EPA/310-R-97-002

EPA Office of Compliance Sector Notebook Project:

Profile of the Ground Transportation Industry Trucking, Railroad, and Pipeline

September 1997

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

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), Science Applications International Corporation (McLean, VA), and Booz-Allen & Hamilton, Inc. (McLean, VA). This publication may be purchased from the Superintendent of Documents, U.S. Government Printing Office. A listing of available Sector Notebooks and document numbers is included on the following page.

All telephone orders should be directed to:

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

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

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

Complimentary volumes are available to certain groups or subscribers, such as public and academic libraries, Federal, State, and local governments, and the media from EPA's National Center for Environmental Publications and Information at (800) 490-9198. For further information, and for answers to questions pertaining to these documents, please refer to the contact names and numbers provided within this volume.

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

Cover photograph by Steve Delaney, EPA.

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.

GROUND TRANSPORTATION INDUSTRY (SIC 40, 42, 46, AND 49) TABLE OF CONTENTS

List of Exhibits vi

List of Acronyms vii

I. Introduction to the Sector Notebook Project 1
A. Summary of the Sector Notebook Project 1
B. Additional Information 2

II. Introduction to the Ground Transportation Industry 3
A. Introduction, Background, and Scope of the Notebook 3
B. Industry Sectors Analyzed 3
1. Rail Transportation 3
2. Trucking 4
3. Pipelines 5

III. Rail Transportation 7
A. Characterization of the Rail Transportation Industry 7
1.Industry Characterization 7
2. Industry Size and Geographic Distribution 8
3. Economic Trends 10
B. Operations in the Rail Transportation Industry 12
1. Rail Car Refurbishing and Maintenance 12
2. Locomotive Maintenance 13
3. Transportation 13
C. Raw Material Inputs and Pollution Outputs 13
1. Rail Car Refurbishing and Maintenance 13
2. Locomotive Maintenance 14
3. Transportation Operations 16

IV. Trucking 19
A. Characterization of the Trucking Industry 19
1. Industry Characterization 19
2. Industry Size and Geographic Distribution 21
3. Economic Trends 24
B. Operations in the Trucking Industry 26
1. Truck Terminals and Maintenance Facilities 26
2. Truck Washing 29
3. Tank Truck Cleaning 29
4. Transport Operations 30

C. Raw Material Inputs and Pollution Outputs 30
1. Truck Terminals and Maintenance 30
2. Truck Washing 32
3. Tank Cleaning 32
4. Transport Operations 33

V. Pipelines 37
A. Characterization of Pipelines 37
1. Industry Characterization 37
2. Industry Size and Geographic Distribution 38
3. Economic Trends 40
B. Operations in the Pipeline Industry 43
1. Pigging 44
2. Pipeline Leaks 44
3. Pipeline Inspections 45
4. Glycol Dehydration Units 49
C. Pollution Outputs and Causes of Pipeline Leaks 50
1. Pipeline Failures 50
2. Glycol Dehydration - Inlet Separator 52
3. Breakout Tank Leakage 52

VI. Pollution Prevention/Waste Minimization 55
A. Introduction 55
B. Rail Transportation 55
1. Water Discharge 55
2. Oil 57
3. Waste from Maintenance and Repair Operations 58
4. Paint 59
5. Fueling 59
C. Trucking 60
1. Truck Terminal and Maintenance Facilities 60
2. Vehicle Washing 61
3. Stormwater Pollution Prevention 61
4. Alternatively-Fueled Vehicles 63
D. Pipelines 63
1. Direct Leak Detection Enhancements 63
2. Supervisory Control and Data Acquisition (SCADA) Systems 64
3. Hydrostatic Testing 64
4. Cathodic Protection 65
5. Smart Pigs 65
6. Breakout Tanks 66
7. Proper Training 66

VII. Summary of Applicable Federal Statutes and Regulations 67
A. General Description of Major Statutes 67
B. Industry Sector Specific Regulations 78
1. Rail Transportation 78
2. Trucking 82
3. Pipelines 84
C. Pending and Proposed Regulatory Requirements 88

VIII. Compliance and Enforcement History 89
A. Background 89
B. Compliance and Enforcement Profile Description 89
C. Industry Sector Compliance History 93
D. Comparison of Enforcement Activity Between Selected Industries 98

IX. REVIEW OF MAJOR LEGAL ACTIONS 103
A. Review of Major Cases 103
1. Rail 103
2. Trucking 104
3. Pipelines 105
B. Supplemental Environmental Projects (SEPs) 106

X. Compliance Activities and Initiatives 107
A. Sector-Related Environmental Programs and Activities 107
1. Rail 107
2. Trucking 107
3. Pipelines 109
B. EPA Voluntary Programs 110
C. Trade Association/Industry-Sponsored Activity 113
1. Railroad Tank Car Safety Research and Test Project 113
2. The North American Non-Accident Release Reduction Program 113
3. Environmental Compliance Handbook for Short Line Railroads 114
4. Environmental Training Publications and Videotapes 114
5. Pipeline Integrity Programs - Natural Gas and Hazardous Liquid One-Call Systems 115
6. Summary of Trade Associations 116

XI. Resource Materials/Bibliography 121

List of Exhibits

Exhibit 1: Facility Size Distribution of Rail Industry 9
Exhibit 2: Line-Haul and Switching and Terminal Railroads 9
Exhibit 3: Geographic Distribution of Railroads in the United States 10
Exhibit 4: Tons Originated and Revenue by Commodity 11
Exhibit 5: Rail Car Refurbishing and Maintenance Process Material Input/Pollutant Output . . 14
Exhibit 6: Truck Types 20
Exhibit 7: Facility Size Distribution of Trucking Industry 22
Exhibit 8: Geographic Distribution of Trucking Industry Facilities 23
Exhibit 9: Share of Freight Revenues by Mode of Transportation 24
Exhibit 10: Typical Trucking Maintenance Facility 28
Exhibit 11: Hydrocarbons Emission Sources 33
Exhibit 12: Carbon Monoxide Emission Sources 34
Exhibit 13: Nitrogen Oxides Emission Sources 34
Exhibit 14: Process Material Input/Pollutant Output from Trucking Operations 35
Exhibit 15: Facility Size Distribution of Pipeline Industry 39
Exhibit 16: Geographic Distribution of Oil Pipelines 40
Exhibit 17: Natural Gas Delivery Infrastructure 42
Exhibit 18: Methods of Monitoring Pipelines 48
Exhibit 19: Hazardous Liquid Pipeline Incident Summary by Cause 51
Exhibit 20: Natural Gas Pipeline Incident Summary by Cause 51
Exhibit 21: Storm Water Pollution Prevention Flowchart 62
Exhibit 22: Clean Water Act Requirements Applicable to Railroads 80
Exhibit 23: Heavy-Duty Truck Engine Emission Standards 83
Exhibit 24: Five-Year Enforcement and Compliance Summary for Transportation Sectors . . . 94
Exhibit 25: One-Year Enforcement and Compliance Summary for Transportation Sectors . . . 95
Exhibit 26: Five-Year Enforcement and Compliance Summary by Statute for Transportation Sectors 96
Exhibit 27: One-Year Enforcement and Compliance Summary for Transportation Sectors . . . 97
Exhibit 28: Five-Year Enforcement and Compliance Summary for Selected Industries 99
Exhibit 29: One-Year Enforcement and Compliance Summary for Selected Industries 100
Exhibit 30: Five-Year Inspection and Enforcement Summary by Statute for Selected Industries 101
Exhibit 31: One-Year Inspection and Enforcement Summary by Statute for Selected Industries 102
Exhibit 32: Supplemental Environmental Projects in the Transportation Industry 106

List of Acronyms

AAR - Association of American Railroads
AFS - AIRS Facility Subsystem (CAA database)
AGA - American Gas Association
AIRS - Aerometric Information Retrieval System (CAA database)
ATA - American Trucking Associations
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
LERCs - Local Emergency Response Commissions
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
NAICS - North American Industrial Classification System
NCDB - National Compliance Database (for TSCA, FIFRA, EPCRA)
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NEIC - National Enforcement Investigations Center
NESHAP - National Emission Standards for Hazardous Air Pollutants
NO_2 - Nitrogen Dioxide

NOV - Notice of Violation
NO_X - Nitrogen Oxide
NPDES - National Pollution Discharge Elimination System (CWA)
NPL - National Priorities List
NRC - National Response Center
NSPS - New Source Performance Standards (CAA)
OAR - Office of Air and Radiation
OECA - Office of Enforcement and Compliance Assurance
OPA - Oil Pollution Act
OPPTS - Office of Prevention, Pesticides, and Toxic Substances
OSHA - Occupational Safety and Health Administration
OSW - Office of Solid Waste
OSWER - Office of Solid Waste and Emergency Response
OW - Office of Water
P2 - Pollution Prevention
PCS - Permit Compliance System (CWA Database)
POTW - Publicly Owned Treatments Works
RCRA - Resource Conservation and Recovery Act
RCRIS - RCRA Information System
RPI - Railway Progress Institute
RSPA - Research and Special Programs Administration
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
SPCC - Spill Prevention Control and Countermeasure
TOC - Total Organic Carbon
TRI - Toxic Release Inventory
TRIS - Toxic Release Inventory System
TCRIS - Toxic Chemical Release Inventory System
TSCA - Toxic Substances Control Act
TSDF - Treatment, Storage and Disposal Facility
TSS - Total Suspended Solids
UIC - Underground Injection Control (SDWA)
UST - Underground Storage Tanks (RCRA)
VOCs - Volatile Organic Compounds

TRANSPORTATION INDUSTRY (SIC 40, 42, 46, AND 49)

I. INTRODUCTION TO THE SECTOR NOTEBOOK PROJECT

I.A. Summary of the Sector Notebook Project

Integrated environmental policies based upon comprehensive analysis of air, water and land pollution are a 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 originally 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 to its current form. 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 who 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 (2223-A), 401 M St., SW, Washington, DC 20460. Comments can also be uploaded to the Enviroene World Wide Web for general access to all users of the system. Follow instructions in Appendix A for accessing this system. 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 industry sector described in this notebook approximates the national occurrence of facility types within the sector. In many instances, industries within specific geographic regions or states may have unique characteristics that are not fully captured in these profiles. 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 already covered, please contact the Office of Compliance at 202-564-2395.

II. INTRODUCTION TO THE GROUND TRANSPORTATION INDUSTRY

This section provides background information on the size, geographic distribution, employment, production, sales, and economic condition of the ground transportation industry. Facilities described within this document are described in terms of their Standard Industrial Classification (SIC) codes.

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

This notebook pertains to the transportation industry as classified by the Office of Management and Budget (OMB) under Standard Industrial Classification (SIC) codes 40 (Rail Transportation); 42 (Trucking); and 46, 4922-4924 (Pipelines). Where possible, data are specific to sub-divisions of these SIC codes. In many cases, information about the industries (i.e., rail, trucking, and pipeline) does not directly correlate to SIC distinctions. This is due to various factors, including different reporting requirements and classifications within each industry that are not consistent with SIC delineations. This limitation is discussed throughout the notebook, as appropriate. OMB is in the process of changing the SIC code system to a system based on similar production processes called the North American Industrial Classification System (NAICS). In the NAICS system, Rail Transportation is classified as NAIC 482, Trucking is NAIC 484 and 492, and Pipelines are NAIC 486.

The transportation industry includes other modes of transport such as water and air. Although these are not addressed in this document, they make up an important portion of overall transportation activity in the United States.

The transportation industry affects nearly every American. Either through the necessity of traveling from one place to another, shipping goods and services around the country, or working in a transportation-related job, transportation's share of the national economy is significant. According to the Eno Transportation Foundation, for all transportation-related industries, total transportation expenditures in the U.S. accounted for 16.1 percent of the gross national product in 1993.

II.B. Industry Sectors Analyzed

II.B.1. Rail Transportation

The rail transportation industry includes establishments furnishing transportation by line-haul railroad, and switching and terminal establishments. These terms refer to the distance the particular railroad operation covers — line-haul operations cover longer distances, often connecting two cities, while switching and terminal railroads generally travel

through a single city. For the purpose of this notebook, rail transportation does not include passenger railways serving a single municipality, contiguous municipalities, or a municipality and its suburban areas; these economic units are classified in SIC 41. Other services related to railroad transportation are classified in SIC 47; lessors of railroad property are classified in SIC 6517. The rail SIC sectors covered in this notebook are shown in the following table.

SIC 40 - RAILROAD TRANSPORTATION	
4011	Railroads, Line-Haul Operations
4013	Railroad Switching and Terminal Establishments

II.B.2. Trucking

The trucking industry includes establishments engaged in motor freight transportation and warehousing. This includes local and long-distance trucking or transfer services, and establishments engaged in the storage of farm products, furniture, and other household goods, or commercial goods of any kind. For the purpose of this notebook, the trucking industry also includes the operation of terminal facilities for handling freight, both those with and without maintenance facilities. The trucking SIC sectors covered in this notebook are shown in the following table.

SIC 42 - MOTOR FREIGHT TRANSPORTATION & WAREHOUSING	
4212	Local Trucking Without Storage
4213	Trucking, Except Local
4214	Local Trucking With Storage
4215	Courier Services, Except by Air
4221	Farm Product Warehousing & Storage
4222	Refrigerated Warehousing & Storage
4225	General Warehousing & Storage
4226	Special Warehousing & Storage, NEC*
4231	Terminal & Joint Terminal Maintenance Facilities for Motor Freight Transportation

* NEC = Not Elsewhere Classified

II.B.3. Pipelines

The pipeline industry includes establishments primarily engaged in the pipeline transportation of petroleum and other commodities. Pipelines are classified within two SIC categories, Major Group 46 (Pipelines, except Natural Gas) and Major Group 49 (Electric, Gas, and Sanitary Services). This notebook will integrate the relevant operations from the two groups whenever possible. Occasionally, due to surveys that focus only on one of the groupings, data is segregated. The pipeline SIC sectors covered in this notebook are shown in the following table.

SIC 46 - PIPELINES, EXCEPT NATURAL GAS	
4612	Crude Petroleum Pipelines
4613	Refined Petroleum Pipelines
4619	Pipelines, NEC*
SIC 49 - ELECTRIC, GAS, AND SANITARY SERVICES	
4922	Natural Gas Transmission
4923	Natural Gas Transmission and Distribution
4924	Natural Gas Distribution
4925	Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Distribution

* NEC = Not Elsewhere Classified

Page 6 intentionally left blank.

III. RAIL TRANSPORTATION

III.A. Characterization of the Rail Transportation Industry

III.A.1.Industry Characterization

On February 28, 1827, the State of Maryland chartered the Baltimore & Ohio (B&O) Railroad, inaugurating America's first common-carrier railroad. The B&O marked the beginning of the nation's rail system. By 1850, rail trackage extended over 9,000 miles, mostly in the Northeast. Mirroring the movement of people to the American West, the first transcontinental rail link opened in 1869. By 1916, railroad tracks stretched across 254,000 miles. During the mid-twentieth century, railroads suffered from strict regulation and increased competition from trucks, buses, barges, and planes. By the late 1970s, nearly a quarter of the nation's rail mileage was operated in bankruptcy.

Railroads began to recover economically in 1980 with the passage of the Staggers Rail Act. This legislation partially deregulated the shipment rates charged by railroads, but continued to allow the Interstate Commerce Commission (ICC) to protect shippers from market abuse. The economic balance struck by the Staggers Act renewed the rail industry: by 1990, the rates charged to ship goods by rail had fallen 28.8 percent (adjusted for inflation). Ton-miles of freight moved by rail (reflecting the number of tons hauled and the miles traveled) per employee more than doubled from 1980 levels.

By 1993, the biggest railroads moved a record 1.1 trillion ton-miles of freight with 57 percent fewer employees, 30 percent fewer miles of track, 36 percent fewer locomotives, and 48 percent fewer freight cars than in 1980 (*Association of American Railroads Information Handbook*, 1994).

From an environmental standpoint, it is important to recognize that other industries have grown up around the rail industry. For example, railroads do not generally clean rail tank cars. This is usually performed by service companies on a fee-for-service basis. In addition, rail cars and tank cars are often owned and loaded by the shipper at its facility. Some of the operations described in this section are performed by these types of entities.

III.A.2. Industry Size and Geographic Distribution

Industry Size

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

The Interstate Commerce Commission (ICC) was the Federal agency that regulated many economic aspects of the rail industry. The ICC was abolished by an act of Congress in December 1995, with remaining essential functions transferred to a newly created Surface Transportation Board (STB) within the Department of Transportation. ICC statistics reported prior to the ICC's abolishment are referenced in this document. The ICC classified railroads based on their level of operating revenue. The levels are adjusted annually to reflect inflation. For 1994, the revenue threshold for Class I railroads was $255.9 million or more; Class II railroads had revenues of between $20.5 million and $255.8 million; and Class III railroads had revenues of less than $20.5 million. Since 1979, the ICC required reporting on financial and operating information from Class I railroads only. Class I railroad systems make up approximately two percent of the number of American railroads, but account for 73 percent of the mileage operated, 89 percent of the employees, and 90 percent of freight revenue in the industry. To fill the gap in information left by the ICC's decreased reporting requirements, the Association of American Railroads (AAR) annually surveys non-Class I railroads.

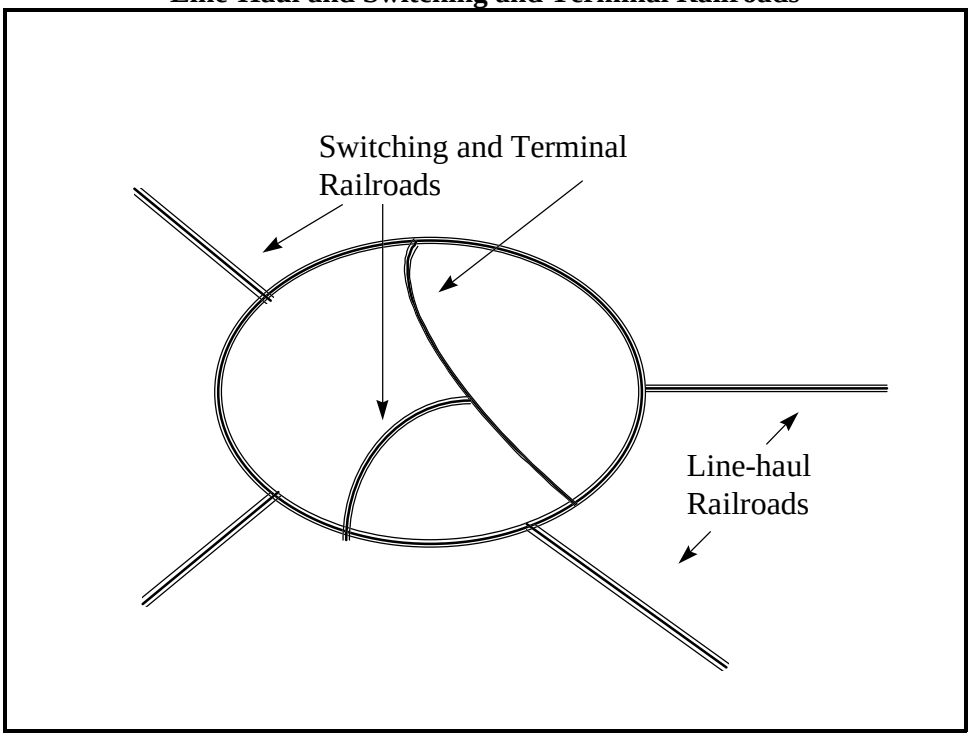
The AAR defines non-Class I railroads as being either regional or local (in contrast to the ICC definitions, which were based strictly on revenue). In 1994, regional railroads were defined as line-haul railroads operating at least 350 miles of road and/or earning revenue between $40 million and $255.9 million. Local railroads included those line-haul operations not meeting the regional criteria, plus switching and terminal railroads. Exhibit 1 summarizes the operating information for Class I, regional, and local railroads. Exhibit 2 depicts the relationship between line-haul railroads and switching and terminal railroads.

Exhibit 1
Facility Size Distribution of Rail Industry

Railroad	Number	Miles Operated	Year-End Employees	Freight Revenue
Class I	**12**	**123335**	**189,240**	**$29,930,893**
Regional	**32**	**19842**	**10,701**	**$1,744,893**
Local	**487**	**25599**	**13,070**	**$1,422,285**
Total	**531**	**168776**	**213,011**	**$33,098,071**

Source: Compiled from Railroad Facts (Association of American Railroads, 1995).

Exhibit 2
Line-Haul and Switching and Terminal Railroads



Geographic Distribution

Reflecting the national importance of railroad transportation, the rail industry is widely dispersed, and the rail system passes through every State in the country. Due to the nature of its operations, however, the rail industry is not characterized on a State-by-State basis, but rather by dividing the country into two halves, separated by the Mississippi River. Freight train-miles measure the movement of a train the distance of one mile, and are based on the distance between terminals and/or stations. Of the 440,896,000 total freight-train miles in the U.S. in 1994, 281,347,000 (64 percent) are West of the Mississippi and 159,549,000 (36 percent) are East of the Mississippi.

Exhibit 3
Geographic Distribution of Railroads in the United States:
Mileage of Class I Railroads*

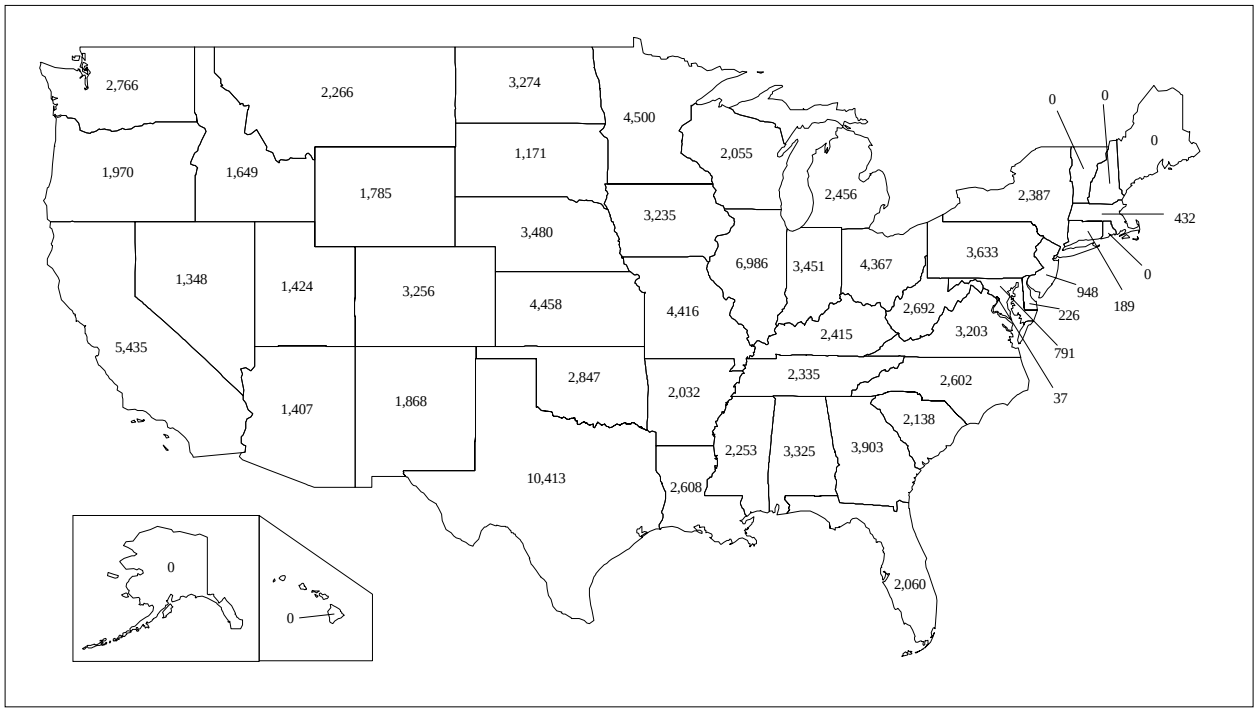


Exhibit 3 illustrates the miles of track associated with major rail routes in the United States.

III.A.3. Economic Trends

The rail industry began to recover from a period of nearly 25 years of steady economic decline in 1980, with the passage of the Staggers Act. This legislation allowed railroad managers to restructure internal operations and meet competitive pressures. The Staggers Act authorized railroads to offer contract rate volume discounts for guaranteed shipments. The railroad is assured minimum volumes, which assists in capital budgeting and operations planning.

The railroad industry rebounded from the effects of widespread flooding in 1993 to post improved financial and operational results in 1994. Class I railroad traffic in 1994 increased 8.2 percent from 1993 to 1.201 trillion revenue ton-miles, reflecting increases in tons originated and longer average hauls. American railroads accounted for 39.2 percent of total inter-city revenue freight ton-miles.

Operating revenue rose 6.9 percent in 1994 to $30.8 billion, while operating expenses rose at a less rapid rate of 4.1 percent to $25.5 billion. Net railway

operating income (defined as operating revenue minus the sum of operating expenses, current and deferred taxes, and rents for equipment and joint facilities) was $3.4 billion, an increase of 34.7 percent over 1993 figures.

Traditionally, the largest segment of railroad freight has been coal. In 1994, coal accounted for 39.1 percent of total tonnage and 21.7 percent of freight revenue. Other major rail commodities in 1994 included chemicals and allied products, motor vehicles and equipment, food and kindred products, and farm products. Exhibit 4 summarizes the tons originated and revenue associated with the shipment of commodities by Class I railroads in 1994.

