participants receive public recognition and are given a period of time to correct any violations discovered during these experimental projects. (Contact: Tai-ming Chang, ELP Director, 202-564-5081 or Robert Fentress, 202-564-7023)

Project XL

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

Green Lights Program

EPA's Green Lights program, initiated in 1991, has the goal of preventing pollution by encouraging U.S. institutions to use energy-efficient lighting technologies. The program has over 1,500 participants which include major corporations; small and medium sized businesses; Federal, State and local governments; non-profit groups; schools; universities; and health care facilities. Each participant is required to survey their facilities and upgrade lighting wherever it is profitable. EPA provides technical assistance to the participants through a decision support software package, workshops and manuals, and a financing registry. EPA's Office of Air and Radiation is responsible for operating the Green Lights Program. (Contact: Susan Bullard at 202-233-9065 or the Green Light/Energy Star Hotline at 202-775-6650)

WasteWi$e Program

The WasteWi$e Program was started in 1994 by EPA's Office of Solid Waste and Emergency Response. The program is aimed at reducing municipal solid wastes by promoting waste minimization, recycling collection, and the manufacturing and purchase of recycled products. As of 1994, the program had about 300 companies as members, including a number of major corporations. Members agree to identify and implement actions to reduce their solid wastes and must provide EPA with their waste reduction goals along with yearly progress reports. EPA in turn provides technical assistance to member companies and allows the use of the WasteWi$e logo for promotional purposes. (Contact: Lynda Wynn, 202-260-0700 or the WasteWi$e Hotline at 1-800-372-9473)

Climate Wise Recognition Program

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

NICE^3

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

VIII.C. Trade Association/Industry-Sponsored Activity

The trade associations that represent the Stone, Clay, Glass, and Concrete Products Industry are a valuable source of economic and environmental compliance data. The following two subsections list major stone, clay, glass, and concrete products trade organizations and highlight environmental initiatives sponsored by such trade associations and other manufacturing groups.

VIII.C.1. Environmental Programs

In 1986, California voters approved the Safe Drinking Water and Toxic Enforcement Act, known as Proposition 65. This law requires businesses in California to provide warnings when they expose the public to hazardous chemicals like lead. In early 1993, a group of ceramic dish manufacturers agreed to provide warnings about the lead content in their dishes by marking dishes with a yellow triangle. Dishes with this yellow triangle have been tested and have been found to leach lead into food above Proposition 65 warning levels. Through the use of this triangle, the public is better informed about possible exposure to hazardous chemicals.

VIII.C.2. Summary of Trade Associations

The trade and professional organizations serving the stone, clay, glass, and concrete industry are presented below according to the type of product manufactured.

Concrete

American Concrete Institute (ACI) 22400 West Seven Road Detroit, MI 48219 Phone: (313) 532-2600 Fax: (313) 538-0655	Members: 19,000 Staff: 62 Budget: $7,600,000 Contact: George F. Leyh

Founded in 1905, ACI is a technical society of engineers, architects, contractors, educators, and others interested in improving techniques of design construction and maintenance of concrete products and structures. ACI operates a 2,000 volume library and speakers' bureau and offers specialized education seminars. Publications offered by ACI include Concrete International (monthly), ACI Materials Journal (bimonthly), ACI Structural Journal (bimonthly), and technical reports.

Glass

National Glass Association (NGA) 8200 Greensboro Dr., 3rd floor McLean, VA 22102 Phone: (703) 442-4890 Fax: (703) 442-0603	Members: 4.500 Staff: 25 Budget: $4,000,000 Contact: Philip J. James

Founded in 1948, NGA represents manufacturers, installers, retailers, distributors, and fabricators of flat, architectural, automotive, and specialty glass and metal products, mirrors, shower and patio doors, windows, and table tops. NGA compiles market statistics and provides educational and technical services. Its publications include Autoglass Magazine (bimonthly) and Glass Magazine (monthly).

Glass Technical Institute (GTI) 12653 Portada Pl. San Diego, CA 92130 Phone: (619) 481-1277 Fax: (619) 481-6771	Members: NP Staff: 3 Budget: For-Profit Contact: Dr. Robert A. Drake

Founded in 1984, GTI represents companies, suppliers, and engineering firms serving the glass industry. GTI works to promote and improve the glass industry by offering environmental regulation counseling, engineering and technical services, research and development, and product design consulting services. GTI provides an environmental and energy database as well as publications including Glass Factory (periodic).