Exhibit 4
Tons Originated and Revenue by Commodity — 1994*

	TONS ORIGINATED		REVENUE	
Commodity Group	Tons (thousands)	Percent of Total	$(millions)	Percent of Total
Coal	574,213	39.1	7,021	21.7
Chemicals & Allied Products	142,931	9.7	4,559	14.1
Farm Products	130,992	8.9	2,407	7.4
Non-metallic Minerals	106,404	7.2	862	2.7
Food & Kindred Products	87,710	6	2,427	7.5
Lumber & Wood Products	54,192	3.7	1,421	4.4
Primary Metal Products	47,799	3.3	1,165	3.6
Stone, Clay & Glass Products	42,257	2.9	1,009	3.1
Petroleum & Coke	41,564	2.8	928	2.9
Metallic Ores	40,367	2.7	378	1.2
Pulp, Paper & Allied Products	36,583	2.5	1,510	4.7
Waste & Scrap Materials	36,527	2.5	655	2
Motor Vehicles & Equipment	27,792	1.9	3,174	9.8
All Other Commodities	100,666	6.8	4,909	15.1
TOTAL	1,469,997	100	32,424	100

**Information is for Class I railroads only.*
Source: Railroad Facts (Association of American Railroads, 1995).

The 1990's saw an increase in the efficiency of railroads, the transport of different materials such as waste and scrap materials, and a shift from boxcar to the faster intermodal container transport. Intermodal is a term used to describe containerization of freight for easy transloading to different modes of transportation. For example, the same container may be transferred from a truck to a train, with both modes of transportation equipped with locks or other mechanisms to hold the container in place. In rail transport, there is a growing use of truck containers and trailers.

III.B. Operations in the Rail Transportation Industry

This section provides an overview of commonly employed operations in the railroad industry. This discussion is not exhaustive; the operations discussed are intended to represent the major sources of environmental hazards from railroad transportation practices. These operations are grouped into three categories: rail car refurbishing and maintenance; locomotive maintenance; and transportation operations. Rail car refurbishing and maintenance operations consist of cleaning the interiors and exteriors of the rail cars, striping and painting the rail cars, and maintaining/repairing rail car parts. Locomotive maintenance operations include the cleaning, repair, and maintenance of the engine and locomotive car. Transportation operations include all activities associated with the movement of locomotives and cars over a section of track, including the loading and unloading of freight.

III.B.1. Rail Car Refurbishing and Maintenance

Rail car refurbishing and maintenance consists of cleaning the interiors and exteriors of rail cars, refurbishing operations (i.e., striping and painting rail cars), and other maintenance operations (i.e., brake and wheel set repair).

The initial cleaning of rail cars involves two steps: a mechanical cleaning and a water wash. Mechanical cleaning is the physical shaking and vibrating of the rail cars to loosen dirt and other debris. Typically, dirt and debris fall through a steel grate in the floor of the maintenance facility and are intermittently collected for disposal. The wash step usually consists of a high pressure water cleaning, collection of wastewater, and wastewater treatment at an on-site treatment facility.

Refurbishing operations are not employed at all rail facilities. Many railroad establishments contract out refurbishing work. Refurbishing operations usually start with paint removal using a steel grit blast system or other method. Paint chips and grit are collected through a steel grate in the floor and the mixture is conveyed to a cyclone and filter system for separation of reusable grit and paint. Once the original paint has been removed from the rail cars, new paint is applied to the clean rail car surface.

Rail cars have brakes and wheel sets that must be maintained and sometimes repaired or replaced. Brake and wheel set maintenance and repair operations consist of disassembly, cleaning, and repair; or disassembly and replacement of damaged parts. When wheel sets and air brakes are to be replaced or rebuilt, the cars must first be disassembled. Axles that can be reused are washed in a caustic solution to remove grease and dirt. External debris is removed from the air brakes or wheels using a grit or bead blast system or other method. Parts cleaning may also include the removal of paint and

cleaning with solvents or caustics. Repaired brakes or wheel set may require repainting with spray guns.

III.B.2. Locomotive Maintenance

Locomotive maintenance includes, but is not limited to, the following operations: brake repair; large scale equipment cleaning operations (e.g., locomotive car); small scale cleaning operations (e.g., engine parts); hydraulic system repair, locomotive coolant disposal, metal machining, oil filter replacement and used oil management, painting and metal finishing, paint stripping, and spent battery management.

Locomotive maintenance operations usually take place at facility that is owned and maintained by the railroad. Most used oil is recycled or reused in energy recovery. Most locomotive batteries are recycled.

III.B.3. Transportation

Transportation operations include all activities associated with the movement of locomotives and cars over a section of track. These activities include fueling and hazardous material transport.

III.C. Raw Material Inputs and Pollution Outputs

III.C.1. Rail Car Refurbishing and Maintenance

Pollutant outputs from rail car refurbishing and maintenance are generally in the form of wastewater from preliminary cleaning of interiors and exteriors, and hazardous wastes generated from painting, paint removal, and the cleaning of parts. Exhibit 5 shows typical hazardous wastes generated including: spent solvents and solvent sludges; spent caustics and caustic sludges; paint chips; and paint sludges. Volatile organic compound (VOC) air emissions are also generated during the use of solvents and paints. Wastewater from preliminary cleaning of the rail cars and spent caustic solution is often treated in an on-site wastewater treatment system and then discharged to a publicly owned treatment works (POTW). Hazardous wastes are typically drummed and shipped off site as RCRA hazardous waste. Spent solvents, however, can be sent off site for reclamation. Brake and wheel set repair is not a significant environmental hazard, but discarded brake shoes may be regulated under the Resource Conservation and Recovery Act (RCRA) in some States.

Exhibit 5
Rail Car Refurbishing and Maintenance Process Material Input/Pollutant Output

Process	Material Input	Waste
Oil and Grease Removal	Degreasers, engine cleaners, aerosol, solvents, acids/alkalies	Ignitable wastes, spent solvents, combustible solids, waste acid/alkaline solutions, used oil
Car and Equipment Cleaning	Degreasers, solvents, acids/alkalies, cleaning fluids	Ignitable wastes, spent solvents, combustible solids, waste acid/alkaline solutions, rags
Rust Removal	Strong acids, strong alkalies	Waste acids, waste alkalies
Paint Preparation	Paint thinners, enamel reducers, white spirits	Spent solvents, ignitable wastes, ignitable paint wastes, paint wastes with heavy metals, rags
Painting	Enamels, lacquers, epoxies, alkyds, acrylics, primers	Ignitable paint wastes, spent solvents, paint wastes with heavy metals, ignitable wastes, rags
Spray Booth, Spray Guns, and Brush Cleaning	Paint thinners, enamel reducers, solvents, white spirits	Ignitable paint wastes, heavy metal paint wastes, spent solvents
Paint Removal	Solvents, paint thinners, enamel reducers, white spirits	Ignitable paint wastes, heavy metal paint wastes, spent solvents, rags

Source: U.S. EPA Office of Solid Waste, 1993.

III.C.2. Locomotive Maintenance

Each of the locomotive maintenance operations listed above is a potential source of pollution outputs. Following are brief discussions of the wastes that can be generated by these locomotive maintenance operations.

Brake Repair

Brake repair does not pose a significant environmental hazard, but discarded brake shoes may be regulated under RCRA in some States. Some older brake shoes contain asbestos and may require special disposal.

Cleaning Operations

Sludges created as a result of cleaning operations may be characterized as hazardous. If so, hazardous waste regulations must be complied with prior to disposal. Waste waters from locomotive cleaning can contain elevated levels of oil, grease, suspended solids (a measure of particulate matter in water) and pH (acidity or alkalinity of water). These substances are regulated water pollutants, so wash waters must be processed in a way that is consistent with Clean Water Act (CWA) requirements. In most cases, the State has authority for enforcement of CWA provisions and permit administration. Treatment of wash waters may be required before release to a local sewer system or an outfall regulated by a National Pollutant Discharge Elimination

System (NPDES) permit. The type of cleaning solution used may also pose an environmental concern. If mineral sprits or other chemicals are used to clean equipment, a variety of environmental compliance issues may result. Mineral sprits are hazardous substances that have environmental compliance requirements for storage, handling, and disposal.

Hydraulic System Repair

Used hydraulic fluids are listed as used oils under RCRA. The major compliance issues associated with hydraulic system repair involve handling and disposing of the hydraulic fluid, spill containment, and storage. Environmental damage can occur from waste oil seepage into the soil, waste oil run-off into water bodies during storms, and other contamination methods.

Coolant Disposal

Locomotive cooling systems do not contain automotive type ethylene glycol-based antifreeze. Because of this, locomotive cooling systems may need to be drained when engines are shut down during road operation in cold weather. Failure to do so can result in serious engine damage due to freezing of the coolant. To protect the cooling system from corrosion, locomotive coolants contain a dilute additive package, which is basically a mixture of sodium borate and sodium nitrate. The additive package usually contains a dye, to help identify leaks and ensure the cooling system is protected. The compounds are diluted in the cooling system to approximately one to three percent. The concentrations of the individual corrosion inhibitors is a fraction of one percent. Used coolant must be disposed of properly.

Metal Machining

Metal machining and punching can generate regulated wastes that may contaminate the environment from direct release into water or from stormwater runoff. Pollutant-carrying stormwater runoff may violate the CWA. Coolants from metal multi-punch operations may be regulated substances under RCRA or local waste regulations and may require special handling.

Oil Filter Replacement and Used Oil Disposal

A variety of environmental issues need to be considered when performing any oil handling activities such as oil changes or oil filter replacement to locomotives. Oil can drip or spill during maintenance and repair operations, particularly during oil filter replacement operations. Oil releases to the environment from oil drippage can also occur during locomotive tie-up. Oil filter and used oil replacement are generally conducted indoors at locomotive maintenance facilities and locomotive idling is conducted, to the extent

practical, over track pans, absorbent materials, or other collection devices. This makes it possible for most facilities to collect used oil and oil filters before they leak or spill oil into the environment. Some facilities have routed track pan drains to oil-water separation systems. Used oils are not typically categorized as hazardous wastes under RCRA, but used oils have strict disposal requirements in some States.

Painting

Painting operations can be significant sources of environmental harm. Air pollution from the evaporation of chemicals contained in the paint (e.g., solvents) can contribute to smog and worker health and safety problems. Solid and hazardous wastes from the painting process (e.g., paint-covered cloths) may contaminate water and soil if not disposed of properly. Whether hazardous wastes are generated during painting depends upon the type of paint applied. Typically, latex paints and related paint wastes are classified as non-hazardous. Ignitable or solvent-based paint or paint thinner wastes are classified as hazardous. Air pollution issues are typical concerns only for large-scale painting operations involving paint booths and associated air ducting.

Battery Storage and Disposal

Used battery storage and disposal can be a significant environmental liability for railroads since many spent signal batteries are classified as hazardous wastes under RCRA. Most locomotive batteries are lead acid and recycled as non-hazardous solid waste.

III.C.3. Transportation Operations

The three main transportation operations that pose potential environmental problems are fueling, hazardous material transport, and oil and coolant releases during transport.

Fueling Operations

Air pollution and fuel spillage are the major environmental concerns associated with fueling operations. While air emissions are a problem for volatile petroleum products such as gasoline, the railroad industry uses very little gasoline on site. Their largest fuel product is diesel fuel, which is less volatile. If gasoline is dispensed on site, it could contribute to local air quality problems, and may require permitting and control. Spilled fuel may contaminate soil, ground water, or water bodies. Some super tanker fueling systems deliver fuel at approximately four gallons per second, so even a small connection malfunction can result in a large spill event. Filling and maintenance of fuel storage may require air quality permitting in some States.

Hazardous Materials

The spilling/leaking of hazardous materials is a significant environmental concern for the rail industry. According to DOT statistics, approximately 16 percent of all hazardous material releases to the environment in 1988 were from rail transport. In addition to being harmful to the environment, hazardous material spills and releases are subject to a variety of environmental regulations and may result in costly cleanups or fines.

Valve leakage or safety valve releases can be sources of material spills on pressurized and general service tank cars or other hazardous material containers such as covered hoppers, intermodal trailers/containers, or portable tanks. These leaks can manifest themselves as odors or vapors clouds from tanker top valves; spraying or splashing from the tanker top valves; wetness on the side of the car; or drippage from the bottom outlet valve. In intermodal cars, spills/leaks can result from improper packing and resultant load shifting during transport. Intermodal container doors and other openings can be spill/release sources. Unloading and transfer facilities are high potential spill and release areas. It should be noted that it is the responsibility of the shipper to properly secure the transportation vehicles to prevent these types of occurrences. In the latest effort to identify the source of these leaks, in 1995 the Association of American Railroads (AAR) introduced the non-accident release (NAR) program. The purpose was to identify and report these releases so that corrective measures could be taken to reduce them.

If hazardous materials are transported, DOT requirements regulate car inspections, car placement, switching, and shipping papers (e.g., waybills, manifests). If hazardous materials pass through a facility, rail containers should be inspected for proper labeling, valve cover placement, any signs of leakage, proper car stenciling, and fulfillment of other DOT requirements. Placarding and/or labeling is required for all containers carrying hazardous materials.

Oil and Coolant Releases

Oil and coolant releases from the locomotive engine to the environment can occur during transport operations. Oils can contaminate surface water, ground water, and soil, and expose the rail facility to punitive fines from violations of a variety of environmental statutes. Coolants may be regulated substances under RCRA or local waste regulations.

Page 18 intentionally left blank.

IV. TRUCKING

IV.A. Characterization of the Trucking Industry

IV.A.1. Industry Characterization

Construction of the nation's first transcontinental highway, the Lincoln Highway (U.S. 30), started in 1912. It took 20 years to complete the 3385-mile road between New York City and San Francisco. In 1956, the Federal Aid Highway Act was signed into law, authorizing the 41,000-mile National System of interstate and defense highways to be completed by 1972 at a cost of $42 billion. In 1982, landmark legislation boosted Federal spending for highway construction and repair work. By 1986, more than 97 percent of the 42,500-mile interstate highway system was open to traffic as the program entered its 30th year. The system represented a total Federal and State investment of more than $120 billion. Currently, there are 44,700 miles of interstate highways with 132,000 miles of other arteries in the United States.

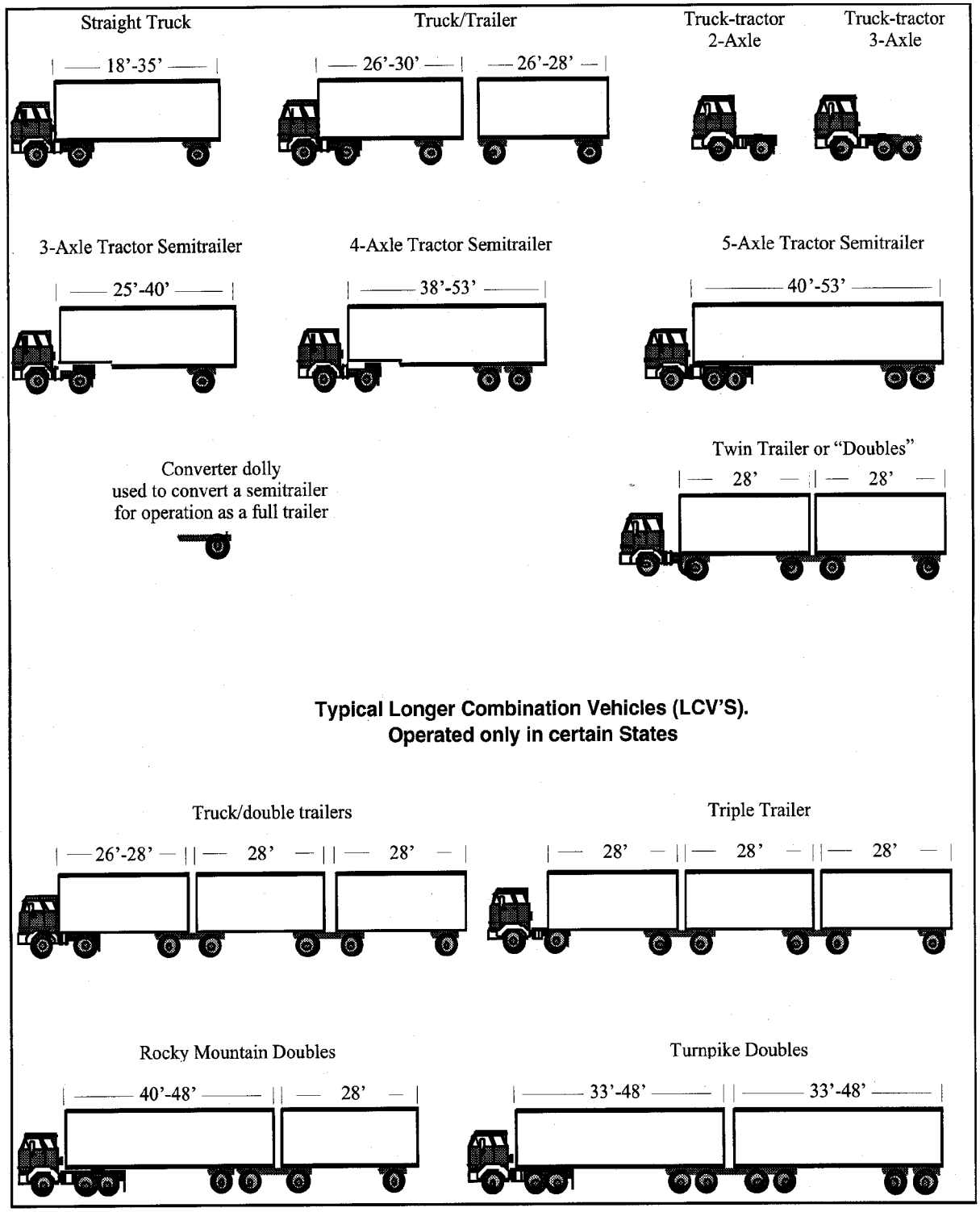
The types of trucks that travel these roads are diverse, ranging from small pickup trucks to large tractor trailer combination units. Methods of quantifying these vehicles vary as well. This section presents information from a variety of sources, including the Census Bureau and trucking associations. Different groups use various benchmarks to quantify the trucking industry. This document does not attempt to reconcile these differences, but rather reports the data as they are maintained by each source.

According to the American Trucking Associations (ATA), the total number of commercial trucks in 1993 was 16.2 million, with approximately 3.9 million commercial trailers registered in the same period. The ATA reports 322,739 interstate motor carriers on file with the U.S. Department of Transportation (DOT) as of January 5, 1995. Eighty-two percent of those operate fewer than six trucks, and 96 percent operate 28 or fewer trucks. 59,310 for-hire carriers were authorized by the Interstate Commerce Commission (ICC), to haul goods.

Types of trucks and trucking establishments are defined by various classifications. Exhibit 6 shows the shape and size of different truck types. This diagram does not include smaller trucks such as pickups, panels, vans, and utility trucks which are usually not counted in industry statistics because they are often used for personnel purposes.

In general, trucking establishments falls into two broad categories: private and for-hire. Private carriers are shippers, manufacturers, merchants, and others who use their own vehicles or leased trucks under their direct control for moving their own goods. For-hire carriers are compensated for providing transportation of freight belonging to another entity.

Exhibit 6
Truck Types



There are three types of interstate for -hire carriers: common, contract, and exempt carriers. Common carriers transport freight for the general public at published rates. Contract carriers are those in stipulated types of operations, such as trucks used only to carry newspapers, or vehicles used incidentally to support air transport. (*Motor Trucking Engineering Handbook*, James W. Fitch, Society of Automotive Engineers, 1994).

For-hire carriers regulated by the ICC were classified by size of operating revenue. The ICC was abolished by an act of Congress in December 1995, with remaining essential functions transferred to a newly created Surface Transportation Board (STB) within the Department of Transportation. ICC statistics reported prior to the ICC's abolishment are referenced in this document. As of January 1, 1994, the ICC defined Class I carriers as those establishments with annual revenues greater than $10 million, Class II carriers with annual revenues between $3 and $10 million, and Class III carriers with annual revenues of less than $3 million.

IV.A.2. Industry Size and Geographic Distribution

As discussed in Section IV.A.1 above, variation in facility counts occur across data sources due to many factors, including reporting and definition differences. This document does not attempt to reconcile these differences.

Industry Size

Trucking companies are diverse, ranging from large employers to private transporters who work for themselves and have no additional employees. A concise discussion of the trucking industry is complicated by the different methods used by the Census Bureau, the ICC, and trucking associations to estimate the size of the trucking industry. In some cases, as with most census data, only those companies with payrolls – those that pay drivers who were not also owners – are tracked. In addition, only those trucking companies formerly regulated by the ICC were required to report data.

The trucking industry consists of approximately 111,000 establishments with payrolls, employing nearly 1.6 million people. This does not include small, independent truckers who have no employees other than themselves. The total number of truck drivers holding commercial drivers licenses as of June 1995 exceeded 6.5 million. In 1993, these drivers drove 656.6 billion miles (American Trucking Trends, 1995). According to the American Trucking Associations (ATA), 7.8 million people were employed throughout the economy in jobs that relate to trucking activity and 2.8 million heavy-duty truck drivers (including linehaul, local, courier, government, etc.) were employed in 1994. In 1993, $226.9 billion was paid in wages relating to trucking activity.

Over 88 percent of trucking companies are small businesses, as defined by the Small Business Administration. According to the ATA, of the 359,787 interstate motor carriers on file with the Office of Motor Carriers, 82 percent operate six or few trucks, while 96 percent operate 28 or fewer trucks (as of February 1996).

Exhibit 7 illustrates the facility size distribution for those motor freight transportation and warehousing facilities with payrolls, based on the latest complete Census Bureau data (1992).

Exhibit 7
Facility Size Distribution of Trucking Industry*

Industry	SIC Code	Total Employees	Total Number of Facilities	Employees per Facility
Local Trucking Without Storage	4212	354,742	49,870	7.11
Trucking, Except Local	4213	758,435	40,821	18.6
Local Trucking with Storage	4214	64,417	4,512	14.3
Courier Services, Except by Air	4215	307,061	5,966	51.5
Farm Product Warehousing and Storage	4221	6,497	584	11.1
Refrigerated Warehousing and Storage	4222	18,963	929	20.4
General Warehousing and Storage	4225	49,091	6,753	7.3
Special Warehousing and Storage, NEC*	4226	20,594	1,452	14.2
Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation	4231	295	21	14.1
Total		1,580,095	110,908	14.2

Source: Compiled from official 1992 statistics of the U.S. Bureau of the Census.
**Facilities with payrolls only.*

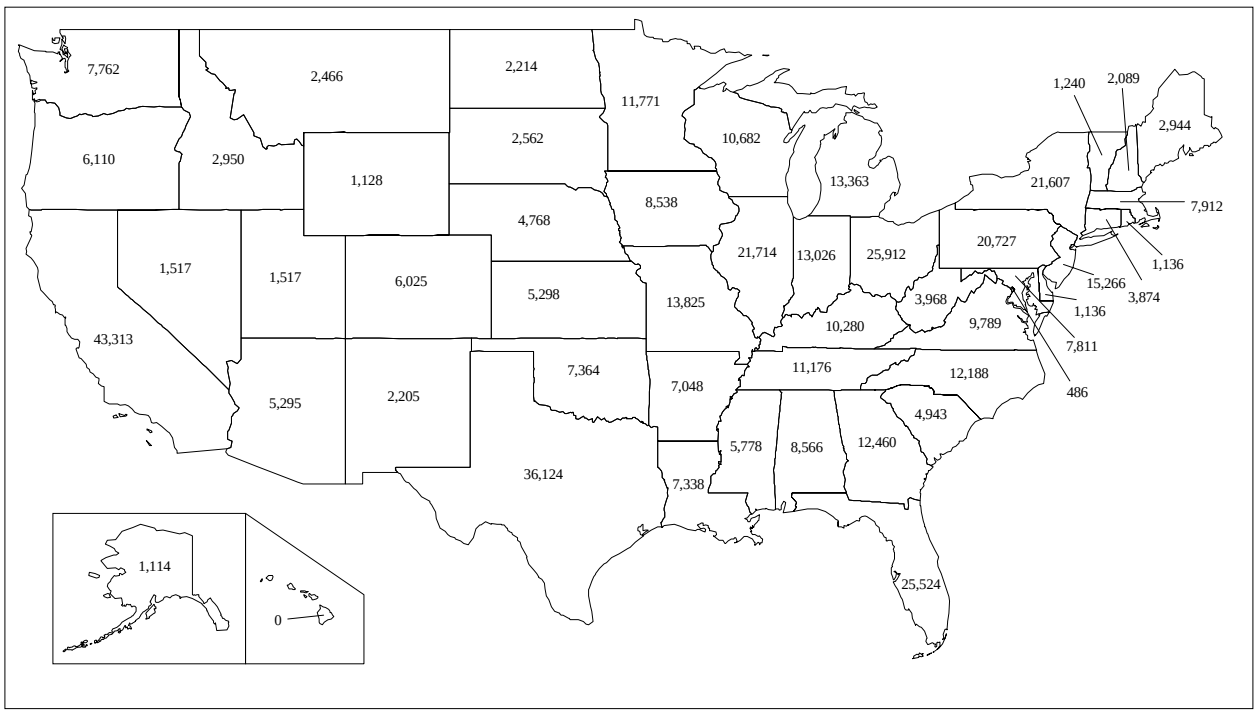
As demonstrated in Exhibit 7, the majority of establishments and employees in the trucking industry which maintain payrolls are classified in SIC Code 4212, Local Trucking Without Storage. This category includes dump trucking, general freight, and garbage and trash collection. Trucking, except local (SIC 4313), accounts for most of the other establishments and persons employed in the trucking industry. General freight trucking accounts for most

trucking industry facilities.

Geographic Distribution

Reflecting the national importance of highway transit, the trucking industry is widely dispersed, with every State reporting the existence of at least 400 industry establishments (U.S. Bureau of the Census). The numbers in Exhibit 8 include both businesses with and without payrolls. All businesses covered by the economic censuses are included, except direct sales retail and tax exempt service businesses.

Exhibit 8



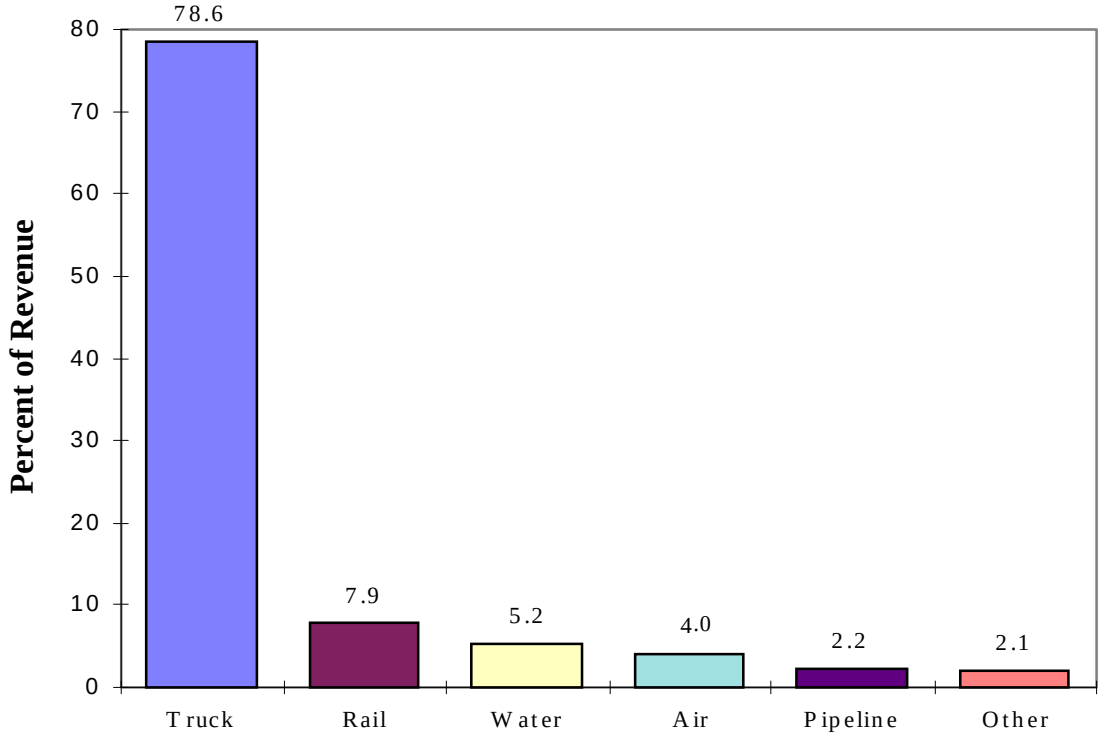
Geographic Distribution of Trucking Industry Facilities

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

Although the trucking industry is highly represented throughout the country, motor freight facilities are most heavily concentrated around the Great Lakes States (Minnesota, Wisconsin, Illinois, Indiana, Michigan, and Ohio). Reflecting the important trade routes between these States and the Northeast, this concentrated area extends through Pennsylvania and New York. The five largest States in terms of number of trucking establishments with payrolls are California, Texas, Ohio, Florida, and New York.

Exhibit 8 illustrates the number of trucking establishments as recorded by the Bureau of the Census. These numbers do not correlate to those presented in Exhibit 9, also from the Bureau of the Census, due to the different scope of the census data.

Exhibit 9
Share of Freight Revenues by Mode of Transportation



Source: American Trucking Trends, 1995

IV.A.3. Economic Trends

In terms of revenue, trucking accounts for the vast majority of total U.S. freight services. Exhibit 8 illustrates the trucking industry's enormous share of total freight revenue. This reflects trucking's higher revenues-per-ton and per-ton mile (a ton-mile equals the movement of one ton of weight over a one mile distance), compared to the rail and barge sectors, which generally carry lower-valued bulk commodities. Thus, the trucking industry's share of tons shipped (43 percent) and ton-miles (27 percent) is much lower than its share of revenues (U.S. Industrial Outlook 1994 – Transportation).

The growing use of rail transport and rail transport of truck containers and trailers has offered economic competition to motor freight companies. According to the ATA, by the year 2003, trucking will lose 1.9 percent of its share of total 1993 revenue – primarily to air and rail intermodal – but trucks will still account for 76.7 percent of freight transportation revenue. Reportedly, the estimated profit margin of the companies and independent

truckers averages one to two percent.

The following economic information is from the Census Bureau's *1993 Motor Freight Transportation and Warehousing Survey Report*. As with the census data conveyed in Exhibit 7, this survey excludes private motor carriers that operate as auxiliary establishments to non-transportation companies, as well as independent owner-operators with no paid employees. As a result, the dollar volume estimates and estimates of year-to-year percentage change presented in this report should not be interpreted as representing measurements of total trucking industry activity.

Revenue in 1993 for the for-hire trucking and courier services industry (excluding air courier services) was estimated at $135.9 billion, up six percent from 1992. Long-distance trucking, which accounted for approximately 75 percent of all motor carrier revenue, was up 5.6 percent over 1992. Local trucking revenue rose 9.6 percent from 1992 to approximately $31.6 billion in 1993. Truckload shipments accounted for approximately 61 percent of motor carrier revenue in 1993 and increased 6.8 percent from 1992.

Nearly 48 percent of motor carrier revenue comes from transporting manufactured products, such as furniture, hardware, glass products, textiles and apparel, and the delivery of small packages. Revenue in 1993 from the transport of metal products rose 8.8 percent from 1992. Expenses totaled $127.9 billion in 1993, up 5.8 percent from 1992. Revenue for the courier services industry, excluding air courier services (SIC 4215), rose 7.7 percent in 1992 to approximately $20.2 billion in 1993. The Truck Inventory and Use Summary (TIUS), part of the Census Bureau's Census of Transportation, provides data on the physical and operational characteristics of the U.S. truck population. According to TIUS, an increasing proportion of trucks are being used mainly for "personal transportation," i.e., commuting to work, outdoor recreation, etc. In 1992, almost 70 percent of all trucks were identified as being for personal use; in 1987 the proportion was 66 percent, and in 1982 only 57 percent.

Annual payroll accounted for approximately 33 percent of all trucking expenses, totaling $41.5 million for 1993. Purchased transportation rose 7.6 percent from 1992, while the cost of fuels and maintenance and repair expenses rose 6.7 percent and 7.0 percent, respectively.

Public Warehouse Services

Total operating revenue for public warehousing services increased 8.6 percent from 1992 to $8.1 billion. Total operating expenses rose 8.4 percent from 1992 to $6.8 billion. Employer contributions to employee benefit plans

were up to 7.2 percent and represented almost eight percent of the warehousing industry's total operating expenses.

Over 50 percent of all revenue was from general warehousing and storage (SIC 4225). Revenue from refrigerated warehousing and storage (SIC 4222) increased 3.3 percent to $1.7 billion, and accounted for 21 percent of the warehousing industry's total operating revenue in 1993.

Revenue in 1993 for farm product warehousing and storage (SIC 4221), which represents approximately eight percent of the warehousing industry's total operating revenue, increased 9.2 percent to $686 million from 1992, while expenses for the industry were up 7.8 percent to $593 million over the same period.

IV.B. Operations in the Trucking Industry

This section provides an overview of commonly-employed processes within the trucking industry, broken down by operations. This discussion is not exhaustive; the operations discussed here are intended to represent the major sources of environmental hazards from trucking operations. The operations discussed include materials transport, truck maintenance, truck washing, tank truck cleaning, and transport operations.

IV.B.1. Truck Terminals and Maintenance Facilities

Many segments of the trucking industry operate their own truck terminals and maintenance facilities. Truck terminals are places where trucks come to consolidate and transfer loads of shipped goods. Terminals typically have large parking and staging areas for tractors and trailers, and a loading dock, from which freight is moved between trailers. Truck maintenance facilities, which may be located on the same property as the maintenance facilities, which may be located on the same property as the terminals, perform routine vehicle maintenance activities which are similar to those performed in the automotive service industry. These activities include replacement of fluids (e.g., motor oil, radiator coolant, transmission fluid, brake fluid), replacement of non-repairable equipment (e.g., brake shoes/pads, shocks, batteries, belts, mufflers, electrical components, water pumps),and repair of fixable equipment (e.g., brake calipers/rotors/drums, alternators, fuel pumps, carburetors). Some maintenance terminals also have fueling facilities, repair vehicle bodies, wash trucks, and perform painting operations.

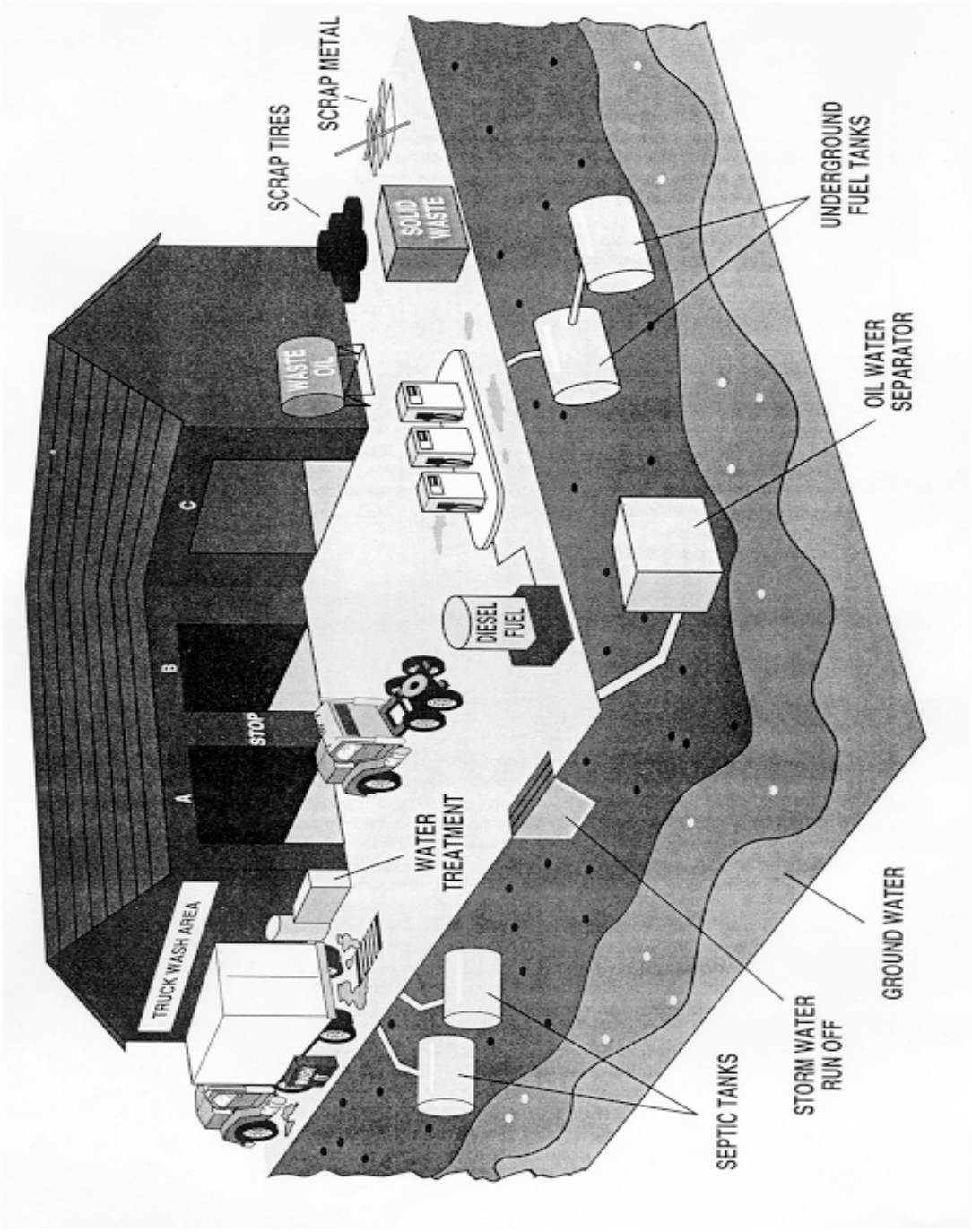
Truck maintenance involves the regular changing of a number of fluids. Automotive fluids used to maintain trucks include brake fluid, transmission fluid, gear oil, radiator fluid, and motor oil. Truck parts removed for repair often require cleaning to allow for better visual inspection of the parts and to remove contaminated lubricants/greases that would lead to early failure of

the repaired part. Rags are often used to clean up a fluid spill or to wipe grease from a part being repaired. If necessary, clean lubricants/greases are applied to the parts during reassembly.

Parts cleaning often involves the use of a parts washer. Washers used in the trucking industry include solvent parts washers, hot tanks, and jet spray washers. A solvent parts washer recirculates solvent continuously from the solvent drum to the solvent wash tray where the parts are cleaned. Old solvent is typically replaced with fresh solvent on a monthly basis. The solvents used for parts cleaning contain petroleum-based ingredients or mineral spirits. Carburetor cleaner contains methylene chloride. Electrically heated tanks are also used to clean parts. Parts are placed in a tank of hot aqueous detergent or caustic solution to achieve cleaning and air or mechanical agitation is employed to increase cleaning efficiency. Jet spray washers also use hot aqueous solutions for cleaning, but in this application, rotating jets spray the parts with cleaner. Both hot tanks and jet sprays are usually serviced monthly by removing the spent cleaner and sludge and recharging the washer with fresh detergent. Sludge that accumulates in the waste sump of the pressure spray cleaning bays and in area wash-down clarifiers is often taken off site to a local municipal landfill.

Truck maintenance facilities may also perform fueling operations. Fueling facilities typically dispense diesel fuel. Exhibit 10 shows the layout of a typical truck maintenance facility.

Exhibit 10
Typical Trucking Maintenance Facility



Source: Stormwater Pollution Prevention Manual for the Trucking Industry ATA, 1993

IV.B.2. Truck Washing

Trucks can be washed manually or by using a fixed wash bay system. Dry washing, by using dry rags and a spray bottle, can be an option for manual truck washing. Manual washing includes hand-held wash systems, hand-held wand systems, and hand brushing with soap. Fixed bay washing operations involve fixed equipment, such as drive-through wash racks or gantry wash systems. Typically, wash bay systems include chemical storage facilities, chemical and water application arches, water reclamation systems, and waste water treatment systems.

IV.B.3. Tank Truck Cleaning

Tank trucks typically haul a wide range of liquid and dry bulk commodities, including food-grade products such as milk and corn syrup, and industrial process chemicals. Many aspects of transportation and labeling, as well as spills and releases of these materials, are regulated by the Research Special Programs Administration (RSPA) of the DOT. Because the material being transported is loaded directly into a tank truck without any sort of container, these trucks require special cleaning to remove residual cargo. Washing, rinsing, and drying methods vary depending on the facility's equipment, the last cargo carried, and the next cargo to be carried. Some cargoes may require only a water rinse, while others may need a series of wash and rinse cycles using different wash solutions.

Prior to tank cleaning, residual cargo, or heel, is removed. Heel volume from tank trucks is typically five to ten gallons (EPA Office of Water and *Preliminary Data Summary for the Transportation Equipment Cleaning Industry*, U.S. EPA, 1989, and EPA Office of Water, Engineering Analysis Division, 1995). Heel can be sent to an off-site Treatment Storage and Disposal Facility (TSDF) or can be treated on site if it is an aqueous solution. If organic, it may be put into containers for later treatment as a hazardous waste.

Tank truck washing is performed either manually with hand-held sprayers, or automatically with high pressure spinner nozzles or "butterworths." With automatic washing, high pressure spinner nozzles are inserted through the main tank hatch, and wash solution and rinse water is automatically sprayed onto the tank surface at 100-600 p.s.i. while rotating around vertical and horizontal axes.

Washing solution may consist of detergent solution, caustic solution, organic solvents, or steam. Any wash solution can be used with either the manual or automatic washing method, although worker safety is a concern when manually spraying solvent and caustic wash solutions. Some facilities have the capability to recycle washing solutions within a closed system, and

periodically change to fresh water solutions. Tanks can be rinsed with hot or cold water, and dried with passive or forced air.

IV.B.4. Transport Operations

Transport operations refer to all operations performed by a truck while on the road. These operations include loading and unloading cargo, running the truck engine, and fuel consumption. Commercial trucking transportation operations consumed approximately 36 billion gallons of oil in 1993, or about 63 percent of total U.S. consumption. This figure, according to the ATA, includes 23 billion gallons of diesel fuel and 13 billion gallons of gasoline.

IV.C. Raw Material Inputs and Pollution Outputs

IV.C.1. Truck Terminals and Maintenance

Materials Spills and Releases

In truck terminals, spills and releases of hazardous material shipments are the main environmental issue of concern. Hazardous waste transportation is a highly regulated and specialized segment of the trucking industry, covered by extensive EPA (40 CFR) and DOT (49 CFR) regulations while the waste is in transit. Due to the additional insurance and safety requirements, the majority of general freight trucking companies do not have the authority nor desire to transport hazardous waste.

Truck Maintenance

Maintenance facilities handle vehicle fluids that are used during normal trucking operations, including oil, transmission fluid, brake fluid, and antifreeze. The quantities of waste materials vary depending on the size of the facility and the types of maintenance activities that are performed.

Oil, transmission fluid, and other liquids that are replaced, must be collected and stored for later disposal. The storage, disposal, and transportation of used oil is regulated by EPA and is a primary environmental concern in the trucking industry. Generators of used oil must meet on-site management standards for storage prior to shipment off-site or burning on-site for energy recovery. Storage containers must be in good condition without leaks and clearly labeled with the words "USED OIL." If a release occurs (spill or leak), the generator must stop and contain the release, clean up and properly manage the released used oil, and repair or replace any leaking containers.

Fluids such as antifreeze must be evaluated for hazardous waste

characteristics and dealt with accordingly if spilled or released. Antifreeze consists of water and ethylene glycol. Neither of these ingredients demonstrates hazardous waste characteristics, however, as a result of use, the antifreeze may become hazardous based on metals or benzene content.

Sludge that accumulates in the maintenance facility floor drains can contain oil, grease, solvents, and dirt from routine operations. The hazardous/non-hazardous nature of the sludge will determine the applicable disposal regulations.

Truck Repair

Repair activities typically produce several types of waste materials in addition to the parts themselves (i.e., batteries, brake parts, etc.), including oil, coolants, and solvents. Oil rags can be considered a "used oil" waste. Shop rags which are used to wipe up a hazardous waste (i.e., paint thinner) may be a hazardous waste.

Spent lead-acid batteries are exempt from regulation as a hazardous waste provided they are recycled. Generators of spent lead-acid batteries may store and/or transport those batteries without waste activity notifications or permits as long as the batteries are ultimately reclaimed. In some States, a new battery cannot be purchased without the return of a used battery.

Used tires are a significant waste produced at truck maintenance facilities. Old tires are not acceptable for landfill disposal unless they have been shredded or quartered. Tires can be returned to a central location for processing or recycling. Used truck tires are usually retreaded or recycled. Used tires otherwise ready to be scrapped might be categorized as hazardous waste.

Parts Washing

Parts washing solvents and residual liquids such as petroleum distillates, mineral spirits, and naphtha are all considered hazardous wastes due to ignitability. Filters removed from parts whose units may also be hazardous due to toxicity (presence of metals and/or benzene) and ignitability. Even filters which are not hazardous may still not be acceptable for landfill disposal due to hydrocarbon content.

Air emissions occur when the solvent is sprayed onto parts and when parts are improperly drained of solvent. Many air quality control districts specify that equipment cannot be designed so as to provide a fine spray mist (which leads to high evaporation rates) and that parts must be properly drained before removal from the washer. For washers in which the solvent bath is always exposed to the atmosphere (i.e., wash tanks), the lid must be kept

closed whenever the tank is not in use.

Fueling Operations

Fueling operations may result in fuel spills or releases. Waste diesel fuel may be a hazardous waste because its flash point ranges from 120°F to 160°F and because it may contain concentrations of heavy metals and benzene in excess of regulatory limits. Diesel fuel spills and releases – both underground and above ground – are a significant concern in the trucking industry in terms of stormwater run-off and land contamination.

IV.C.2. Truck Washing

The waste streams generated by vehicle washing operations are variable. If vehicles are washed often, they enter the washing operation relatively clean, and the waste wash water generated is cleaner thana waste stream generated from washing vehicles that are washed only occasionally. The technology used to wash the vehicle will also affect the waste stream. For example, if a two-step acid-detergent wash is used, acid or salts will be found in the waste stream that would not be present if the vehicle was steam cleaned. Season and location can also affect the waste stream generated, for example, vehicles in the northeast often bring in heavy mud and road salt in the winter months.

Vehicle washing is a regulated maintenance activity under the NPDES program. Wastewater from vehicle washing and floor drain discharge is considered industrial waste. The hazardous or nonhazardous nature of the wastewater determines the applicable disposal regulations.

IV.C.3. Tank Cleaning

The primary pollutant output from tank cleaning operations is wastewater contaminated with tank residues and cleaning solutions. Specific outputs include: spent cleaning fluids, fugitive volatile organic compound (VOC) emissions, water treatment system sludges, and tank residues. The quantities of these outputs vary widely from facility to facility depending on the type of cargo and cleaning methods. For example, an independent owner/operator tank truck cleaning facility serving a large number of different users will generate wastewater containing many ore contaminants than a shipper operated facility serving trucks all carrying the same cargo.

Tank heels from a shipment of hazardous waste greater than 0.3 percent of weight of the tank capacity continue to be regulated by RCRA after the discharge of the waste at a TSDF. Under current regulation, the use of solvents to further rinse out tanks is not considered treatment; however, certain State RCRA programs regulate these processes more stringently and

should be contacted to determine if a treatment permit is required.

IV.C.4. Transport Operations

Transport operations have the potential to generate three types of waste: the release or spill of a hazardous waste during loading and unloading operations; the spill or release of vehicle fluids such as oil or antifreeze during travel; and, most significant, the emissions generated during fuel combustion. As discussed above, engines, especially those of heavy duty trucks, generate several forms of air pollution. Among common substances released to the air from truck engines are hydrocarbons, carbon monoxide, oxides of nitrogen, sulfur compounds, and particulate matter. A description of each of these pollutants follows, while more information about EPA regulations governing emissions is provided in Section VII.

Hydrocarbons: Although hydrocarbon emissions are not problematic when they leave the vehicle, some hydrocarbons react in the atmosphere to promote the formation of photochemical smog. Ozone concentration is generally used to measure the extent of this photochemical reaction. Hydrocarbon emission standards have been set to meet the National Ambient Air Quality Standard (NAAQS) for ozone.

Exhibit 11
Hydrocarbons Emission Sources

Hydrocarbons Emissions Source	Percentage of Total Emissions
Stationary Fuel Combustion	3.1%
Industrial Processes	13.3%
Passenger Cars - Gasoline Engine	17.8%
Light-Duty Trucks - Gasoline Engine	6.4%
Heavy-Duty Vehicles - Gasoline Engine	0.8%
Diesel Engine Vehicles	1.8%
Other	56.8%

Source: ATA

Carbon Monoxide: Carbon monoxide (CO) is a byproduct of incomplete fuel combustion. The chemical is a colorless, tasteless, odorless gas that displaces oxygen in the body. At high concentration in confined areas, CO can be injurious to health. EPA has set a NAAQS and a vehicle emission standard for CO.

Exhibit 12
Carbon Monoxide Emission Sources

Carbon Monoxide Emissions Source	Percentage of Total Emissions
Stationary Fuel Combustion	7.1%
Industrial Processes	5.7%
Passenger Cars - Gasoline Engine	44.0%
Light-Duty Trucks - Gasoline Engine	14.5%
Heavy-Duty Vehicles - Gasoline Engine	2.9%
Diesel Engine Vehicles	1.9%
Other	23.8%

Source: ATA

Nitrogen Oxides: Emissions of nitrogen oxides (NO_X) are a significant contributor to the creation of nitrogen dioxide, and are ingredients in the formation of smog, although they play an ambiguous role in the process; at times No_x appear to promote smog, while at other times they seem to inhibit smog in urban areas.

Exhibit 13
Nitrogen Oxides Emission Sources

Nitrogen Oxides Emissions Source	Percentage of Total Emissions
Stationary Fuel Combustion	50.6%
Industrial Processes	3.8%
Passenger Cars - Gasoline Engine	15.2%
Light-Duty Trucks - Gasoline Engine	4.9%
Heavy-Duty Vehicles - Gasoline Engine	0.8%
Diesel Engine Vehicles	11.4%
Other	13.2%

Source: ATA

Sulfur Compounds: Sulfur compounds are oxides that aggravate the respiratory system and may cause respiratory disease. Very dense smog is generally attributed to the buildup of SO and particulates during periods of little air movement. Motor vehicles of all types, including passenger cars, contribute only 4.2 percent of ambient sulfur compounds.

Particulates: Particulates are particles of solid material that are products of

incomplete combustion, such as soot and fly ash. Small particles may remain suspended in the air for long periods of time, while larger particles return to the ground as dust. Suspended particles cause reduced visibility and increased health hazards from other contaminants by providing a surface to carry chemicals into human lungs.