Stone

National Stone Association (NSA) 1415 Elliot Pl., N.W. Washington, D.C. 20007 Phone: (202) 342-1100 Fax: (202) 342-0702, (800) 342-1415	Members: 425 Staff: 20 Budget: $2,500,000 Contact: William C. Ford

Founded in 1985, NSA represents producers and processors of crushed stone used for all construction purposes, railroad ballast, and chemical, metallurgical, and agricultural processes; manufacturers of machinery, equipment, and supplies used in production of crushed stone; firms providing technical, engineering, and /or scientific services. Its activities include research, engineering consultation and testing, product promotion, and representation in Washington, D.C. NSA conducts educational programs and seminars. Its publications include Stone

Review (bimonthly), National Stone Association - Buyer's Guide (annual), and other marketing and technical publications.

Cultured Marble Institute (CMI) 1735 North Lynn Street, Suite 950 Arlington, VA 22209 Phone: (703) 276-2644 Fax: (703) 524-2300	Members: 310 Staff: 4 Regional Groups: 10 Budget: $600,000 Contact: Edward L. Kawala

Founded in 1974, CMI represents firms and corporations that make cultured marble products (such as cast marble vanity tops), and firms and corporations that supply raw materials and production equipment to manufacturers of cultured marble products. It promotes the merits of cultured marble products to the market and develops industry-wide standards of product quality and acceptability. CMI represents the cultured marble industry before government and regulatory agencies of all types, and defends the industry against unwarranted regulations. Its publications include Cultured Marble News (quarterly), Forecaster (quarterly), and technical, safety, and regulation bulletins.

Clay

Brick Institute of America (BIA) 11490 Commerce Park Dr. Reston, VA 22091 Phone: (703) 620-0010 Fax: (703) 620-3928	Members: 60 Staff: 15 State Groups: 10 Budget: $1,500,000 Contact: Nelson J. Cooney

Founded in 1934, BIA represents manufacturers of clay brick. It maintains a technical library of 2,000 volumes on engineering and ceramics pertinent to masonry construction. BIA publications include BIA News (monthly), Brick in Architecture (bimonthly), and Technical Notes (bimonthly).Other Associations

American Ceramic Society (ACerS) 735 Ceramic Place Westerville, OH 43081 Phone: (614) 794-5817 Fax: (614) 899-6109	Members: 16,000 Staff: 57 Budget: $7,000,000 Contact: Greg Geiger

Founded in 1899, ACerS represents scientists, engineers, educators, plant operators, and others interested in the glass, cements, refractories, nuclear ceramics, whitewares, electronics, engineering, and structural clay products industries. It disseminates scientific and technical information through its publications and technical meetings, as well as through the continuing education courses and training it offers. ACerS operates a 3,400 volume library of materials on ceramic history, brick, cement, glass, and industrial and technical aspects of ceramics, porcelain, and pottery. It also maintains a computerized, online ceramic abstracts database. An hourly fee is charged for ACerS research services, including access to the online database. ACerS publications include the American Ceramic Society Bulletin (monthly), Ceramics Abstracts (bimonthly), and Journal of the American Ceramic Society (monthly).

IX. CONTACTS/ACKNOWLEDGMENTS/RESOURCE MATERIALS/BIBLIOGRAPHY

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Contacts[3]

Name	Organization	Telephone
Dr. Robert Blake	Glass Technical Institute	619-481-1277
Ed Buckner	EPA, Region VII (inspector)	913-551-7621
Greg Geiger	American Ceramic Society	614-794-5817
Harry Miles	Primary Glass Manufacturing Console	615-239-6891
John Harmon	U.S. EPA 33/50 Program	202-260-6395
John Keil	Libby Owens Ford	419-247-3715
Melissa Salinas	California EPA	916-322-7636
Pam Franz	Environmental Defense Fund	510-658-8008
Robert Miller	Bureau of Census	301-763-7897
Nathan Tyler	Glass Packaging Institute	202-887-4850

[3]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.