Exhibit 14 summarizes the pollution outputs from those operations in the trucking industry discussed in this document.

Exhibit 14
Process Material Input/Pollutant Output from Trucking Operations

Activity	Material Input	Air Emissions	Process Wastes
Truck Terminals and Maintenance Facilities	Motor oil, brake fluid, transmission fluid, coolants, solvents, parts cleaning solutions, lubricants, truck cargo	Possible CFC and VOC emissions	Used oil, used automotive fluids, solvents, coolants, used rags, used cleaning solutions, spilled or released truck cargo
Vehicle Exterior Washing	Detergent, caustic solution, organic solvents, steam	VOC emissions	Oil and grease, suspended solids, detergents, pH, metals
Tank Cleaning	Residuals from shipments, cleaning fluids – detergent, caustic solution, organic solvents, steam	VOC emissions	Spent cleaning fluids, water treatment system sludges, tank residues
Transport Operations	Gas and diesel fuels, alternative fuels, motor oil, brake fluid, transmission fluid, coolant, truck cargo	Hydrocarbons, carbon monoxide, oxides of nitrogen, sulfur compounds, particulates	Used oil, used automotive fluids, spilled or released truck cargo

Page 36 intentionally left blank.

V. PIPELINES

V.A. Characterization of Pipelines

V.A.1. Industry Characterization

The history of oil and gas pipelines as they are used today begins with the first commercial oil well, drilled in 1859. The first oil pipeline – 109 miles long, with a diameter of six inches – was laid from Bradford to Allentown, Pennsylvania, in 1879. Since the late 1920s, virtually all oil and gas pipelines have been welded steel, a departure from the early versions made from wrought iron. Although the first cross-country pipeline was laid in 1930, connecting Chicago, Minneapolis, and other cities, it was not until World War II, with frequent disruptions in coastal tanker traffic, that large-scale pipelines were laid connecting different regions of the country. In the 1960s, larger-diameter pipelines proved their economic advantage when a line consisting of 32, 34, and 36 inch diameters was built from Houston to New York, and a 40-inch pipeline was constructed connecting Louisiana to Illinois. Discovery of oil on Alaska's North Slope precipitated the construction of the country's largest pipeline, the 48-inch diameter Trans-Alaskan Pipeline, or Alyeska (*Oil and Gas Pipeline Fundamentals*, Kennedy, 1994).

By 1994, U.S. interstate pipeline mileage totaled nearly 410,000 miles, of which over 250,000 miles transported gas and over 158,000 shipped liquid oil and petroleum. Natural gas is delivered to U.S. consumers through a network of 1.2 million miles of buried pipe and 429 underground storage reservoirs that are linked to more than 1,200 local gas distribution companies.

Throughout this section, distinctions are made between gas and oil pipelines. Although the fundamental design and purpose of these two systems are similar, there are differences in their conveyance systems. Distinctions are also made for product pipelines and breakout tanks which are defined below.

Oil Pipelines

Crude oil must undergo refining before it can be used as product. Once oil is pumped from the ground, it travels through pipes to a tank battery. One or more tank batteries may be installed in a single field, each serving a number of individual wells. A typical tank battery contains a separator to separate oil, gas, and water; a fired heater to break water/oil emulsions to promote removal of water from the oil; and tanks for storing the oil until it is shipped as crude oil by truck or, more commonly, by a gathering line connected to storage tanks. From these tanks, the oil is moved through large diameter, long-distance trunk lines to refineries or to other storage terminals.

Trunk lines rely on pumps to initiate and maintain pipeline pressure at the level required to overcome friction, changes in elevation, or other pressure-decreasing factors. Pumps are required at the beginning of the line and are spaced along the pipeline to adequately propel the oil along.

Gas Pipelines

The purpose of gas-gathering and gas transmission pipelines is similar to that of crude-gathering and crude trunk lines, but operating conditions and equipment are quite different. Gas pipelines operate at higher pressures than do crude lines, and use compressors instead of pumps to force the gas along. Unlike oil, gas does not undergo refining, and transmission lines connect directly to utility companies that distribute the gas to consumers via small, metered pipelines. Gas is often treated in scrubbers or filters to ensure it is "dry" prior to distribution.

Gas-well flowlines connect individual gas wells to field gas-treating and processing facilities or to branches of a larger gathering system. The gas is processed at the treating facility to remove water, sulfur, acid gases, hydrogen sulfide, or carbon dioxide. Most field gas processing plants also remove hydrocarbon liquids from the produced as stream. From field processing facilities, the dried, cleaned natural gas enters the gas transmission pipeline system, analogous to the oil trunk line system.

Products Pipelines

Once oil is refined, product pipelines transport it to storage and distribution terminals. Refined oil products include automotive gasoline, diesel, home heating oils, ammonia, and other liquids. Other products pipelines transport liquefied petroleum gases (LPG) and natural gas liquids (NGL) from processing plants, where oil and gas are produced, to refineries and petrochemical plants.

Breakout Tanks

Breakout tanks are above ground tanks used to relieve surges in a hazardous liquid pipeline systems or to receive and store hazardous liquid transported by a pipeline for reinjection and continued transportation by the pipeline.

V.A.2. Industry Size and Geographic Distribution

Variation in facility counts occur across data sources due to many factors, including reporting and definition differences. This document does not attempt to reconcile these differences, but rather reports the data as they are maintained by each source. The Bureau of the Census segregates economic data depending on whether an establishment maintains a payroll. In the

transportation industry, many owners/operators are independent businesses with no employees, while others, including companies involved with pipelines, hire contracted employees who are reported under other entities' payrolls. The following data is available only for establishments with payrolls.

Industry Size

According to the Census Bureau, the pipeline industry consists of approximately 4,900 establishments and employs nearly 170,000 people. Exhibit 15 illustrates the facility size distribution for the industry based on 1992 U.S. Census Bureau data.

Exhibit 15
Facility Size Distribution of Pipeline Industry*

Industry	SIC Code	Total Employees	Total Number of Facilities	Employees per Facility
Crude Petroleum Pipelines	4612	10,355	405	25.6
Refined Petroleum Pipelines	4613	5,578	358	15.6
Pipelines, NEC**	4619	846	81	10.4
Natural Gas Transmission	4922	12,928	515	25.1
Natural Gas Transmission and Distribution	4923	69,311	1,648	42.1
Natural Gas Distribution	4924	65,239	1,734	37.6
Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Distribution	4925	445	71	6.3
Gas and Other Services Combined	4932	4,459	124	36.0
Total		169,161	4936	34.3

Source: Compiled from official 1992 statistics of the U.S. Bureau of the Census.
**Facilities with Payrolls only*
***Not Elsewhere Classified*

Geographic Distribution

State data is available only for those facilities with payrolls, as discussed above. Because the Census Bureau does not segregate data for the natural gas sectors covered by this profile, State-by-State information is available only for oil pipelines. The oil pipeline industry is anchored in the Southwest, with Texas, Louisiana, and Oklahoma accounting for over one-third of all reported establishments. California, with 55 pipeline facilities, and Illinois, with 41, have the next highest numbers of oil lines.

Exhibit 16 illustrates the number of oil pipeline establishments per State as recorded by the U.S. Census for 1992.

Exhibit 16
Geographic Distribution of Oil Pipelines*

Source: Compiled from official 1987 statistics of the U.S. Bureau of the Census.
**Establishments with payroll only.*

V.A.3. Economic Trends

Most gathering and long-distance pipelines in the U.S. are owned by pipeline companies whose sole function is to operate a pipeline system. Historically, natural gas in the U.S. was purchased by the pipeline company from the producer, transported to market, then resold to a local distribution company. Now, most gas is sold directly to the local distribution company the producer, and pipeline companies provide only a transportation service. Oil, on the

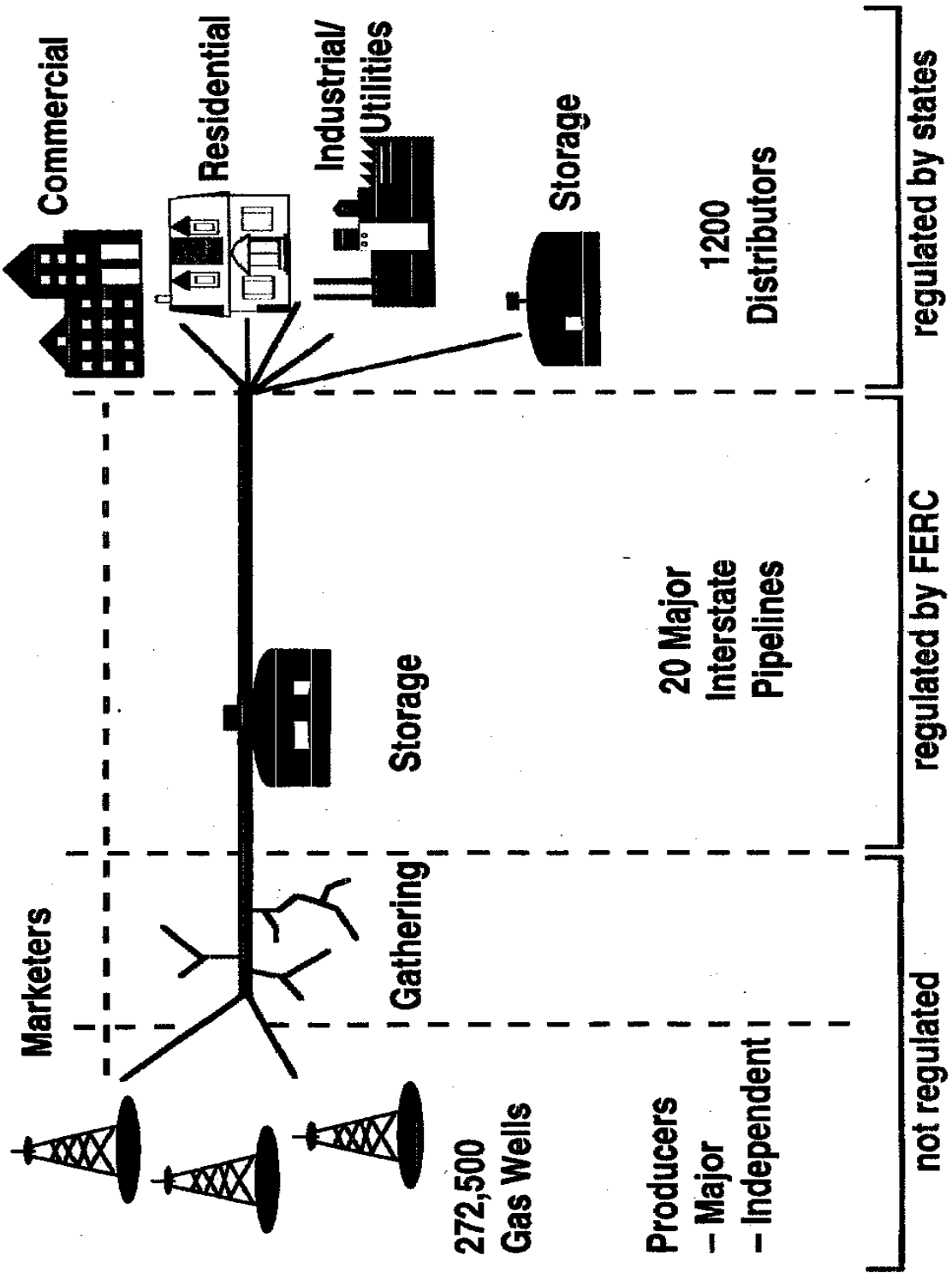
other hand, has traditionally been transported in the U.S. via pipeline by a shipper/owner, who is generally a refiner as well (Kennedy).

Annual reports filed for 1994 with the Federal Energy Regulatory Commission (FERC) show that both natural-gas and petroleum liquids pipeline companies increased their net incomes in 1994 despite declining operating figures. The ongoing shift of natural gas pipelines to primarily transportation providers was reflected by an increase in volumes of gas moved for others while volumes sold declined. Liquids pipelines moved nearly the same number of barrels in 1994 as in 1993, but showed an increase in barrel-miles, a measure of heightened efficiencies (Oil and Gas Journal, November 1995).

The nearly 410,000 miles of pipeline in the U.S. in 1994 represents a 2.2 percent, 9,000 mile, decline from the previous year. All pipeline mileage operated to move natural gas in interstate service declined nearly 4,000 miles, while mileage used in deliveries of petroleum liquids fell more than 5,000 miles. Transmission pipeline mileage showed little change from 1993 to 1994. Transmission mileage accounted for 77.5 percent of all natural gas mileage reported to FERC. The more than 128,000 miles of crude oil and product trunk lines represented more than 80 percent of all liquids mileage operated.

Natural gas companies have completed the shift from being marketers to being transporters that began when the FERC began implementing a series of regulatory orders that increased efficiency and heightened competition by establishing open-access transportation. This allowed traditional pipeline customers to buy gas from other sellers and have the pipelines provide transportation only. A final piece of regulatory restructuring occurred in 1992 with the release of FERC Order 636, requiring pipelines to offer gas sales, transportation, and storage services separately. In 1994, gas pipeline companies moved nearly 20 times as much gas for other companies as they sold from their own systems. Exhibit 17 demonstrates the relationship between pipelines, marketers, producers, and users of natural gas.

Exhibit 17
Natural Gas Delivery Infrastructure



U.S. crude oil and product oil trunk line traffic also increased in 1994. Crude oil traffic increased by 33 percent, while product traffic saw a modest rise of nearly three percent.

A solid measure of the profitability of oil and natural gas pipeline companies is the portion of operating income that is net income. For liquid pipeline companies in 1994, income as a portion of operating revenues was 29.5 percent, up from 25.4 percent in 1993. Income as a portion of revenues for natural gas companies was 14.3 percent, a marked increase from the 9.1 percent level reported in 1993.

Available information concerning future construction for the gas pipeline industry indicates a slow growth rate. Based on filings during the 12 months ending June 30, 1995, 725 new miles of land pipeline were proposed, and nearly 78,000 horsepower of new or additional compression were applied for.

The world oil price (the average cots of imported crude oil for U.S. refiners) is not expected to move significantly in 1996 from its current level of approximately $16 per barrel. Despite the continued rise in world oil demand over the forecast period, expected to exceed one million barrels per day per year, world oil production capacity increases should accommodate the demand growth in a balanced manner, keeping average prices relatively flat.

V.B. Operations in the Pipeline Industry

Gas and oil pipelines are essentially similar, with the greatest operational difference resulting from the varying needs of transporting gas versus liquid. Oil pipelines require pumps to propel their liquid contents, while gas lines rely on compression to force the resource through the pipe. In both pump and compressor stations, corrosion of piping and vessels must be monitored constantly to prevent failure.

Most pipelines fall into three groups: gathering, trunk/transmission, or distribution. One type of gathering pipeline is flowlines. Flowlines are small-diameter pipelines that are owned by the producer and connect individual oil or gas wells to central treatment, storage, or processing facilities in the field. Another gathering system made up of larger-diameter lines, normally owned by a pipeline company rather than an oil or gas producer, connects these field facilities to the large-diameter, long-distance trunk or transmission line. In some cases, individual wells are connected directly to the pipeline company's gathering system. Crude trunk lines move oil from producing areas to refineries for processing. Gas transmission lines carry natural gas from producing areas and treatment/processing facilities to city utility companies and other customers. Through distribution networks of small pipelines and metering facilities, utilities distribute natural gas to commercial, residential, and industrial users.

Refined liquids and products, such as gasoline, kerosene, fuel oil, and jet fuel are transported thousands of miles throughout the U.S. in product pipelines. Efficient long distance transport by pipeline requires high operating pressures, typically 500-1200 psi. Liquefied petroleum gases such as propane, butane, and their mixtures, are usually liquids under normal line operating pressures, so the pipelines transporting them are classified as liquid lines. Pump stations are needed on liquid lines at line friction, and elevation changes. Storage structures, such as tank farms for liquids and, increasingly, underground salt caverns for propane, are also used as buffers in transmission network operations and to distribution points of contact. Common pipeline operations are discussed below.

V.B.1. Pigging

Pipeline pigs are used for multiple purposes in both liquid and natural gas pipelines. A mechanical pig consists of a steel body with rubber or plastic cups attached to seal against the inside of the pipeline and to allow pressure to move the pig through the line. Brushes and scrapers are attached to the pig to facilitate cleaning or other functions. Pigs and spheres are forced through the pipeline by the pressure of the flowing fluid.

Mechanical pigs have traditionally been used to clean or segregate fluids within liquid pipelines. Mechanical pigs are most often used in gas pipelines to clean the line and maintain maximum efficiency. Downstream of compressor stations, lubricating oil from the compressors needs to be removed from the gas lines. On the intake side of both compressor and pump stations, cleaning pigs are used to prevent unwanted materials from contaminating the pumps or compressors. Recently, the use of pigs has increased as sophisticated instruments are used to monitor pipeline conditions and detect potential problems.

Large amounts of debris can be removed by a pig run over a long distance. For example, assume a pig is run in a 24-inch diameter pipeline that is 100 miles long and removes 0.016 inches of wax material from the wall of the pipeline. After 100 miles, the pig would be pushing a plug of wax about 1,450 feet long (Kennedy). Several sweeps by the pig may be required to effectively clean the line. Both brush and scraper pigs contain holes that allow fluid to bypass the pig, preventing buildups in front of the machine that could cause plugging.

V.B.2. Pipeline Leaks

Pipeline leaks are considered either small, medium, or large. Small leaks are below the limits of current computational pipeline monitoring leak detection capabilities. They can be detected with chemical sensing cables or by finding

small pools of leaking product or dead vegetation on the pipeline right of way. They result from small, stable fractures or small corrosion holes that result in leak rates usually less than one percent of flow. Many vendor- and company-developed systems can detect leaks as small as 0.1 percent flow in field tests, but pipeline operators are not counting on this capability and are continuing with visual inspections (US DOT/RSPA/Volpe Center 1995). Small leaks can stay small and go unnoticed for weeks.

Medium leaks are detectable with some inferential leak detection methods, but are not large enough to cause a loss of working line pressure. Spill rates as high as 100 bbls per hour have gone undetected for up to a day on large lines without the use of sophisticated detection systems. Medium leaks are caused by fractures that remain narrow and by worn gaskets and valve stem packings.

Large leaks result in a rapid loss of working line pressure, which will generate an alarm to the dispatcher, even without a leak detection system (LDS). They are caused by third party damage and by unstable fractures that can grow many feet in length. Many high carbon steels used before 1`970 are prone to unstable fracture. Hydrogen gas, generated by cathodic protection systems with excessively high voltage, and hydrogen sulfide, found in sour crude oil, can make steel brittle and more prone to such fractures.

Improvements in materials, construction technologies, and inspection and monitoring techniques have reduced the incidence of damage to pipelines. In Western Europe, for example, gas leaks have dropped by 30 percent in the past 20 years, despite an aging pipeline system.

V.B.3. Pipeline Inspections

More than half of the gas transmission pipeline capacity in the U.S. will be over 40 years old by the year 2000. It is becoming increasingly important to guarantee the structural integrity of these pipelines through structural monitoring and periodic inspections. In addition, pipelines in unstable terrain must be monitored using geotechnical instruments such as inclinometers and pezometers, as well as by direct measurement of pipeline deformations, using strain gauges. Over the past 50 years, methods for performing these tasks have steadily improved.

Leak detection methods may be divided into two categories, direct and inferential. Direct methods detect leaking commodity outside the pipeline. Inferential methods deduce a leak by measuring and comparing the amount of product moving through various points on a line.

Traditionally, pipelines have been inspected visually by walking along this line or patrolling the pipeline route from the air. Today, leak detection ha become more thorough, in part to meet environmental and safety regulations. A

thorough inspection program requires both systematic periodic controls (e.g., patrolling the line or cathodic protection measurements) and specific occasional controls (e.g., in-line inspection or hydrostatic retesting). Inspection programs must address the needs of the pipeline, requiring a detailed knowledge of construction characteristics, past and present service conditions, the local environment, and maintenance history. Factors influencing the rate of detection include the type of fluid, the accuracy of measuring systems, line size, pipe thickness, length of the line, analytical equipment, and the experience of the personnel involved.

One successful inspection technology is the instrument internal inspection device, commonly referred to as the smart pig. Growing out of earlier technology (mechanical pigs used for cleaning), smart pigs carry detection and logging tools that store data on the state of the pipeline including data on metal loss, pits, gouges, and dents while moving through the pipeline system. The smart pig is launched from a pig launcher (a spur off the mainline), run through the pipeline segment, trapped, and removed from the pipeline. The data is then downloaded from the start pig data storage unit and analyzed.

The smart pig technology is based on the use of a single "sensor," called magnetic flux leakage, or MFL. MFL pigs can detect metal loss, usually the result of corrosion. Based on limited data, smart pigs are able to detect approximately 60 percent of pipe defects. They cannot detect stress corrosion cracking, longitudinal cracks, small defects, or gouges and dents caused by excavation damage. An emerging technology called ultrasonic sensor technology can detect smaller cracks and defects. However, sensors currently require liquid to serve as a contact between the sensor and the material being inspected. Research is underway to develop ultrasonic sensors that can function in a dry natural gas pipeline. One of the most difficult inspection hurdles is the many miles of pipes that cannot be inspected using pigs. Design constraints such as intrusive valves, varying pipe diameters, and sharp turns make internal pipe inspection difficult.

Another inspection practice is to measure the amount of pressure and volume in a pipeline. This is done through metering. Metering measures the amount of flow in and out of a pipeline segment. This approach is effective using both simple and complex leak detection systems. The detection of small leaks can be enhanced by sophisticated instrumentation and the use of computer models.

Natural gas pipelines can be inspected for leaks with surface-sampling instruments by the flame-ionization principle. These units are made up of a sampling probe with a pump to draw an atmospheric sample to a detection cell. In the cell, the sample envelops a small hydrogen flame and carbon ions flow to a collector plate, causing an imbalance in the circuit that deflects the indicating meter. Because natural gas weighs less than air, it rises to the ground surface as it progresses through the atmosphere. Leaks in liquid

natural gas pipelines are not as easily detected, and the soil around the line must be tested for constituents like propane and butane. Exhibit 18 shows some of the practices used to monitor pipelines and the types of damage they can reveal.

Exhibit 18
Methods of Monitoring Pipelines

	R-O-W PATROL		CORROSION CONTROL			IN-LINE INSPECTION				BELLHOLES		TESTS
PRACTICES / **CONDITIONS**	Aerial Patrols	Ground Systems	CP Measurements	Close Interval	Coupons Monitors	MFL Pigs	Geometry Pigs	Mapping Pigs	Cameras	Visual Inspection	NDE Examination	Hydrostatic Retesting
OUTSIDE FORCES												
3rd party damage	X	X					X		X	X		
Earth movements	X	X					X	X				
METAL LOSS												
External corrosion			X	X		X				X	X	X
Internal corrosion					X	X	X					X
Gouges						X				X	X	X
GAS LEAKAGE	X	X								X		
COATING			X	X						X		
CRACKS												
Seam weld										X	X	X
Girth weld										X	X	X
Stress corrosion											X	X
Fatigue										X		
Selective corrosion										X	X	X
GEOMETRY												
Ovality, buckles							X		X	X		
Obstructions, dents							X		X	X		
Ovality, wrinkles							X		X	X		
Bend radius							X	X				
Pipeline movement								X				
METALLURGICAL												
Inclusions						X					X	X
Hard spots						X					X	X
Laminations											X	

Source: Natural Gas Technologies, 1993.

V.B.4. Glycol Dehydration Units

Glycol dehydration units are commonly used to remove water vapor from natural gas. Glycol dehydration of natural gas streams helps prevent corrosion and the formation of hydrates in pipelines. Up to 40,000 glycol dehydration units may be operating in the U.S. Approximately 17 to 18 trillion cubic feet per year of natural gas is currently dehydrated in North America, with a large fraction of that amount being treated in the United States.

During the water removal process, the glycol picks up other compounds from the natural gas that can become part of waste streams. The most significant issue is air emissions from the reboiler still vent. Increasing regulatory pressure has made emissions of benzene, toluene, ethylbenzene, the xylene isomers (BTEX), and volatile organic compounds (VOC) from the reboiler still vent of glycol dehydration units a major concern of the natural gas industry.

Varying amounts of water accompany the production of natural gas, depending on the temperature and pressure of the gas and the age of the field. In addition to the produced water, most natural gas is saturated with water vapor at the production temperature and pressure. The water vapor content of saturated natural gas can be estimated given the temperature and pressure of the gas. For example, at 800 psig and 80°F, natural gas may contain as much as 38 pounds of water per million standard cubic feet (MMSCF). In addition, sour natural gas (i.e., gas containing significant concentrations of hydrogen sulfide and carbon dioxide) will have a higher water content than sweet gas.

As the pressure and temperature vary in the gas pipeline, water can combine with the natural gas molecules (e.g., methane, ethane, and propane) to form solid hydrates that can block or plug a pipeline. Hydrates are crystalline structures composed primarily of water and hydrocarbons; methane can form hydrate cells with up to 136 molecules of water. Hydrates may also incorporate other gases such as hydrogen sulfide, ammonia, carbon dioxide, acetylene, and bromine into their structure.

Initially, small hydrate crystals will form in the flowing gas when free liquid water is present at the proper temperature and pressure. These small crystals become condensation nuclei, and, as they collide and stick together, larger crystals are formed. They will also accumulate on obstructions such as valves, orifice meters, or sharp objects where pressure and flow rate changes occur. Eventually, these crystals can grow to become a solid block of hydrates that can completely close off a pipeline or other equipment at high pressure.

Water also increases the corrosivity of the acid gases in the natural gas. Upon cooling, water may condense in the pipeline and cause slug flow, resulting in increased pipeline corrosion, erosion, and pressure drop.

To prevent the formation of hydrates at pipeline pressures and to limit corrosion, natural gas must be dehydrated before it is sent to the pipeline. In the U.S., the typical pipeline specification for the water content of the gas is 7 lb/MMSCF of natural gas.

V.C. Pollution Outputs and Causes of Pipeline Leaks

Unlike the other pollution output sections in the document, this section reflects the importance of determining the causes of pipeline ruptures, rather than focusing on the material released. By definition, most pollution outputs associated with pipelines are the oil and gas resources and products that the pipelines convey.

The Federally-regulated pipeline system has consistently improved its safety record over the last 25 years. However, there are still about 20 large (1,000 barrels or more) spills on the DOT's Office of Pipeline Safety (OPS) regulated liquids lines each year (US DOT/RSPA/Volpe Center 1995). Between 1988 and 1994, the OPS received 1,401 reports of hazardous-liquid spills on U.S. pipelines in which operators claimed a total of 1.2 million barrels of lost product and $220 million in property damage, as well as a number of injuries and fatalities.

Large crude and other viscous product spills are difficult and expensive to clean up. Lighter products, such as gasoline and highly volatile liquids pose less of a cleanup problem, but the risk of fire and explosion is significant. Much of the improvement in the pipeline safety record over the last 25 years has resulted from technical developments such as those in pipeline components, construction, inspection, and corrosion control.

V.C.1. Pipeline Failures

According to the DOT, for gas pipelines, 40 percent of leak/spill incidents are due to outside force or third-party damage; 21 percent are due to corrosion; 16 percent to material construction defects, and 23 to operational causes. For oil pipelines, only 18 percent of incidents are due to outside force or third-party damage; 20 percent due to corrosion, 16 percent due to material construction defect, and 45 percent to operational incidents (US DOT National Pipeline Safety Summit 1994, Data prepared by the NJ Institute of Technology). Exhibits 19 and 20 provide more specific breakdowns of the causes of pipeline leaks for hazardous liquid pipelines and natural gas pipelines as well as a breakdown of the resulting damage.

Exhibit 19
Hazardous Liquid Pipeline Incident Summary by Cause - 1994

Cause	Number of Incidents	Percent of Total	Property Damage	Percent of Total	Deaths	Injuries
Internal	9	3.69	$282,000	0.50	0	0
External	38	15.57	$1,833,043	3.25	0	0
Defective	21	8.61	$4,320,680	7.65	0	0
Incorrect	8	3.28	$15,600	0.03	0	0
Defective	11	4.51	$2,154,000	3.82	0	0
Outside	57	23.36	$35,593,513	63.05	0	1,853
Malf.. of	22	9.02	$1,159,517	2.05	0	1
Other	78	31.97	$11,095,251	19.65	1	4
Total	244	100	$56,453,604	100	1	1,858

Source: DOT Office of Pipeline Safety, 1995.

Exhibit 20
Natural Gas Pipeline Incident Summary by Cause - 1994

Cause	Number of Incidents	Percent of Total Incidents	Property Damage	Percent of Total Damages	Deaths	Injuries
Internal	20	25.0	$2,632,812	583	0	0
External	13	16.25	$2,028,835	4.49	0	1
Damage from	23	28.75	$32,127,680	71.13	0	16
Construction/	9	11.25	$342,647	0.76	0	2
Other	15	18.75	$8,038,319	17.8	0	0
Total	80	100	$45,170,293	100	0	19

Source: DOT Office of Pipeline Safety, 1995.

V.C.2. Glycol Dehydration - Inlet Separator

The inlet separator removes liquid water, heavy hydrocarbons, brine solution, and particulate matter such as sand, pipeline scale, and rust, or iron sulfide from the incoming natural gas. The vessel is typically sized on the basis of operating pressure and gas throughput to ensure that adequate separation occurs and carryover is prevented. The liquid level must be regulated or checked regularly so that plugs or upsets do not result in carryover; one way to do this is to install a high-liquid-level shutdown. The liquid drain line should be protected from freezing; if this line is frozen or plugged, the separator will not remove any liquids. A mist eliminator in the top of the separator is usually sufficient to reduce or prevent the carryover of liquid droplets and particulate matter, although a filter may be required if aerosols or compressor oils are present in the gas stream.

The inlet separator is considered by many to be the most important part of a glycol unit, because a properly designed inlet separator can eliminate many downstream problems. If the inlet separator is undersized or poorly designed, contaminants may be carried over into the absorber, resulting in the following problems in downstream equipment:

- Free liquid water may enter the absorber and overload the glycol in the absorber, which may prevent the gas from being dried to pipeline specifications.

- Hydrocarbon contamination of the glycol may cause foaming.

- Heavy hydrocarbons may foul the heat exchange surfaces in the reboiler, resulting in poor heat transfer, localized thermal degradation of the glycol, inadequate glycol regeneration, and eventual fire tube failures.

- Sodium chloride and calcium chloride may enter the system. Sodium chloride often precipitates in the reboiler, calcium chloride precipitates in the coldest portions of the system such as the absorber. Salt contamination may ultimately necessitate replacement of the glycol.

V.C.3. Breakout Tank Leakage

Leaking above ground storage tanks pose several environmental problems. First, leaking above ground tanks can seriously contaminate groundwater, often making it impossible to ever return the groundwater to drinking water standards. Groundwater is a source of drinking water for over half the country; in rural areas, nearly all residents drink water from groundwater wells. Pipeline-related facilities are frequently located in populated areas that may rely on groundwater for drinking. Leaking tanks can also pose health and

fire hazards to nearby buildings or infrastructures such as sewers, since gaseous components can migrate into these enclosed areas and concentrate to toxic or combustible levels.

Page 54 intentionally left blank.

VI. POLLUTION PREVENTION/WASTE MINIMIZATION

VI.A. Introduction

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.

The Pollution Prevention Act of 1990 established a national policy of managing waste through source reduction, which means preventing the generation of waste. The Pollution Prevention Act also established as national policy a hierarchy of waste management options for situations in which source reduction cannot be implemented feasibly. In the waste management hierarchy, if source reduction is not feasible the next alternative is recycling of wastes, followed by energy recovery, and waste treatment as a last alternative.

In order to encourage these approaches, this section provides both general and company-specific descriptions of pollution prevention activities that have been implemented within the pharmaceutical 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 be, 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. 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 be examined to determine how each option affects air, land and water pollutant releases.

VI.B. Rail Transportation

VI.B.1. Water Discharge

At locomotive maintenance facilities, eliminating water from the clean up processes may enable a facility to seal off the floor drains and attain zero discharge. Spent solvents and cleaning solutions are often toxic and/or hazardous and should be disposed of in an environmentally safe manner rather

than by pouring them into the storm drain or waste water line. If hazardous cleaning agents (e.g., solvents) are used, care should be taken to wear protective safety gear and follow good housekeeping practices (e.g., clear labeling of all chemicals and wastes to avoid misuse and potential injury or contamination).

If a discharge is going to a wastewater treatment facility, it should be pretreated. Pretreatment means reducing the amount of pollutants in a discharge before it proceeds to a municipal wastewater treatment plant. If waste water is discharged directly or indirectly (i.e., via percolation or injection wells) into a stream, a facility must obtain and comply with the terms of an NPDES or State permit.

When disposing of wastewater, the following activities will foster pollution prevention:

- If a municipal treatment plant is not available, or it will not accept the waste, route the waste to a tank or container for proper accumulation, treatment, and disposal.

- Keep wastewater from service bays out of storm drains by constructing berms around hazardous material storage areas to keep spills from leaving the storage area.

- Do not discharge industrial wastes to septic systems, drain fields, dry wells, cesspools, pits, or separate storm drains or sewers. Facilities that use these types of disposal systems may be in violation of Federal, State, or local requirements.

- If there is a floor drain in the facility, it should be plumbed to an oil/water separator or appropriate wastewater treatment facility.

- Alternatives to water cleaning include recycled solvents in self contained solvent sinks. Dry cleaning can include cleaning by wire brush or bake oven.

Waste minimization in equipment cleaning may be achieved by reducing the amount of water used to clean large equipment. A reduction in water usage will translate into a reduction in the volumes of generated waste waters.

Axle protective coatings can be removed with 140 solvent or a similar non-hazardous or aqueous solvent to avoid hazardous waste generation. The use of hazardous cleaning compounds in outdoor large equipment cleaning can also be avoided by using a detergent/water mixture or steam. In these processes, waste waters must be channeled properly for treatment or disposal.

For small cleaning operations, it is possible to switch from hazardous organic-based to non-hazardous aqueous-based solvents. This will reduce the amount of hazardous waste generated from cleaning operations. Solvent recycling can also decrease hazardous waste production from small parts cleaning.

Spent solvents can be cleaned and recycled with a solvent still. Spent solvent, if hazardous, must be treated and disposed of as hazardous waste, unless recycled properly. Solvents should not be poured down sewer drains, mixed with used oil, or stored in open containers that allow them to evaporate. Certain aqueous parts washers can use detergents instead of solvents.

VI.B.2. Oil

Most facilities in the rail industry recycle used oil. Recycling used oil requires equipment like a drip table with a used oil collection bucket to collect oil dripping off parts. Drip pans can be placed under locomotive or rail cars awaiting repairs in case they are leaking fluids. Some facilities use absorbent materials (e.g., pigmat) to catch drips or spills during activities where oil drips might occur. One facility has established a reuse system for its waste oil: waste oil is transported to another facility where it is used for fuel. This method decreased disposal and heating costs while reducing landfill waste loads. Used oil burning of this nature has permitting implications that a facility needs to follow. Used oil burning can also occur in on-site space heaters under certain circumstances. Recycling used oil by sending it to a commercial recycling facility saves money and protects the environment. To encourage recycling, the publication "How To Set Up A Local Program To Recycle Used Oil" is available at no cost from the RCRA/Superfund Hotline at 1-800-424-9346 or 1-703-412-9810.

Another pollution prevention alternative some railroads have initiated is the use of retention tanks on locomotives. Locomotive retention tanks catch leaking oil from the engine compartment. The tanks are subsequently drained to an appropriate waste treatment facility during routine maintenance and servicing.

Spent petroleum-based fluids and solids should be sent to a recycling center wherever possible. Solvents that are hazardous waste must not be mixed with used oil, or, under RCRA regulations, the entire mixture may be considered hazardous waste. Non-listed hazardous wastes can be mixed with waste oil, and as long as the resulting mixture is not hazardous, can be handled as waste oil. All used drip pans and containers should be properly labeled.

A Material Safety Data Sheets (MSDS) logbook should be kept in a central location and be easily accessible during an emergency. Along with MSDS's, an emergency response plan should posted at all times and each employee should know where it is and what procedures are included in it. All

employees should be aware of and understand the properties and potential adverse effects of the materials they handle.

Facilities should conduct audits of the spill possibilities at their facilities. Spills can be avoided by determining those locations and situations where spill events are likely to take place and making employees aware of them. Some facilities have posted signs at likely spill locations or conducted training with their employees on spill awareness and preparedness. In addition, MSDS sheets can be centralized for easy access in case of a spill event. A folder or binder can be used for this purpose and should be maintained by a designated MSDS collection person.

VI.B.3. Waste from Maintenance and Repair Operations

Batteries may be recycled through suppliers. Batteries should be stored in an open rack or in a water tight, secondary containment area like a concrete bin with sealer on the floor and walls. Batteries should be inspected for leaks and/or cracks as they are received at the facility. Acid residue from cracked or leaking batteries is likely to be hazardous waste under RCRA because it is likely to demonstrate the characteristic of corrosivity, and may contain lead and other metals. Many waste batteries must therefore be handled as hazardous waste. Lead acid batteries are not considered a hazardous waste as long as they are recycled. Facilities have many battery disposal options: recycling on site, recycling through a local rail facility, recycling through a supplier, or direct disposal. Facilities should explore all options to find one that is right for the facility. In general, recycling batteries may reduce the amount of hazardous waste stored at a facility, and thus the facility's responsibilities under RCRA. The following best management practices are recommended when sorting used batteries:

- Palletize and label them by battery type (e.g., lead acid, nickel, and cadmium)
- Protect them from the weather with a tarp, roof, or other means
- Store them in an open rack or in a water tight secondary containment unit to prevent leaks
- Inspect and document them for cracks and leaks as they come in to your storage program. If a battery is dropped, treat it as if it is cracked
- Avoid skin contact with leaking or damaged batteries
- Neutralize acid spills and dispose of the resulting waste as hazardous if it still exhibits a characteristic of a hazardous waste.

Coolants for locomotives are not glycol based, but are a nitrate-based corrosion inhibitor in water. These type of waste coolants can be disposed to most POTWs. Though much of the activities associated with vehicles takes place at off-site service centers, some maintenance is performed on this type of equipment, where coolants from maintenance vehicles and fleet vehicles should be collected and recycled and not mixed with locomotive coolant. Solvents containing chlorinated hydrocarbons should be stored in separate containers and disposed of properly. When possible, coolant should be discharged when the locomotive has stopped and is at a location where the coolant can be collected and managed. Locomotive operators should be familiar with the spill reporting requirements of the States in which they operate, and act accordingly when a coolant discharge takes place.

Metal scrap from old machine parts that is likely to be contaminated with oil (e.g., wheel truing scrap), should be stored under a roof or covered with tarpaulin to protect it from the elements. This scrap metal should also be protected from rain water to eliminate the potential of contaminated runoff. Metal scrap can be recycled if sorted and properly stored. Labeled recycling containers can be placed around the shop for easy access and later sorting.

Liquid drum containers, if stored outdoors, should be in a berm and on a paved impermeable surface or in a secondary containment unit to prevent spills from running into water bodies.

Metal filings from parts machining should be collected and recycled if possible. In no case should the filings be allowed to fall into a storm drain.

VI.B.4. Paint

To reduce the amount of wastes created by painting operations, all paint should be used until containers are completely empty. "Empty" containers of latex paint may be disposed of as solid waste. Used containers of hazardous substances may need to be disposed of as hazardous wastes, if they are not completely empty. To prevent environmental problems, it is possible to switch from hazardous organic-based to non-hazardous aqueous-based paints. Also, paint may be purchased in recyclable and/or returnable containers to reduce disposal costs.

VI.B.5. Fueling

Self-locking fueling nozzles minimize the risk of both fuel spillage and air pollution by ensuring a secure seal between the fuel source and tank. During locomotive fueling, personnel should look for fuel drippage and spillage. Catchment pans on either side of and between the rails will collect fuel spills and prevent soil contamination. These pans should be drained to an oil-water separator or retention tank. These pans can be cleaned periodically by

railroad personnel to remove fuel debris and accumulated wastes for proper disposal. In case of a spill, facilities should keep the following on hand: absorbent booms, pads, or blankets to help contain spills and soak up pooling liquid; rubber gloves and boots; and a shovel.

VI.C. Trucking

VI.C.1. Truck Terminal and Maintenance Facilities

Trucks require regular changing of fluids, including oil, coolant, and others. To minimize releases to the environment, these fluids should be drained and replaced in areas where there are no connections to storm drains or municipal sewers. Minor spills should be cleaned prior to reaching drains. Used fluids should be collected and stored in separate containers. Automotive fluids can often be recycled. For example, brake fluid, transmission gear, and gear oil are recyclable. Some liquids are able to be legally mixed with used motor oil which, in turn, can be reclaimed.

During the process of engine and parts cleaning, spills of fluids are likely to occur. The "dry shop" principle encourages spills to be cleaned immediately, without waiting for the spilled fluids to evaporate into the air, be transmitted to land, or to contaminate other surfaces. The following techniques help prevent spills from happening:

- Collect leaking or dripping fluids in designated drip pans or containers. Keep all fluids separated so that they may be properly recycled.

- Keep a designated drip pan under the truck while unclipping hoses, unscrewing filters, or removing other parts. The drip pan prevents splattering of fluids and keeps chemicals from penetrating the shop floor or outside area where the maintenance is taking place.

- Immediately transfer used fluids to proper containers. Never leave drip pans or other open containers unattended.

Radiator fluids are often acceptable to antifreeze recyclers. This includes fluids used to flush out radiators during cleaning. Reusing the flushing fluid minimizes waste discharges. If a licensed recycler does not accept the spent flushing fluids, consider changing to another brand of fluid that can be recycled.

If the maintenance facility services air conditioners, special equipment must be used to collect the Freon or other refrigerant because it is not permissible to vent the refrigerant to the atmosphere. Reusing the refrigerant on site is less costly than sending the refrigerant to an off site recycler.

VI.C.2. Vehicle Washing

Vehicle washing has become a major environmental compliance issue for most companies that operate a fleet of vehicles. The following pollution prevention activities will help ensure that a facility is addressing potential sources of pollution:

- Waste water discharge can be prevented by dry washing vehicles using a chemical cleaning and waxing agent, rather than detergent and water. The dry washing chemical is sprayed on and wiped off with rags. No waste water is generated. Dry washing is labor intensive and creates solid waste that must be disposed of properly.

- Waste water can be contained by washing at a low point of the facility, blocking drains from the facility using a containment dike or blanket, or washing on a built-in or a portable containment pad.

- Waste water can be disposed of by evaporation from the containment area, or by discharging the waste water to a sanitary sewer system. (Pretreatment of waste wash water generated from manual washing before disposal to the sanitary sewer is not usually required for vehicle exterior (no undercarriages or engines) washing. Permission must be obtained from the sewer district before waste wash water can be drained, pumped, or vacuumed to a sanitary sewer connection.

VI.C.3. Stormwater Pollution Prevention

Under the Clean Water Act NPDES requirements, discussed in more detail below, truck maintenance facilities must maintain a stormwater pollution prevention plan. The following information is taken from *Stormwater Pollution Prevention Plan for the Trucking Industry*, American Trucking Associations, 1993.

An effective pollution prevention plan for trucking facilities strives to prevent pollution at the source, before it enters the environment. This is best done by properly addressing the following potential sources of pollution:

- Underground and above ground storage tanks of petroleum fuel

- Drips, spills, and releases from fueling operations

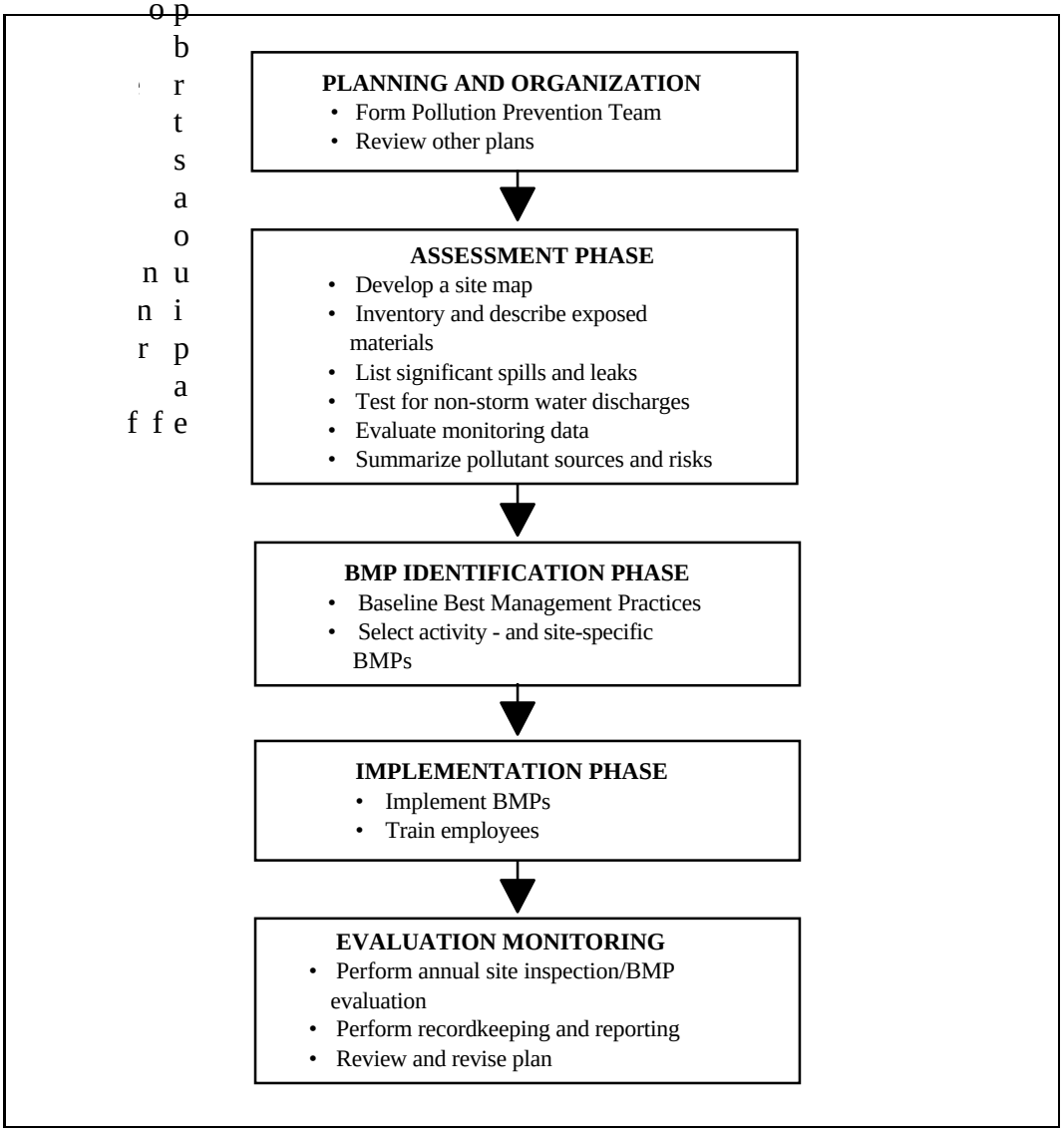
- Routine maintenance, including tire, battery, fluids, and oil changes

- Containers of antifreeze, solvents, used oil, and other liquid wastes

- Management of shop drains (sometimes connected to an oil-water separator) which may accumulate oil, grease, and other shop wastes
- Vehicle washing operations
- Storage of scrap tires and batteries.

The American Trucking Associations has developed a flowchart, duplicated as Exhibit 21, that directs the attention of facility managers to the sources of environmental contamination, and alerts them to the practices that best ensure

Exhibit 21
Storm Water Pollution Prevention Flowchart



Source: Stormwater Pollution Prevention Manual for the Trucking Industry, ATA, 1993.

VI.C.4. Alternatively-Fueled Vehicles

One way to reduce vehicle emissions from the trucking industry is to switch to alternative fuels. Natural gas vehicles, for example, are a viable alternative to gasoline-and diesel-powered transportation. Almost any gasoline- or diesel-powered vehicle can be converted to run on natural gas including, light-duty trucks and vans, medium-duty trucks, and even heavy-duty trucks such as semi-tractors. Converting a gasoline-powered vehicle to run on natural gas involves installing a natural gas fuel system and storage tanks without removing any existing equipment. Diesel conversions are somewhat more complicated because they also involve reducing compression and adding a sparked-ignition system. Other fuels suitable for trucks can include methanol, ethanol, and propane.

Some of the momentum to switch to alternative fuels such as natural gas is coming from legislation. Over the past few years, Congress has passed even stricter clean-air laws, as well as incentives to encourage the use of alternative fuels. Federal (and in some areas State) tax deductions for Alternative Fuel Vehicles (AFVs) and related refueling equipment are available. The maximum tax deductions range from $2,000 to $50,000 for each AFV and up to $100,000 on refueling stations. Deductions on vehicles, including original equipment manufactured vehicles or after-market conversions, apply to the incremental cost of an AFV over the cost of its gasoline or diesel counterpart. The deduction for AFVs can be taken by either an individual or a business, but the deduction on refueling equipment applies only to businesses.

VI.D. Pipelines

VI.D.1. Direct Leak Detection Enhancements

Direct leak detection is typically performed by line patrols who inspect the pipeline right-of-way for pools of leaking product and dead vegetation. Section 195.412 of the Federal pipeline safety regulation requires that hazardous liquid pipelines be patrolled 26 times each year. A new technology for direct leak detection is chemical sensing cable buried along the pipeline right of way. Some cable systems can detect the presence and location of hydrocarbon vapors. Other cables locate leaks by absorbing liquids, which results in a loss in the cables' electrical conductivity at an identifiable location. Sensing cables can offer superior detection times, sensitivity, and location accuracy, especially in gathering lines, where the flows can be too irregular for other methods. These cables must be buried close to the pipeline to work well, and some liquid sensing cables must be dug up and replaced after every detection. New burying methods are being developed for these cables to lower their operating cost.

VI.D.2. Supervisory Control and Data Acquisition (SCADA) Systems

The traditional inferential method of leak detection is called line balance, where one measures the volume of product sent into the pipeline and compares it with the volume that comes out the other end. Enhancement of this method and others are used by SCADA and LDS systems to provide the dispatcher with information that suggests a possible leak. SCADA systems give pipeline dispatchers the ability to effectively monitor pipeline conditions and control a pipeline's operation from a central location. SCADA systems include pipeline sensing devices, a communications network, a centralized or distributed data processing system, and a user interface for the dispatcher.

SCADA systems continuously monitor, transmit, and process pipeline information for the control room dispatcher. Monitoring is conducted using Remote Terminal Units (RTUs), which are placed at intervals along the pipeline and at associated facilities, such as pump stations and delivery terminals. RTUs periodically collect data from field instruments, which measure pressure, temperature, flow, and product density. RTUs can also receive information from vapor detectors and tank level gauges in pipeline system routing and storage areas. RTUs process this information to varying degrees and transmit it for analysis to a central computer through a communications network. Information from RTUs may be transmitted by company-owned lines, by a commercial telephone service, or by using ground- or satellite-based microwave or radio communication.

The leak detection capabilities of most SCADA systems can be enhanced with additional leak detection software and user interfaces. Field instruments specifically designed for leak detection are also available for SCADA systems, such as acoustic sensors and hydrocarbon cables.

VI.D.3. Hydrostatic Testing

Pipeline and utility companies test the pipes that comprise their system both before they are buried and when they suspect that a section of pipe may need maintenance. Hydrostatic testing is the process of filling a section of pipe with water and pressurizing it to a level above normal operating levels. This verifies the integrity of the pipeline.

Depending on the location of the pipeline, the water used in a hydrostatic test is drawn from a local river, stream, or lake; taken from municipal supplies; or trucked to the site. After air is bled from the pipeline, a pump raises the pressure inside the pipe to the pre-determined testing level, where it is maintained and monitored during the test period. Precision measurement instruments are used to monitor pressures, and a record is maintained to chart the results.

VI.D.4. Cathodic Protection

Corrosion in pipelines is a common phenomenon, and must be controlled to effectively prevent pipeline leaks or structural problems. Although modern pipes are constructed of high quality steel, this will nevertheless corrode over time. Corrosion results from an electrical current that naturally flows from a pipe into the surrounding soil. As this occurs, metal loss, or corrosion, results.

One way to impede this process is to insulate the metal from the soil. This occurs in the manufacturing process, when the pipe is coated. The coating is rechecked at the construction site using a detector that looks for imperfections or gouges that could occur during transportation. New coating is then applied at the welded joints between pipe sections, first by sandblasting the weld, and then applying the new coat.

To further protect the pipeline from corrosion, anodes or "ground beds" are constructed at strategic points along the pipeline. These groundbeds provide cathodic protection by inducing a very small electrical charge into the soil, impeding the flow of electrons to the pipe.

The rectifier that induces the current into the ground bed is regularly checked by pipeline personnel, who ensure that the system is applying sufficient current to maintain cathodic protection to the pipeline. A single 200 foot ground bed can protect as much as 50 miles of pipeline, but the low voltages used does not harm animals or plants in the vicinity.

VI.D.5. Smart Pigs

Surveying a working pipeline for damage or corrosion can be disruptive to consumers if sections of the pipeline must be taken out of service. One nondestructive method of evaluation is a device called a smart pig. Smart pigs are designed for use inside larger operating pipelines (as opposed to smaller distribution lines) to identify possible corrosion defects or abnormalities. Smart pigs are self-contained units consisting of three to five sections held together by universal joints, allowing them to negotiate bends in the line. A typical pig will have a recorder section for storing survey data, a magnetic section that creates the magnetic field used to measure pipeline flaws, and a drive section holding the battery power for the unit. Around the perimeter of the pig are the transducers that measure the fluctuations in the magnetic field indicating possible wall abnormalities.

The smart pig is placed into the pipeline at a pig launcher, which is a spur off the mainline. Once the pig has been loaded, the launcher is pressurized so that the pig enters the mainline. The pig will travel between five to ten miles per hour while collecting data about the pipeline. To enable the pig to record its

location while gathering data, devices called above ground markers (AGMs) are placed at regular intervals along the surveyed pipeline.

The pig is removed from service at a pig trap or receiver. Crews prepare the receiving site with a catch pan to collect pipeline liquids pushed ahead of the pig. After removing the pig and placing it back into a holding trough, survey personnel remove the tape recorder and download its records. The tape is placed onto a special playback machine that feeds the data into instruments that analyze the information and print out a log revealing information like the location of potential corrosion sites or other anomalies not recognizable by above-ground inspection methods.

VI.D.6. Breakout Tanks

To prevent spills and leaks, above ground tanks should have secondary containment underneath tank bases and piping (or move piping above ground for daily visual inspection) to capture any releases before soil or groundwater is contaminated. Corrosion protection should be added to tank bottoms. Regular groundwater water monitoring should be employed and baseline measurements should be taken at the time of installation.

VI.D.7. Proper Training

In a DOT study of remote control spill reduction technology, most pipeline operators interviewed felt that the critical link in reducing the number of incidents and the volume of pipeline spills lies with dispatcher training. They frequently indicated that there was no substitute for a well-trained dispatcher, especially not a software unit designed to automatically shut down the pipeline. The dispatcher is often the final decision-maker in the process of leak detection and pipeline shutdown. If dispatchers fail to recognize a problematic situation and fail to intervene, unchecked spills are likely to be large.

VII. SUMMARY OF APPLICABLE FEDERAL STATUTES AND REGULATIONS

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

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

The descriptions within Section VII 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 clarification 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.

VII.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 (ignitability, corrosivity, reactivity, or toxicity and designated with the code "D").

Regulated entities that generate hazardous waste are subject to waste accumulation, manifesting, and record keeping standards. Facilities must obtain a permit either from EPA or from a State agency which EPA has

authorized to implement the permitting program if they store hazardous wastes for more than 90 days before treatment or disposal. Facilities may treat hazardous wastes stored in less-than-ninety-day tanks or containers without a permit. Subtitle C permits contain general facility standards such as contingency plans, emergency procedures, record keeping and reporting requirements, financial assurance mechanisms, and unit-specific standards. RCRA also contains provisions (40 CFR Part 264 Subpart S and §264.10) for conducting corrective actions which govern the cleanup of releases of hazardous waste or constituents from solid waste management units at RCRA-regulated facilities.

Although RCRA is a Federal statute, many States implement the RCRA program. Currently, EPA has delegated its authority to implement various provisions of RCRA to 47 of the 50 States and two U.S. territories. Delegation has not been given to Alaska, Hawaii, or Iowa.

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

Identification of Solid and Hazardous Wastes (40 CFR Part 261) lays out the procedure every generator must follow to determine whether the material in question 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 EPA 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) (40 CFR Part 268) are regulations prohibiting the disposal of hazardous waste on land without prior treatment. Under the LDRs program, materials must meet LDR treatment standards prior to placement in a RCRA land disposal unit (landfill, land treatment unit, waste pile, or surface impoundment). 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 processor, re-refiner, burner, or marketer (one who generates and sells

off-specification used oil), additional tracking and paperwork requirements must be satisfied.

RCRA contains unit-specific standards for all units used to store, treat, or dispose of hazardous waste, including **Tanks and Containers**. 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 that store such waste, including large quantity generators accumulating waste prior to shipment off-site.

Underground Storage Tanks (USTs) containing petroleum and hazardous substances 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 includes upgrade requirements for existing tanks that must be met by December 22, 1998.

Boilers and Industrial Furnaces (BIFs) that use or burn fuel containing hazardous waste must comply with 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 and EPCRA Hotline, at (800) 424-9346, responds to questions and distributes guidance regarding all RCRA regulations. The RCRA Hotline operates weekdays from 9:00 a.m. to 6:00 p.m., ET, excluding Federal holidays.

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a 1980 law known commonly 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 equals or exceeds a reportable quantity. Reportable quantities are 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 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 and EPCRA Hotline, at (800) 424-9346, answers questions and references guidance pertaining to the Superfund program. The CERCLA Hotline operates weekdays from 9:00 a.m. to 6:00 p.m., ET, excluding Federal holidays.

Emergency Planning And Community Right-To-Know Act

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

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

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

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

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

EPCRA §313 requires manufacturing facilities included in SIC codes 20 through 39, which have ten or more employees, and which manufacture, process, or use specified chemicals in amounts greater than threshold quantities, to submit an annual toxic chemical release report. This report, known commonly 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 RCRA, Superfund and EPCRA Hotline, at (800) 424-9346, answers questions and distributes guidance regarding the emergency planning and community right-to-know regulations. The EPCRA Hotline operates weekdays from 9:00 a.m. to 6:00 p.m., ET, excluding Federal holidays.

Clean Water Act

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

The CWA regulates both direct and indirect discharges. The National Pollutant Discharge Elimination System (NPDES) program (CWA §502) controls direct discharges into navigable waters. Direct discharges or "point source" discharges are from sources such as pipes and sewers. NPDES permits, issued by either EPA or an authorized State (EPA has authorized **42** States to administer the NPDES program), contain industry-specific, technology-based and/or water quality-based limits, and establish pollutant monitoring requirements. A facility that intends to discharge into the nation's waters must obtain a permit prior to initiating its discharge. A permit applicant must provide quantitative analytical data identifying the types of

pollutants present in the facility's effluent. The permit will then set the conditions and effluent limitations on the facility discharges.

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. These regulations require that facilities with the following storm water discharges apply for an NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal storm sewer system; or (3) a discharge which EPA or the State determines to contribute to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.

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

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

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 291-petroleum refining; and SIC 311-leather tanning and finishing, 32 (except 323)-stone, clay, glass, and concrete, 33-primary metals, 3441-fabricated structural metal, and 373-ship and boat building and repairing.

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.

Spill Prevention, Control and Countermeasure Plans

The 1990 Oil Pollution Act requires that facilities that could reasonably be expected to discharge oil in harmful quantities prepare and implement more rigorous Spill Prevention Control and Countermeasure (SPCC) Plan required under the CWA (40 CFR §112.7). There are also criminal and civil penalties for deliberate or negligent spills of oil. Regulations covering response to oil discharges and contingency plans (40 CFR Part 300), and Facility Response Plans to oil discharges (40 CFR §112.20) and for PCB transformers and PCB-containing items were revised and finalized in 1995.

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

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) mandates that EPA establish regulations to protect human health from contaminants in drinking water. The law authorizes EPA to develop national drinking water standards and to

create a joint Federal-State system to ensure compliance with these standards. The SDWA also directs EPA to protect underground sources of drinking water through the control of underground injection of liquid wastes.

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

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

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

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

Toxic Substances Control Act

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

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

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

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

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

Clean Air Act

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

Pursuant to Title I of the CAA, EPA has established national ambient air quality standards (NAAQSs) to limit levels of "criteria pollutants," including carbon monoxide, lead, nitrogen dioxide, particulate matter, volatile organic compounds (VOCs), 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 section 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. Revised NAAQSs for particulates and ozone were proposed in 1996 and may go into effect as early as late 1997.

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.

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 I, section 112(c) of the CAA 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 of the CAA establishes a sulfur dioxide nitrous oxide 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 CAA 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 of the CAA 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) and chloroform, were phased out (except for essential uses) in 1996.

EPA's Clean Air 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 Clean Air Technology Center's website includes recent CAA rules, EPA guidance documents, and updates of EPA activities (www.epa.gov/ttn then select Directory and then CATC).

VII.B. Industry Sector Specific Regulations

The transportation industry is regulated by several different Federal, State, and local agencies. As noted earlier, several government entities regulate specific transportation sectors. For example, the Department of Transportation's (DOT's) Research and Special Program Administration is designed to ensure the safe, reliable and environmentally sound operation of the nation's pipeline transportation system. The DOT has traditionally established national standards that are not affected by local or State laws.

EPA has traditionally relied on delegation to States to meet environmental standards, in many cases without regard to the methods used to achieve certain performance standards. This has resulted in States with more stringent air, water, and hazardous waste requirements than the Federal minimums. This document does not attempt to discuss State standards, but rather highlights relevant Federal laws and proposals that affect the rail, trucking, and pipeline industries.

VII.B.1. Rail Transportation

RCRA

Railroad facilities produce a variety of RCRA regulated wastes in the course of normal operations and utilize underground storage tanks for product and fuel storage. Many railroad facilities qualify as hazardous waste generators under RCRA law. Under RCRA, it is the facility's responsibility to determine whether or not a waste is hazardous. See 40 CFR 261.31 - 261.33 for a full list of EPA hazardous wastes.

Some examples of hazardous wastes produced during railroad operations include solvent residues from parts cleaning and spent nickel cadmium batteries. Used oil is currently not listed as a hazardous waste under RCRA; however, if used oil meets one of the hazardous waste characteristics (e.g., ignitable) or is mixed with a listed hazardous waste, it must be stored and disposed of as a hazardous waste. Most waste oil generated by a railroad (e.g., spilled diesel fuel, motor oil) is not a hazardous waste, but cutting oil, hydraulic oils, and any oil containing heavy metals may require hazardous waste handling.

Potential RCRA hazardous wastes generated during railroad operations include:

- Absorbent materials contaminated with hazardous substances
- Aerosol cans, still pressurized
- Cutting oils, hydraulic oils, and oil with heavy metals contamination
- Grit blast wastes
- Ignitable paint thinners
- Lead-based or ignitable paint and related wastes
- Lead acid batteries, non-recycled
- Nickel cadmium, nickel iron, and carbonaire batteries
- Oil filters constructed with "terne"metal (a lead-tin alloy)
- Solvents and solvent sludge.

Clean Water Act

The CWA is set up to regulate two types of water pollution: one from a point source (e.g., an outflow pipe from a parts-washing basin), the other from a non-point source (e.g., non-drained ground where oil has dripped). The CWA applies to a variety of railroad operations. Any railroad operation that produces a wastewater (e.g., locomotive, rail car, and small parts washing) or deposits substances on the ground that may be carried away by stormwater (e.g., fuel and oil spills), will trigger CWA requirements.

The CWA requires the following from railroads:

- NPDES or POTW permits
- Stormwater discharge permits
- Spill prevention control and countermeasure (SPCC) plans and spill reporting.

Exhibit 22
Clean Water Act Requirements Applicable to Railroads

• Sets limits on volume and nature of discharge • Sets limits on quantity of certain pollutants • Contains monitoring and reporting requirement • *Note: facilities discharging to POTWs do not require NPDES permits.*	• For certain industrial facilities, required if stormwater drains to a municipal separate storm sewer system or directly to receiving water • Required for facilities involved in vehicle maintenance or equipment cleaning • Site maps, drainage and discharge structures, and other information required by permit applications	• Triggered by oil or petroleum product storage in excess of 660 gallons in a single tank or 1,320 gallons in aggregate at facility • Local environmental representatives to be contacted in case of discharge • Documentation of storage vessels, types of containment, emergency equipment available, etc.

The CWA also requires facilities to develop SPCC plans for petroleum products, such as oil, if they are stored in large quantities at a particular railroad. SPCC plans document the location of storage vessels, types of containment, dangers associated with a major release of material from the tanks, types of emergency equipment available at each site, and procedures for notifying the appropriate regulatory and emergency agencies. No SPCC plan is considered complete until it has been reviewed and certified by a Registered Professional Engineer.

Clean Air Act

The CAA establishes two major categories for air pollution regulation: mobile sources (e.g., automobiles, locomotives) and stationary sources (e.g., power boilers, solvent-based cleaning stations). Possible air pollution sources for the railroad industry include boilers, incinerators, forges, foundries, painting or refinishing operations, shop blasting and dust collection control systems, degreasers, and the filling and maintaining of fuel storage tanks.

The CAA regulations on chlorofluorocarbons (CFCs) and asbestos-containing materials also affect railroad operations. Equipment containing CFCs, such as refrigeration units or air conditioning systems, are common. In addition, many old railroad facilities have asbestos-containing materials in floor tiles, ceiling tiles, siding, or thermal system insulation.

Title II of the 1990 CAA Amendments deals with "mobile sources" and seeks to phase in a new set of limits on emissions between 1994 and 1998. If necessary, the EPA has discretion to implement an additional round of mobile source emission limits in 2003.

Section 213(a)(5) of the CAA requires EPA to regulate emissions from locomotives. EPA is expecting to propose locomotive emission regulations in the latter part of 1996 and issue final regulations in the latter part of 1997. The final regulations are expected to impose emission limits on remanufactured and new locomotives.

TSCA

Railroad operations may be affected by TSCA with respect to electrical equipment, such as transformers, containing PCBs. TSCA regulations require proper use, inspection, labeling and marking, recordkeeping, storage, reporting, transportation, management, and disposal of all equipment containing PCBs.

CERCLA

Under CERCLA, incidents must be immediately reported when any spill or release exceeds the Reportable Quantity (RQ). Such a release must be reported if it:

- Occurs on a railroad's property.
- Occurs during transport
- Occurs at a mechanical fixed facility like repair shops or engineering operations.

EPCRA

EPCRA requires companies to identify their facilities to enforcement agencies and provide certain data about the chemicals used at those facilities. EPCRA does not require the reporting of spills that are confined to the boundaries of a facility. All railroads with fixed facilities should maintain Material Safety Data Sheets (MSDSs) for the materials used or stored at the facility. Hard copies should be kept at the facility's site or be available by computer or fax. The transportation of hazardous materials and storage incident to such transportation is exempted from EPCRA requirements.

FIFRA

FIFRA regulations are applicable to railroad operations where herbicides are used to control weeds and brush, or when pesticides and rodenticides are used for pest control in company buildings. FIFRA can also apply to the field application of creosote when bridge timbers or switch ties are installed.

Railroad operations should only apply herbicides, both general and restricted use, according to label instructions. Certification is required for use of restricted use herbicides. Railroads often use outside contractors to apply these products. The National Railroad Contractors Association, an organization comprised of railroad weed control contractors, provides

training for restricted use herbicide applicators.

Oil Pollution Act of 1990

See page 84.

VII.B.2. Trucking

Clean Water Act - NPDES Requirements

As discussed above under the general description of the Clean Water Act, EPA published storm water regulations on November 16, 1990, which require certain dischargers of storm water to waters of the U.S. to apply for NPDES permits. According to the final rule, facilities with a "storm water discharge associated with industrial activities" are required to apply for a storm water permit." The rule states that transportation facilities classified as SIC 40, 41, 42 (except 4221-4225), 43, 44, and 5171 which have vehicle maintenance shops, equipment cleaning operations, or airpost deicing operations are considered to have a storm water discharge associated with industrial activity. However, only those portions of the facility that are either involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, airpost deicing operations, or which are otherwise identified under paragraphs (b)(14)(I)-(xi) of section 122.26 are considered to be associated with industrial activity.

Storm water discharges associated with industrial activity that reach waters of the U.S. through municipal separate storm sewer systems (MS4s) are also required to obtain NPDES storm water permit coverage. Discharges of storm water to a combined sewer system or to a POTW are excluded.

The storm water regulation presents two options for storm water discharges associated with industrial activity. The first option is to submit an individual application consisting of NPDES Forms 1 and 2F. The second option is to file a Notice of Intent (NOI) to be covered under a general permit. Regardless of which permit option a facility selects, the resulting storm water discharge permit will most likely contain a requirement to develop and implement a Storm Water Pollution Prevention Plan. Trucking companies which store petroleum products in quantities over 1320 gallons in above ground tanks are also required to develop a Spill Prevention Control and Countermeasures plan (SPCC).

Clean Air Act - Emissions Standards

The most significant CAA regulations under the CAA that affect the trucking industry address mobile source air emissions from truck engines. EPA has

set limits on exhaust emissions from new heavy-duty engines. EPA considers heavy-duty truck engines to be those in vehicles weighing at least 8500 pounds gross vehicle weight rating (GVWR). In 1994, the regulations required all heavy-duty truck engines to reduce the emission of nitrogen oxides (NOx) from 5.0g/bhp-hr to 4.0 g/bhp-hr by 1998. Emissions standards are also set for hydrocarbons (HC), carbon monoxide (CO), and particulates (PM). Exhibit 23 displays the past, current, and future emission standards for heavy-duty truck engines.

Exhibit 23
Heavy-Duty Truck Engine Emission Standards
(g/bhp-hr measured during EPA heavy-duty engine test)

Model Year	NOx	HC	CO	PM
1991	6	1.3	15.5	0.6
1994	5	1.3	15.5	0.25
1998	4	1.3	15.5	0.1

Source: Motor Trucking Engineering Handbook, 1994.

CAA regulations mandate the use of alternate fuels for fleets of vehicles in the 8500-26,000 pound class that operate in 22 of the country's most polluted areas. These fleets will be required to purchase 50 percent of their new or replacement vehicles as clean fuel vehicles in any one of the covered areas. Alternative fuels are defined by their ability to reduce NOx and non-methane hydrocarbon emissions by a combined 50 percent from diesel baseline levels, although a 30 percent reduction is permitted if 50 percent is unattainable.

In large part due to the 1993 introduction of congressionally mandated low-sulfur, limited aromatic diesel fuel, manufacturers of diesel engines have been able to closely approach the 1994 emission limits and to focus their efforts on controlling particulates. New engine designs have been used to achieve more efficient and cleaner combustion (*Motor Trucking Engineering Handbook*, James W. Fitch, 1994).

Truck maintenance facilities may face CAA issues for vapor recovery systems on underground fuel tanks, waste oil to energy shop heaters, vehicle painting operations, or CFC recycling and recovery systems.

RCRA

Hazardous waste transportation is a highly regulated and specialized segment of the trucking industry, covered by extensive EPA and DOT regulations. The majority of general freight trucking companies do not transport hazardous waste. Nevertheless, RCRA issues at trucking facilities include several non-transportation activities.

Some fluids used in truck maintenance are considered hazardous waste,

requiring specific storage treatment, and disposal. Waste accumulated or generated during trucking maintenance may cause facilities to be considered small or large quantity generators depending on the volume waste. The primary RCRA issues for maintenance facilities are used oil, lead-acid motor vehicle batteries, vehicle maintenance fluids, and scrap tire disposal.

EPCRA

Most trucking companies do not store listed chemicals for use in their facilities. The only exception is diesel fuel or gasoline, which when stored at facilities in quantities slightly over 10,000 gallons, requires reporting to Local Emergency Response Commissions (LERCs) and State Emergency Response Commissions (SERCs). Chemicals in transition are exempt from inventory reporting under EPCRA. This includes all hazardous materials shipments in packages or bulk quantities.

OPA

OPA imposes contingency planning and readiness requirements on certain facilities defined to include rolling stock and motor vehicles. These requirements may affect some trucking establishments.

VII.B.3. Pipelines

Almost all of the petroleum feed stock and products used in the U.S. are, at some point, transported through a Federally-regulated pipeline. The Office of Pipeline Safety (OPS), part of the DOT's Research and Special Programs Administration, regulate essentially all of the approximately 155,000 miles of hazardous liquid pipelines in the U.S., as well as the approximately 255,000 miles of gas transmission lines.

RCRA

Natural gas pipelines do not generate significant quantities of listed hazardous waste. Typical pipeline wastes include condensate, cleaning solvents, and used oil. Each gas pipeline compressor station typically produces an average of 20,000 gallons of used oil each year. This figure depends on the amount of maintenance performed on engines, how often the engines are running, and how much oil is drained from the engines. Under RCRA, used oil is not necessarily a hazardous waste and most gas pipeline companies sell it to refiners.

Water contaminated with constituents of crude oil and petroleum can be regulated under RCRA. Oil pipelines generate hazardous waste when hydrocarbons are mixed with water through pressure testing during

installation or through settling in tank bottoms. Oil pipelines can also generate hazardous sludge that results from pigging operations. At pig receipt sites, scraper and cleaning pigs deposit waste materials that often contain hazardous levels of benzene and/or metals.

With regard to storage tanks, RCRA covers hazardous wastes (rather than products) stored in tanks, and such tanks must have secondary containment. EPA has the authority to issue administrative orders requiring cleanup or product releases causing "imminent and substantial endangerment to health or the environment."

OPA

Under the Oil Pollution Act (OPA), the owner or operator of an oil pipeline is liable for removal costs and damages caused by the discharge of oil onto a U.S. shoreline or into navigable waters. The OPA also imposes requirements on affected facilities concerning contingency planning and readiness. Under previous EPA regulations, facilities with the potential to discharge oil were required to have spill prevention, control, and countermeasure (SPCC) plans. Under new requirements, facilities that could be reasonably expected to cause "substantial harm" to the environment by a discharge of oil into navigable waters may be required to adopt such plans.

The DOT's Office of Pipeline Safety (OPS) is responsible for implementing OPA requirements as they apply to onshore oil pipelines that could reasonably be expected to cause significant and substantial harm to the environment by discharging oil into the navigable waters of the U.S. and adjoining shorelines. The OPA applies to all oil pipelines, whether or not they are currently exempt from existing Federal regulations or statutes.

Storage tank facilities that could cause significant and substantial harm to the environment by discharging to navigable water must develop facility response plans and submit them to the Federal government for approval. The act includes extensive liability provisions for spills to navigable waters.

Pipeline Safety Act

Congress passed the Pipeline Safety Act in 1992. The most far-reaching effect of the Act is the expansion of OPS' traditional safety mission to include environmental protection. Major provisions in the Act relate to excess flow valves, cast iron pipelines, gathering lines, customer-owned service lines, underwater inspection and burial, underwater abandoned pipeline facilities, low internal stress pipelines, and emergency flow restricting devices, and contain increased inspection requirements including

use of "smart pigs," and operator qualification testing. The Act also provides a statutory basis for the DOT's Research and Special Programs Administration (RSPA), which had been initially established by the Secretary of Transportation in 1977. The RSPA Administrator is to be appointed by the President and confirmed by the Senate.

Natural Gas Pipeline Safety Act and the Hazardous Liquid Pipeline Safety Act

The Natural Gas Pipeline Safety Act (NGPSA) of 1968 provides for Federal safety regulation of pipeline facilities used in the transportation of natural gases. The Hazardous Liquid Pipeline Safety Act (HLPSA) of 1979 provides for safety regulation of pipeline facilities used in the transportation of hazardous liquids. Both provide a framework for promoting pipeline safety through exclusive Federal regulation of interstate pipeline facilities, and Federal delegation to the States for all or part of the responsibility for intrastate pipeline facilities. To provide expertise during development of pipeline safety regulations, NGPSA and HLPSA established two pipeline safety advisory committees, the Technical Pipeline Safety Standards Committee and the Technical Hazardous Liquid Pipeline Safety Standards Committee, respectively. The Committees review proposed regulations for technical feasibility, reasonableness, and practicability. The Committees also provide advice to the DOT on pipeline safety and environmental issues.

TSCA

Some natural gas pipelines used PCBs in their system through the 1980s. PCBs were widely used in transformers, as heat transfer fluids, and in some types of compressor lubricants. In 1989, the Gas Research Institute began a program to deal with the management of PCB residue. The first step involved measuring and analyzing statistical data on PCB contamination of gas transmission pipelines and reviewing remediation programs involving condensate, soil, pipelines, and surface facilities. The Gas Research Institute developed information on physical properties and analytical methods for PCB condensate mixtures, the soil-water partitioning behavior of these mixtures, and an evaluation of the risks associated with typical pipeline operations and PCB abandonment.

CAA

The Clean Air Act affects pipeline system design, operation, and maintenance. Materials such as carbon dioxide, hydrogen sulfide, and mercaptan sulfur are often present in the field gathering systems that move natural gas from wells to processing plants. Pipeline operators must track emissions from compressor and pump stations. Fugitive emissions of benzene from seals on pumps, compressors, valves, meters, and storage tanks

must also be evaluated and controlled.

In areas that meet Federal clean air standards, new or modified "major sources" (e.g., tank farms) must install "Best Available Control Technology" (BACT). In areas that do not meet Federal clean air standards, new or modified major sources must utilize "Lowest Achievable Emission Rate" technology, which must be at least as stringent as BACT; existing major sources must utilize designated "Reasonably Available Control Technology," which may be less stringent than BACT. For major sources that emit "Hazardous Air Pollutants," EPA is developing "Maximum Achievable Control Technology" regulations.

CWA

The Spill Prevention Control and Countermeasures (SPCC) program covers petroleum above ground tank facilities that may affect "navigable waters." The SPCC program requires reporting of spills to navigable waters and development of contingency plans that must be kept on-site. EPA has the authority to issue administrative orders requiring cleanup.

SDWA

Regulations promulgated under the Safe Drinking Water Act classify underground injection wells according to the type of operation or substance involved. 40 CFR §144.6(b) describes Class II injection wells as those which inject fluids:

- Which are brought to the surface in connection with natural gas storage operations, or conventional oil or natural gas production and may be commingled with waste waters from gas plants which are an integral part of production operations, unless those waters are classified as a hazardous waste at the time of injection.

- For enhanced recovery of oil or natural gas; and

- For storage of hydrocarbons which are liquid at standard temperature and pressure.

Many wells associated with the oil and gas industry, including salt water injection wells, enhanced recovery wells, and wells injecting liquid hydrocarbons for storage, are likely to be regulated under the Underground Injection Control (UIC) program.

Under the UIC, wells are required to obtain and adhere to the requirements of operating permits. The permit application must prove to the permitting authority (usually the State) that operation of the underground injection well

will not endanger drinking water sources. Class II permits are issued for the life of the well, but can be reviewed every five years.

VII.C. Pending and Proposed Regulatory Requirements

Regulations are currently under development for the transportation equipment cleaning industry. These regulations, when effective, will impact railroads that clean the interior of tank cars, hopper cars, and box cars, and produce wastewater. If a tank car has carried hazardous materials, its car cleaning waste waters may require proper handling under RCRA in addition to that for normal waste waters due to contamination from leftover tank contents or "heel."

In addition there may soon be an effluent guideline on Metal Products and Machinery, which will apply to the rail industry especially for metal machining shops.

VIII. COMPLIANCE AND ENFORCEMENT HISTORY

VIII.A. Background

Until recently, 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.

VIII.B. 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 reflect solely 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 (April 1, 1992 to March 31, 1997) and the other for the most recent twelve-month period (April 1, 1996 to March 31, 1997). 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 EPA Regions for certain sectors.[1] This variation may be attributable to state/local data entry variations, specific geographic concentrations, proximity to population centers, sensitive ecosystems, highly toxic chemicals used in production, or historical noncompliance. Hence, the exhibited data do not rank regional performance or necessarily reflect which regions may have the most compliance problems.

Compliance and Enforcement Data Definitions

General Definitions

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

Integrated Data for Enforcement Analysis (IDEA) -- is a data integration system that can retrieve information from the major EPA program office databases. IDEA uses the FINDS identification number to link separate data records from EPA's databases. This allows retrieval of records from across

[1] 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).

media or statutes for any given facility, thus creating a "master list" of records for that 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 (metal mining, nonmetallic mineral mining, electric power generation, ground transportation, water transportation, and dry cleaning), or industries in which only a very small fraction of facilities report to TRI (e.g., printing), the notebook uses the FINDS universe for executing data queries. The SIC code range selected for each search is defined by each notebook's selected SIC code coverage described in Section II.

Facilities Inspected --- indicates the level of EPA and state agency inspections for the facilities in this data search. These values show what percentage of the facility universe is inspected in a one-year or five-year period.

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, between compliance inspections at a facility within the defined universe.

Facilities with One or More Enforcement Actions -- expresses the number of facilities that were the subject of 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, e.g., a facility with 3 enforcement actions counts as 1 facility.

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, e.g., 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 recorded as state enforcement activity. Some states extensively report enforcement activities into EPA data systems, while other states may use their own data systems.

Federal Lead Actions -- shows what percentage of the total enforcement actions are taken by the United States Environmental Protection Agency. This value includes referrals from state agencies. Many of these actions result from coordinated or joint state/federal efforts.

Enforcement to Inspection Rate -- is a ratio of enforcement actions to inspections, and is presented for comparative purposes only. This ratio is a rough indicator of the relationship between inspections and enforcement. It relates the number of enforcement actions and the number of inspections that occurred within the one-year or five-year period. This ratio includes the inspections and enforcement actions reported under the Clean Water Act (CWA), the Clean Air Act (CAA) and the Resource Conservation and Recovery Act (RCRA). 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. Also, this ratio does not account for enforcement actions arising from non-inspection compliance monitoring activities (e.g., self-reported water discharges) that can result in enforcement action within the CAA, CWA, and RCRA.

Facilities with One or More Violations Identified -- indicates the percentage of inspected facilities having a violation identified in one of the following data categories: In Violation or Significant Violation Status (CAA); Reportable Noncompliance, Current Year Noncompliance, Significant Noncompliance (CWA); Noncompliance and Significant Noncompliance (FIFRA, TSCA, and EPCRA); Unresolved Violation and Unresolved High Priority Violation (RCRA). The values presented for this column reflect the extent of noncompliance within the measured time frame, but do not distinguish between the severity of the noncompliance. 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.

VIII.C. Industry Sector Compliance History

Exhibits 24-31 illustrate recent enforcement activity within the transportation industry. Of the 12,904 inspections conducted at rail, trucking, and oil and gas pipeline facilities over a five year period, 774, or 6 percent, resulted in enforcement actions. Of the three transportation industries addressed by this profile, the pipeline industry has received greater scrutiny from Federal and State inspectors, although certain portions of the trucking industry have also been subject to environmental compliance inspections. While the greatest number of inspections of rail facilities addressed the CWA, the trucking industry had more RCRA inspections while the pipeline industry was subject to the most inspections under the CAA.

Exhibit 24
Five-Year Enforcement and Compliance Summary for Transportation Sectors

	A	B	C	D	E	F	G	H	I	J
	SIC Code	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
Rail	4011	434	165	717	36	30	51	74%	26%	0.07
	4013	136	62	328	25	9	13	85%	15%	0.04
Trucking	4212	991	236	987	60	52	147	83%	17%	0.15
	4213	475	205	737	39	34	69	88%	12%	0.09
	4214	195	87	539	22	22	43	81%	19%	0.08
	4215	103	31	60	103	0	0	-	-	-
	4221	219	119	337	39	10	15	73%	27%	0.04
	4222	63	16	52	73	3	6	33%	67%	0.12
	4225	427	151	599	43	25	54	94%	6%	0.09
	4226	479	264	1,828	16	75	182	87%	13%	0.1
	4231	492	180	747	40	28	68	85%	15%	0.09
Oil	4612	377	189	780	29	16	85	82%	18%	0.11
Pipelines	4613	362	193	991	22	16	71	86%	14%	0.07
	4619	45	21	57	47	3	5	100%	0%	0.09
Natural	4922	2,942	1,380	4,566	39	88	122	93%	7%	0.03
Gas	4923	190	84	342	33	2	3	100%	0%	0.01
Pipelines	4924	118	53	210	34	5	7	100%	0%	0.03
	4925	192	112	620	19	12	31	87%	13%	0.05
	4932	30	17	90	20	4	4	100%	0%	0.04
Totals		**7,786**	**3,263**	**12,904**	**36**	**375**	**774**	**84%**	**16%**	**0.06**

Exhibit 25
One-Year Enforcement and Compliance Summary for Transportation Sectors

	A	B	C	D	E		F		G	H
	SIC Code	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*		
Rail	4011	434	73	125	49	67%	6	8%	7	0.06
	4013	136	28	60	23	82%	1	4%	1	0.02
Trucking	4212	991	82	167	87	106%	11	13%	16	0.10
	4213	475	70	126	59	84%	10	14%	16	0.13
	4214	195	43	106	46	107%	9	21%	10	0.09
	4215	103	8	8	5	63%	0	0%	0	-
	4221	219	58	71	24	41%	1	2%	1	0.01
	4222	63	4	6	2	50%	0	0%	0	-
	4225	427	58	95	70	121%	2	3%	2	0.02
	4226	479	152	317	85	56%	17	11%	24	0.08
	4231	492	65	137	45	69%	8	12%	10	0.07
Oil Pipelines	4612	377	114	185	20	18%	2	2%	4	0.02
	4613	362	122	186	32	26%	3	2%	5	0.03
	4619	45	10	45	6	60%	0	0%	0	-
Natural Gas Pipelines	4922	2,942	708	963	159	22%	23	3%	23	0.02
	4923	190	41	66	13	32%	1	2%	2	0.03
	4924	118	29	50	9	31%	2	7%	3	0.06
	4925	192	58	107	16	28%	3	5%	9	0.08
	4932	30	8	13	5	63%	1	13%	1	0.08
Totals		**7,786**	**1585**	**2499**	**681**	**27%**	**85**	**3%**	**103**	**0.04**

**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 26
Five-Year Enforcement and Compliance Summary by Statute for Transportation Sectors

	SIC Code	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
Rail	4011	165	717	51	18%	6%	52%	56%	30%	30%	0%	8%
	4013	62	328	13	30%	8%	56%	54%	13%	31%	1%	8%
Trucking	4212	236	987	147	14%	33%	14%	4%	71%	59%	1%	3%
	4213	205	737	69	13%	17%	11%	4%	74%	78%	1%	0%
	4214	87	539	43	23%	16%	6%	7%	70%	72%	1%	5%
	4215	31	60	0	5%	0%	0%	0%	95%	0%	0%	0%
	4221	119	337	15	88%	87%	1%	0%	9%	7%	1%	7%
	4222	16	52	6	12%	17%	56%	50%	33%	33%	0%	0%
	4225	151	599	54	31%	9%	16%	6%	52%	83%	2%	2%
	4226	264	1,828	182	46%	53%	15%	14%	38%	32%	1%	1%
	4231	180	747	68	17%	7%	11%	13%	71%	78%	1%	1%
Oil Pipelines	4612	189	780	85	79%	71%	8%	5%	13%	25%	0%	0%
	4613	193	991	71	64%	73%	20%	3%	16%	23%	0%	1%
	4619	21	57	5	54%	20%	23%	20%	21%	60%	2%	0%
Natural Gas Pipelines	4922	1,380	4,566	122	92%	86%	3%	3%	5%	6%	0%	5%
	4923	84	342	3	89%	67%	8%	33%	3%	0%	0%	0%
	4924	53	210	7	80%	71%	13%	29%	8%	0%	0%	0%
	4925	112	620	31	71%	72%	12%	13%	17%	9%	0%	6%
	4932	17	90	4	39%	50%	42%	25%	17%	25%	2%	0%
Totals		**3,263**	**12,904**	**774**	**59%**	**41%**	**12%**	**11%**	**29%**	**45%**	**1%**	**3%**

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 27
One-Year Enforcement and Compliance Summary for Transportation Sectors

	SIC Code	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
Rail	4011	73	125	7	16%	17%	51%	67%	33%	17%	0%	0%
	4013	28	60	1	30%	0%	50%	100%	20%	0%	0%	0%
Trucking	4212	82	167	16	17%	31%	14%	0%	69%	69%	0%	0%
	4213	70	126	16	12%	19%	10%	0%	78%	81%	0%	0%
	4214	43	106	10	12%	20%	10%	0%	77%	80%	0%	0%
	4215	8	8	0	25%	0%	0%	0%	75%	0%	0%	0%
	4221	58	71	1	82%	0%	0%	0%	18%	100%	0%	0%
	4222	4	6	0	17%	0%	33%	0%	50%	0%	0%	0%
	4225	58	95	2	37%	50%	14%	0%	49%	50%	0%	0%
	4226	152	317	24	48%	42%	12%	17%	39%	38%	0%	4%
	4231	65	137	10	19%	0%	13%	0%	68%	100%	0%	0%
Oil Pipelines	4612	114	185	4	87%	75%	4%	0%	9%	25%	0%	0%
	4613	122	186	5	72%	60%	22%	0%	6%	40%	0%	0%
	4619	10	45	0	50%	0%	8%	0%	42%	0%	0%	0%
Natural Gas Pipelines	4922	708	963	23	94%	96%	3%	0%	4%	4%	0%	0%
	4923	41	66	2	83%	100%	11%	0%	6%	0%	0%	0%
	4924	29	50	3	92%	33%	2%	67%	6%	0%	0%	0%
	4925	58	107	9	79%	100%	8%	0%	12%	0%	0%	0%
	4932	8	13	1	46%	100%	38%	0%	15%	0%	0%	0%
Totals		**1,585**	**2,499**	**103**	**64%**	**46%**	**11%**	**10%**	**26%**	**44%**	**0%**	**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.*

VIII.D. Comparison of Enforcement Activity Between Selected Industries

The following exhibits present inspection and enforcement information across numerous manufacturing sector industries including the ground, water, and air transportation industries.

Exhibit 28: Five-Year Enforcement and Compliance Summary for Selected Industries

A	B	C	D	E	F	G	H	I	J
Industry Sector	**Facilities in Search**	**Facilities Inspected**	**Number of Inspections**	**Average Months Between Inspections**	**Facilities with 1 or More Enforcement Actions**	**Total Enforcement Actions**	**Percent State Lead Actions**	**Percent Federal Lead Actions**	**Enforcement to Inspection Rate**
Metal Mining	1,232	378	1,600	46	63	111	53%	47%	0.07
Coal Mining	3,256	741	3,748	52	88	132	89%	11%	0.04
Oil and Gas Extraction	4,676	1,902	6,071	46	149	309	79%	21%	0.05
Non-Metallic Mineral Mining	5,256	2,803	12,826	25	385	622	77%	23%	0.05
Textiles	355	267	1,465	15	53	83	90%	10%	0.06
Lumber and Wood	712	473	2,767	15	134	265	70%	30%	0.10
Furniture	499	386	2,379	13	65	91	81%	19%	0.04
Pulp and Paper	484	430	4,630	6	150	478	80%	20%	0.10
Printing	5,862	2,092	7,691	46	238	428	88%	12%	0.06
Inorganic Chemicals	441	286	3,087	9	89	235	74%	26%	0.08
Resins and Manmade Fibers	329	263	2,430	8	93	219	76%	24%	0.09
Pharmaceuticals	164	129	1,201	8	35	122	80%	20%	0.10
Organic Chemicals	425	355	4,294	6	153	468	65%	35%	0.11
Agricultural Chemicals	263	164	1,293	12	47	102	74%	26%	0.08
Petroleum Refining	156	148	3,081	3	124	763	68%	32%	0.25
Rubber and Plastic	1,818	981	4,383	25	178	276	82%	18%	0.06
Stone, Clay, Glass and Concrete	615	388	3,474	11	97	277	75%	25%	0.08
Iron and Steel	349	275	4,476	5	121	305	71%	29%	0.07
Metal Castings	669	424	2,535	16	113	191	71%	29%	0.08
Nonferrous Metals	203	161	1,640	7	68	174	78%	22%	0.11
Fabricated Metal Products	2,906	1,858	7,914	22	365	600	75%	25%	0.08
Electronics	1,250	863	4,500	17	150	251	80%	20%	0.06
Automobile Assembly	1,260	927	5,912	13	253	413	82%	18%	0.07
Shipbuilding and Repair	44	37	243	9	20	32	84%	16%	0.13
Ground Transportation	**7,786**	**3,263**	**12,904**	**36**	**375**	**774**	**84%**	**16%**	**0.06**
Water Transportation	514	192	816	38	36	70	61%	39%	0.09
Air Transportation	444	231	973	27	48	97	88%	12%	0.10
Fossil Fuel Electric Power	3,270	2,166	14,210	14	403	789	76%	24%	0.06
Dry Cleaning	6,063	2,360	3,813	95	55	66	95%	5%	0.02

Exhibit 29: One-Year Enforcement and Compliance Summary for Selected Industries

A	B	C	D	E		F		G	H
				Facilities with 1 or More Violations		Facilities with 1 or more Enforcement Actions			
Industry Sector	Facilities in Search	Facilities Inspected	Number of Inspections	Number	Percent*	Number	Percent*	Total Enforcement Actions	Enforcement to Inspection Rate
Metal Mining	1,232	142	211	102	72%	9	6%	10	0.05
Coal Mining	3,256	362	765	90	25%	20	6%	22	0.03
Oil and Gas Extraction	4,676	874	1,173	127	15%	26	3%	34	0.03
Non-Metallic Mineral Mining	5,256	1,481	2,451	384	26%	73	5%	91	0.04
Textiles	355	172	295	96	56%	10	6%	12	0.04
Lumber and Wood	712	279	507	192	69%	44	16%	52	0.10
Furniture	499	254	459	136	54%	9	4%	11	0.02
Pulp and Paper	484	317	788	248	78%	43	14%	74	0.09
Printing	5,862	892	1,363	577	65%	28	3%	53	0.04
Inorganic Chemicals	441	200	548	155	78%	19	10%	31	0.06
Resins and Manmade Fibers	329	173	419	152	88%	26	15%	36	0.09
Pharmaceuticals	164	80	209	84	105%	8	10%	14	0.07
Organic Chemicals	425	259	837	243	94%	42	16%	56	0.07
Agricultural Chemicals	263	105	206	102	97%	5	5%	11	0.05
Petroleum Refining	156	132	565	129	98%	58	44%	132	0.23
Rubber and Plastic	1,818	466	791	389	83%	33	7%	41	0.05
Stone, Clay, Glass and Concrete	615	255	678	151	59%	19	7%	27	0.04
Iron and Steel	349	197	866	174	88%	22	11%	34	0.04
Metal Castings	669	234	433	240	103%	24	10%	26	0.06
Nonferrous Metals	203	108	310	98	91%	17	16%	28	0.09
Fabricated Metal	2,906	849	1,377	796	94%	63	7%	83	0.06
Electronics	1,250	420	780	402	96%	27	6%	43	0.06
Automobile Assembly	1,260	507	1,058	431	85%	35	7%	47	0.04
Shipbuilding and Repair	44	22	51	19	86%	3	14%	4	0.08
Ground Transportation	**7,786**	**1,585**	**2,499**	**681**	**43%**	**85**	**5%**	**103**	**0.04**
Water Transportation	514	84	141	53	63%	10	12%	11	0.08
Air Transportation	444	96	151	69	72%	8	8%	12	0.08
Fossil Fuel Electric Power	3,270	1,318	2,430	804	61%	100	8%	135	0.06
Dry Cleaning	6,063	1,234	1,436	314	25%	12	1%	16	0.01

**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 30: Five-Year Inspection and Enforcement Summary by Statute for Selected Industries

Industry Sector	Facilities Inspected	Total Inspections	Total Enforcement Actions	Clean Air Act		Clean Water Act		RCRA		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	378	1,600	111	39%	19%	52%	52%	8%	12%	1%	17%
Coal Mining	741	3,748	132	57%	64%	38%	28%	4%	8%	1%	1%
Oil and Gas Extraction	1,902	6,071	309	75%	65%	16%	14%	8%	18%	0%	3%
Non-Metallic Mineral Mining	2,803	12,826	622	83%	81%	14%	13%	3%	4%	0%	3%
Textiles	267	1,465	83	58%	54%	22%	25%	18%	14%	2%	6%
Lumber and Wood	473	2,767	265	49%	47%	6%	6%	44%	31%	1%	16%
Furniture	386	2,379	91	62%	42%	3%	0%	34%	43%	1%	14%
Pulp and Paper	430	4,630	478	51%	59%	32%	28%	15%	10%	2%	4%
Printing	2,092	7,691	428	60%	64%	5%	3%	35%	29%	1%	4%
Inorganic Chemicals	286	3,087	235	38%	44%	27%	21%	34%	30%	1%	5%
Resins and Manmade Fibers	263	2,430	219	35%	43%	23%	28%	38%	23%	4%	6%
Pharmaceuticals	129	1,201	122	35%	49%	15%	25%	45%	20%	5%	5%
Organic Chemicals	355	4,294	468	37%	42%	16%	25%	44%	28%	4%	6%
Agricultural Chemicals	164	1,293	102	43%	39%	24%	20%	28%	30%	5%	11%
Petroleum Refining	148	3,081	763	42%	59%	20%	13%	36%	21%	2%	7%
Rubber and Plastic	981	4,383	276	51%	44%	12%	11%	35%	34%	2%	11%
Stone, Clay, Glass and Concrete	388	3,474	277	56%	57%	13%	9%	31%	30%	1%	4%
Iron and Steel	275	4,476	305	45%	35%	26%	26%	28%	31%	1%	8%
Metal Castings	424	2,535	191	55%	44%	11%	10%	32%	31%	2%	14%
Nonferrous Metals	161	1,640	174	48%	43%	18%	17%	33%	31%	1%	10%
Fabricated Metal	1,858	7,914	600	40%	33%	12%	11%	45%	43%	2%	13%
Electronics	863	4,500	251	38%	32%	13%	11%	47%	50%	2%	7%
Automobile Assembly	927	5,912	413	47%	39%	8%	9%	43%	43%	2%	9%
Shipbuilding and Repair	37	243	32	39%	25%	14%	25%	42%	47%	5%	3%
Ground Transportation	**3,263**	**12,904**	**774**	**59%**	**41%**	**12%**	**11%**	**29%**	**45%**	**1%**	**3%**
Water Transportation	192	816	70	39%	29%	23%	34%	37%	33%	1%	4%
Air Transportation	231	973	97	25%	32%	27%	20%	48%	48%	0%	0%
Fossil Fuel Electric Power	2,166	14,210	789	57%	59%	32%	26%	11%	10%	1%	5%
Dry Cleaning	2,360	3,813	66	56%	23%	3%	6%	41%	71%	0%	0%

Exhibit 31: One-Year Inspection and Enforcement Summary by Statute for Selected Industries

Industry Sector	Facilities Inspected	Total Inspections	Total Enforcement Actions	Clean Air Act		Clean Water Act		RCRA		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	142	211	10	52%	0%	40%	40%	8%	30%	0%	30%
Coal Mining	362	765	22	56%	82%	40%	14%	4%	5%	0%	0%
Oil and Gas Extraction	874	1,173	34	82%	68%	10%	9%	9%	24%	0%	0%
Non-Metallic Mineral Mining	1,481	2,451	91	87%	89%	10%	9%	3%	2%	0%	0%
Textiles	172	295	12	66%	75%	17%	17%	17%	8%	0%	0%
Lumber and Wood	279	507	52	51%	30%	6%	5%	44%	25%	0%	40%
Furniture	254	459	11	66%	45%	2%	0%	32%	45%	0%	9%
Pulp and Paper	317	788	74	54%	73%	32%	19%	14%	7%	0%	1%
Printing	892	1,363	53	63%	77%	4%	0%	33%	23%	0%	0%
Inorganic Chemicals	200	548	31	35%	59%	26%	9%	39%	25%	0%	6%
Resins and Manmade Fibers	173	419	36	38%	51%	24%	38%	38%	5%	0%	5%
Pharmaceuticals	80	209	14	43%	71%	11%	14%	45%	14%	0%	0%
Organic Chemicals	259	837	56	40%	54%	13%	13%	47%	34%	0%	0%
Agricultural Chemicals	105	206	11	48%	55%	22%	0%	30%	36%	0%	9%
Petroleum Refining	132	565	132	49%	67%	17%	8%	34%	15%	0%	10%
Rubber and Plastic	466	791	41	55%	64%	10%	13%	35%	23%	0%	0%
Stone, Clay, Glass and Concrete	255	678	27	62%	63%	10%	7%	28%	30%	0%	0%
Iron and Steel	197	866	34	52%	47%	23%	29%	26%	24%	0%	0%
Metal Castings	234	433	26	60%	58%	10%	8%	30%	35%	0%	0%
Nonferrous Metals	108	310	28	44%	43%	15%	20%	41%	30%	0%	7%
Fabricated Metal	849	1,377	83	46%	41%	11%	2%	43%	57%	0%	0%
Electronics	420	780	43	44%	37%	14%	5%	43%	53%	0%	5%
Automobile Assembly	507	1,058	47	53%	47%	7%	6%	41%	47%	0%	0%
Shipbuilding and Repair	22	51	4	54%	0%	11%	50%	35%	50%	0%	0%
Ground Transportation	**1,585**	**2,499**	**103**	**64%**	**46%**	**11%**	**10%**	**26%**	**44%**	**0%**	**1%**
Water Transportation	84	141	11	38%	9%	24%	36%	38%	45%	0%	9%
Air Transportation	96	151	12	28%	33%	15%	42%	57%	25%	0%	0%
Fossil Fuel Electric Power	1,318	2,430	135	59%	73%	32%	21%	9%	5%	0%	0%
Dry Cleaning	1,234	1,436	16	69%	56%	1%	6%	30%	38%	0%	0%

IX. REVIEW OF MAJOR LEGAL ACTIONS

This section provides summary information about major cases that have affected this sector. As indicated in EPA's Enforcement Accomplishments Reports from 1992-1994, several significant enforcement actions were resolved between 1992-1994 involving the rail, trucking, and pipeline industries. Characterizations of the types of enforcement actions taken are provided for each of the cited cases.

IX.A. Review of Major Cases

IX.A.1. Rail

U.S. v. Consolidated Rail Corporation, CAA, 1992

U.S. District Court entered a second amendment to consent order resolving EPA's CAA contempt action against Consolidated Rail Corporation (Conrail). The amendment requires Conrail to pay $165,000 in penalties for past violations. In addition, it allows the company to apply encrusting agents in lieu of water to control fugitive dust. The amendment is based on a consent order EPA and Conrail negotiated in 1986 to resolve violations of Ohio's State Implementation Plan (SIP).

U.S. v. CSX Transportation, CWA, 1993

CSX Transportation signed a consent decree to pay $3,00,000 in civil penalties and perform four Supplemental Environmental Projects (SEPs) valued at $4,000,000 for alleged violations of CWA for exceeding NPDES limits.

Burlington Northern, Multi-media, 1994

EPA Region V sought $279,078 to recover costs incurred consistent with the NCP under CERCLA and OPA, natural resource damages totaling $250,000, and CWA penalties totaling $2,500,000 for three incidents of railroad derailment.

In the matter of Burlington Northern Railroad, EPCRA, 1994

A RCRA consent order was issued for the contamination of groundwater, and a 1993 unilateral administrative order, based on a multimedia inspection, required the defendant to cease discharge of oil and chlorinated waters.

Southern Pacific Transportation Corporation, 1994

A train derailment caused the release of a herbicide into the Sacramento River killing all plant life for 42 miles. The settlement provided for recovery of $36 million in response costs. The decree also required payment of a $500,000 civil penalty (the statutory maximum for the violation). Defendants must also establish a $14 million fund for natural resource damages.

U.S. v. Norfolk & Western Railway Company, 1994

Criminal plea agreement and settlement resulted in the U.S. receiving $500,000 fine and $500,000 restitution. Missouri received $700,000 fine and $1.7 million in restitution, $1 million for creation of a park, and establishment of a $2.2 million environmental awareness program.

IX.A.2. Trucking

U.S. v. The Carborundum Company, et al. , CERCLA, 1994

On March 30, 1994, a consent decree was lodged in the District Court of New Jersey which partially settles Region II's cost recovery claims relating to the Caldwell Trucking Company Superfund site in Fairchild Township, New Jersey. From 1950 through the mid 1970s, Caldwell Trucking hauled septage and other wastes from residential, commercial, and industrial customers and disposed of these wastes in unlined lagoons at the site. The nine settling defendants agreed to pay $2.46 million for EPA's past and future costs and agreed to perform all scheduled remedial and natural resource restoration work at the site, valued at an additional $32 million. New Jersey will also receive its first natural resource damage payment under CERCLA, in the amount of $984,000, and the U.S. Department of the Interior will receive $40,000 for its assessment and monitoring costs.

U.S. v. Gomer's Diesel and Electric Company, RCRA, 1994

Gomer's Diesel and Electric Co., with automotive and truck maintenance facilities located in Belgrade, Great Falls, and Missoula, Montana, was sentenced on March 24, 1994, following a plea of guilty to one-count of unlawful transportation of a hazardous waste in violation of RCRA. The company was placed on supervised probation for two years and fined $100,000, $50,000 of which was suspended in recognition of remediation conducted at its Belgrade facility.

Hamner, Inc., Corpus Christi, CWA, 1994

An administrative Class I complaint was issued against Hamner, Inc. Corpus

Christi, Texas, on May 24, 1994, with a proposed penalty of $9,108 for violations of the CWA. The corporation's tanker truck overturned, discharging approximately 24 barrels of petroleum naphtha. The petroleum naphtha entered navigable waters of the U.S. in quantities determined to be harmful. The oil did not enter a major waterway, no drinking water supply was affected, and there were no signs of damage to wildlife or aquatic life. Settlement negotiations are underway.

IX.A.3. Pipelines

U.S. v. Shell Oil Pipeline Corporation, Criminal Enforcement, 1992

Pipeline rupture caused an 860,000 gallon oil spill into the Mississippi, Gasconade, and Missouri rivers. Shell pleaded guilty to violation of the Refuse Act and agreed to pay $8,400,000 in fines, restitution, and settlements.

U.S. v. Texaco, CERCLA, 1993

Texaco entered a consent decree for performance of a remedial design and remedial action at the Pacific Cost Pipeline Superfund site in California. The RA is valued at $4,000,000. Texaco also agreed to reimburse California for response costs, the U.S. for future response costs, and EPA for past RI/FS costs.

U.S. v. Transwestern Pipeline Company, TSCA, 1993

A consent decree was terminated when the defendant met all terms and conditions of settlement (including payment of a penalty of $375,000 and groundwater monitoring). Under the decree, 144,991 tons of PCB contaminated soil and debris were removed and disposed in TSCA landfill.

U.S. v. Tennessee Gas Pipeline Co., CWA, 1993

Court entered final order for dismissal after parties agreed to a penalty of $725,000 for unauthorized discharges of PCBs from a pumping station.

U.S. v. U.S. Oil and U.S. v. Texaco, OPA, 1993

U.S. Oil agreed to pay civil penalties of $425,000 and Texaco agreed to pay $480,000 in penalties. Both were made to acquire and install state-of-the-art spill detection and prevention equipment valued at $800,000 for each company. Both were also required to reimburse for Federal spill response costs of $60,000 and $125,000 respectively. The actions represent the first judicial penalties assessed under OPA.

IX.B. 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.

Exhibit 32 contains a sample of SEPs from the transportation industry. The information contained in the chart is not comprehensive and provides only a sample of the types of SEPs developed for the transportation industry.

Exhibit 32
Supplemental Environmental Projects in the Transportation Industry

Case Name	Statute	Estimated Cost to Company	Environmentally Beneficial Activities
General Chemical Company	CAA	$90,000,	Facility was to purchase and install an Airless Paint Spray Unit and Fanu Robotics Spray Unit in order to reduce total VOC releases to the atmosphere by 10 percent.
Thatcher Chemical Company	EPCRA §304	Not Known	SEP included the construction of a building with scrubbing equipment for enclosing loading products to prevent future releases into the environment to be completed by January 24, 1994.
CSX Transportation	CAA	$ 4,000,000	Company was required to: • Perform NPDES compliance audits at 21 active CSX railroad yards • Conduct multi-media risk assessment audit at 61 inactive facilities • Provide environmental awareness training program for managers • Develop best management practices manual and a seminar on storm water runoff at railroad yards.

X. 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. This section of the notebook also contains a listing and description of national and regional trade associations.

X.A. Sector-Related Environmental Programs and Activities

Environmental compliance assurance activities have been conducted by the major trade associations for each of the transportation sectors covered in this report. The following examples represent some of the industry initiatives that promote compliance, or assess methods to reduce environmental contamination.

X.A.1. Rail

Waste Minimization Assessment for a Manufacturer of Rebuilt Railway Cars and Components

U.S. EPA funded a pilot project to assist small- and medium-size manufacturers wishing to minimize their generation of hazardous waste, but lacking the expertise to do so. The Agency established Waste Minimization Assessment Centers (WMACs) at selected universities, adapting procedures from EPA's *Waste Minimization Opportunity Assessment Manual*. The WMAC team at the University of Tennessee inspected a plant that rebuilds approximately 2,000 railway cars each year and that refurbishes wheel assemblies and air brake systems. The team issued a report and made a number of recommendations for minimizing hazardous waste outputs.

X.A.2. Trucking

Consolidated Compliance Reviews

The trucking industry has worked with the Department of Transportation, Federal Highway Administration (FHWA), to develop streamlined processes for conducting compliance reviews. As a result, the FHWA now conducts all record reviews and inspection activities in a "one stop" process.

The original process involved several different inspections. The first type of inspection focused on compliance with ICC rules and operating authority licenses. The second type of inspection focused on safety compliance issues. Additional inspections were conducted to ensure compliance with hazardous materials transportation regulations were added in the 1980's. More recently, driver drug testing was added to the inspection requirements.

DOT-FHWA's compliance review is now conducted with the inspector using a lap-top computer with built in prompters, programs to generate checklists, work sheets, tabulations, and regulations and interpretations. These tools allow the inspector to cover all the components of the inspection in "one stop." The compliance review often occurs at corporate headquarters. The system was developed in 1986; currently, about 200 DOT-FHWA inspectors use the system.

Inspectors receive six weeks of training when they come into the DOT-FHWA, including training on case development, regulations, compliance reviews, and sensitivity. Inspectors do not need permission before entering a facility but usually call in advance so the appropriate staff and records can be available. Unannounced inspections may occur if criminal activity is suspected.

DOT-FHWA inspectors are providing more and more technical assistance to the regulated community. They have education packages on specific issues, such as hazardous materials, and "On Guard" announcements of new safety problems or rules affecting the industry.

Cooperative Hazardous Materials Enforcement Development

The Cooperative Hazardous Materials Enforcement Development (COHMED) program is an outreach activity of the U.S. DOT's Research and Special Programs Administration (RSPA). COHMED works to promote coordination, cooperation, education, and communication for Federal, State, local agencies, and industry having enforcement, response, and management responsibilities for the safe transportation of hazardous materials. Through education and training, COHMED participants are able to improve current programs, and develop new programs to enhance hazardous materials safety.

COHMED conducts semi-annual conferences and hazardous materials seminars. COHMED also publishes a quarterly newsletter, "The Reporter," and the "Bullet" when expedient dissemination of information is required. COHMED participation is open to Federal, State, local agencies, and industry involved in enforcement, emergency response or planning and preparedness. For more information call (202) 366-4900.

CHEMTREC

CHEMTREC is a pubic service organization established by the Chemical Manufacture's Association and its members in 1971 to provide first responders, the transportation industry, medical professionals, and others access to response information and technical assistance from chemical industry experts for incidents involving hazardous materials. The Center is

staffed by trained communicators who can contact thousands of chemical manufacturers, shippers, distributors, and carriers. Through these contacts, CHEMTREC can teleconference responders at the scene of an incident with technical experts to provide immediate advice and assistance. CHEMTREC can also immediately provide and transmit, via fax, product Material Safety Data Sheets or other specific product information. The CHEMTREC Center can be reached 24 hours a day, 7 days a week at 1-800-424-9300.

TRANSCAER

TRANSCAER is an outreach program that focuses on assisting communities that do not host a major chemical facility but have major transportation routes within their jurisdiction. TRANSCAER is sponsored by the chemical manufacturing, distribution and transportation industries. TRANSCAER's objectives are to ensure that communities are prepared to handle hazardous materials transportation emergencies and that an ongoing dialogue exists with the public about chemical transportation. The program provides assistance for communities to develop and evaluate their emergency response plan for hazardous material transportation incidents. For more information contact the TRANSCAER Task Group at c/o CMA, 1300 Wilson Blvd., Arlington, VA, 22209.

CMA's Lending Library

Since 1985, the CMA's Lending Library has provided free access to videotape training programs on hazardous materials and handling hazardous materials incidents. Contact the CMA Publication Fulfillment department at (202) 887-1253 for ordering information.

X.A.3. Pipelines

The giant Alaska company Alyeska has undertaken the most expensive corrosion repair program in the industry's history with a campaign to inspect pipelines for corrosion, repair damaged sections, and replace pipe sections as needed. The estimated costs of this effort from 1991-1996 are $600-800 million. External and internal corrosion at some of the 800-mile line's pump stations was discovered with the help of a corrosion detection pig that exceeded Federal standards for corrosion detection and mitigation (U.S. Petroleum Strategies, Bob Williams, 1991).

X.B. EPA Voluntary Programs

Environmental Leadership Program

The Environmental Leadership Program (ELP) is a national initiative developed by EPA that focuses on improving environmental performance, encouraging voluntary compliance, and building working relationships with stakeholders. EPA initiated a one year pilot program in 1995 by selecting 12 projects at industrial facilities and federal installations that 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, pollution prevention, community involvement, and mentor programs. In return for participating, pilot participants received public recognition and were given a period of time to correct any violations discovered during these experimental projects.

EPA is making plans to launch its full-scale Environmental Leadership Program in 1997. The full-scale program will be facility-based with a 6-year participation cycle. Facilities that meet certain requirements will be eligible to participate, such as having a community outreach/employee involvement programs and an environmental management system (EMS) in place for 2 years. (Contact: http://es.inel.gov/elp or Debby Thomas, ELP Deputy Director, at 202-564-5041)

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 providing participants regulatory flexibility on the condition that they produce greater environmental benefits. EPA and program participants will negotiate and sign a Final Project Agreement, detailing specific environmental objectives that the regulated entity shall satisfy. EPA will provide regulatory flexibility as an incentive for the participants' superior environmental performance. 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 industrial facilities, communities, and government facilities regulated by EPA. Applications will be accepted on a rolling basis. For additional information regarding XL projects, including application procedures and criteria, see the May 23, 1995 Federal Register Notice. (Contact: Fax-on-Demand Hotline 202-260-8590, Web: http://www.epa.gov/ProjectXL, or Christopher Knopes at EPA's Office of Policy, Planning and Evaluation 202-260-9298)

Climate Wise Program

EPA's ENERGY STAR Buildings Program is a voluntary, profit-based program designed to improve the energy-efficiency in commercial and industrial buildings. Expanding the successful Green Lights Program, ENERGY STAR Buildings was launched in 1995. This program relies on a 5-stage strategy designed to maximize energy savings thereby lowering energy bills, improving occupant comfort, and preventing pollution -- all at the same time. If implemented in every commercial and industrial building in the United States, ENERGY STAR Buildings could cut the nation's energy bill by up to $25 billion and prevent up to 35% of carbon dioxide emissions. (This is equivalent to taking 60 million cars of the road). ENERGY STAR Buildings participants include corporations; small and medium sized businesses; local, federal and state governments; non-profit groups; schools; universities; and health care facilities. EPA provides technical and non-technical support including software, workshops, manuals, communication tools, and an information hotline. EPA's Office of Air and Radiation manages the operation of the ENERGY STAR Buildings Program. (Contact: Green Light/Energy Star Hotline at 1-888-STAR-YES or Maria Tikoff Vargas, EPA Program Director at 202-233-9178 or visit the ENERGY STAR Buildings Program website at http://www.epa.gov/appdstar/buildings/)

Green Lights Program

EPA's Green Lights program was initiated in 1991 and has the goal of preventing pollution by encouraging U.S. institutions to use energy-efficient lighting technologies. The program saves money for businesses and organizations and creates a cleaner environment by reducing pollutants released into the atmosphere. The program has over 2,345 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. As of March 1997, participants had lowered their electric bills by $289 million annually. EPA provides technical assistance to the participants through a decision support software package, workshops and manuals, and an information hotline. EPA's Office of Air and Radiation is responsible for operating the Green Lights Program. (Contact: Green Light/Energy Star Hotline at 1-888-STARYES or Maria Tikoff Vargar, EPA Program Director, at 202-233-9178 the)

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 prevention, recycling collection and the manufacturing and purchase of recycled products. As of 1997, the program

had about 500 companies as members, one third of whom are Fortune 1000 corporations. Members agree to identify and implement actions to reduce their solid wastes setting waste reduction goals and providing EPA with yearly progress reports. To member companies, EPA, in turn, provides technical assistance, publications, networking opportunities, and national and regional recognition. (Contact: WasteWi$e Hotline at 1-800-372-9473 or Joanne Oxley, EPA Program Manager, 703-308-0199)

NICE^3

The U.S. Department of Energy is administering a grant program called The National Industrial Competitiveness through Energy, Environment, and Economics (NICE^3). By providing grants of up to 45 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, and demonstrate 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 forest products, chemicals, petroleum refining, steel, aluminum, metal casting and glass manufacturing sectors. (Contact: http//www.oit.doe.gov/access/nice3, Chris Sifri, DOE, 303-275-4723 or Eric Hass, DOE, 303-275-4728)

Design for the Environment (DfE)

DfE is working with several industries to identify cost-effective pollution prevention strategies that reduce risks to workers and the environment. DfE helps businesses compare and evaluate the performance, cost, pollution prevention benefits, and human health and environmental risks associated with existing and alternative technologies. The goal of these projects is to encourage businesses to consider and use cleaner products, processes, and technologies. For more information about the DfE Program, call (202) 260-1678. To obtain copies of DfE materials or for general information about DfE, contact EPA's Pollution Prevention Information Clearinghouse at (202) 260-1023 or visit the DfE Website at http://es.inel.gov/dfe.

X.C. Trade Association/Industry-Sponsored Activity

The trade associations that represent the transportation industry are a valuable source of economic and environmental compliance data. The following subsections list major transportation trade organizations and highlight environmental initiatives sponsored by some of these groups.

X.C.1. Railroad Tank Car Safety Research and Test Project

Since 1970 the Railway Progress Institute (RPI) and Association of American Railroads (AAR) have cosponsored the RPI-AAR Railroad Tank Car Safety Research and Test Project. The purpose of the project, initiated following several fatal tank car crashes in the late 1960s, is to identify and understand the causes of tank car punctures and ruptures in accidents and to develop engineering solutions. Results of this continuing project have led to the development and introduction of several devices to improve tank car crash worthiness, including double-shelf couplers and head and thermal protection systems. In addition, the program has produced a database of more than 35,000 records of tank cars damaged over the past 30 years (*Ensuring Railroad Tank Car Safety*, Transportation Research Board, National Research Council, 1994).

The research conducted on tank car safety has resulted in the implementation of regulation to increase the safety of certain hazardous material cars. DOT HM-175 which was finalized in September 1995, covers a wide range of tank car safety related issues, including new tank car specifications for halogenated organic compounds. This effort has resulted in significantly safer tank cars for these materials.

In addition, there have been several improvements in an industry agreement between the AAR, the Chemical Manufacturers Association (CMA), and RPI, including:

- Thicker tank cars made of stronger steel;
- Elimination of bottom outlets, a common source of releases in accidents; and
- A full height head shield to protect the end of the tank from punctures in accidents.

X.C.2. The North American Non-Accident Release Reduction Program

The North American Non-Accident Release Reduction Program was initiated in June 1995 by the rail industry. A "Non-Accident Release" (NAR) is any unintended release of a hazardous commodity from a railroad car not caused

by a train accident. Most NAR's involve small quantity releases, but some have been very costly and all have the potential for serious injury. The North American NAP Program is an awareness campaign designed to alert shippers and carriers to repeated instances of NARs of hazardous commodities from rail tank cars and encourage positive action to prevent recurrence.

General oversight of the NAR Program rests with AAR's Hazardous Materials Working Committee and the NAR General Committee, made up of representatives from shippers, carriers, car owners, and industry associations. The NAR Program has two sub-committees, a Technical Subcommittee and a Communications/Regulatory Subcommittee. The Technical group reviews NAR data and attempts to develop technical solutions to identified problems. The Communications/Regulatory group works on program publicity and government (regulatory) relations.

NAR data is collected by carriers and reported to AAR, who enters it into an NAR database, keeping all business data confidential. When a threshold number of releases has been recorded for any given company, AAR prepares an "action package" outlining the details of each release and forwards the information to a designated individual at that company. Recipients of action packages are encouraged to take whatever actions are appropriate to address the causes of the releases, advising AAR of their response. The NAR General Committee has set a goal to reduce the number of NARs from hazardous materials tank cars in North America by 25 percent over a two year period. The North American NAR Program is an expansion of a successful program started in Canada in 1992. NAR's in Canada were reduced 32% over a two year period after implementation of the program.

X.C.3. Environmental Compliance Handbook for Short Line Railroads

As part of its mandate to clarify and communicate environmental regulatory responsibilities to the freight and rail industry, EPA's Freight, Economy, and the Environmental Work Group has worked with the Federal Railroad Administration (FRA) to prepare a handbook on EPA regulations applicable to short line railroads. The handbook is a "plain English" guide to short line railroad environmental responsibilities and the laws that created them. The handbook also provides State and Federal agency contacts and Hotlines.

X.C.4. Environmental Training Publications and Videotapes

The American Trucking Associations (ATA) has developed numerous documents and videotapes to help those in the trucking industry to better understand applicable environmental regulations and to assist them in compliance. Following is a list of some the materials offered by the ATA. For a more complete catalogue listing these and other products, contact the ATA document center at (800) ATA-LINE.

- *Stormwater Best Management Practices: Guidance for Vehicle Maintenance Facilities (video)* - Identifies practical and effective best management practices that can be used in vehicle washing, fueling, and loading areas.

- *Used Oil: A Guidebook to Best Management Practices* - Helps the user determine the company's responsibilities and develop procedures that are productive, cost-efficient, and in compliance with Federal and State guidelines.

- *Hazardous Waste Regulations for the Trucking Industry* - Outlines and explains hazardous waste regulations as they relate to the trucking industry.

- *Stormwater: Pollution Prevention for the Trucking Industry* - Explains how to write a pollution prevention plan and covers the five general phases of a plan in detail.

- *Vehicle Washing Compliance Manual* - Provides a State-by-State review of applicable regulations affecting vehicle washing and a survey of vehicle washing technology.

X.C.5. Pipeline Integrity Programs - Natural Gas and Hazardous Liquid One-Call Systems

More than 60 percent of pipeline accidents are the result of third-party damage. One-call systems were developed to reduce the number of incidents involving accidental pipeline ruptures.

Contractors and homeowners who work in the vicinity of natural gas and hazardous liquid lines can learn of their location via a single telephone number. This number is supplied in 48 of the 50 States and in Canada by various one-call systems, and is usually posted on pipeline markers along the pipe route.

Each one-call system is an organization funded by member underground utilities. The system acts as a computerized link between people digging around pipelines and the operators of these conveyance systems. When a contractor or homeowner calls the toll-free number, the one-call operator takes information regarding the time and location of planned work and immediately notifies all members with underground facilities in the excavation area.

When a member receives notification of planned excavation in its area, its operators are responsible for determining the potential hazards to the line.

If the work does have the potential to affect the pipeline, the company will dispatch crews within 24 to 72 business hours to locate and mark the pipeline's route. After determining the direction and width of the pipe, personnel use a series of flags or spray paint to mark the exact location of the system. If the work will cross the pipeline, crews also test for exact pipeline depth.

X.C.6. Summary of Trade Associations

The trade and professional organizations serving the transportation industry are presented below, classified by industry sector.

Rail

Association of American Railroads 50 F Street, NW Washington, D.C. 20001 Phone: (202) 639-2839 Fax: (202) 639-2465	Members: 64 Staff: 607 Budget: $48,800,000

The Association of American Railroads (AAR) is the coordinating and research agency of the American railway industry. Membership is comprised of the larger, Class I, railroads. Focus areas include: railroad operation and maintenance, statistics, medical problems, cooperative advertising and public relations, rates, communication, safety, and testing of railroad equipment. The AAR was founded in 1934 and maintains a library of current and historical volumes and periodicals. The AAR also operates an on-line database of all railcars, trailers, and containers used in North America called Universal Machine Language Equipment Register. Publications include the quarterly *Official Railway Equipment Register*, the biweekly *Rail News Update*, and the annual *Railroad Facts*. The AAR also publishes studies, statistical reports, and general information publications.

National Railway Labor Conference 1901 L Street, NW, Suite 500 Washington, D.C. 20036 Phone: (202) 862-7200 Fax: (202) 862-7230	Members: 150 Staff: 25 Budget: $4,100,000

The National Railway Labor Conference (NRLC), founded in 1963, serves as a management collective bargaining agency for the railroad industry. NRLC represents railroads as well as switching and terminal companies and compiles statistics on the industry.

Trucking

American Trucking Associations 2200 Mill Road Alexandria, VA 22314 Phone: (703) 838-1844 Fax: (703) 838-1992	Members: 4,100 Staff: 300 Budget: $45,000,000

The American Trucking Associations (ATA), founded in 1933, represents motor carriers, suppliers, State trucking associations, and national conferences of trucking companies. The ATA works to influence the decisions of Federal, State, and local governmental bodies to promote increased efficiency, productivity, and competitiveness in the trucking industries. ATA promotes highway and driver safety, supports highway research projects, and studies technical and regulatory problems of the trucking industry. ATA and its affiliated conferences provide extensive educational opportunities and products to assist trucking companies with safety, OSHA, and environmental regulation. In addition, the association provides members with a guide to Federal and State regulations and offers a comprehensive accounting service for carriers of all sizes. An information center containing numerous ATA and other publications is available to members and the public.

Association of Waste Hazardous Materials Transporters 2200 Mill Road Alexandria, VA 22314 Phone: (703) 838-1703 Fax: (703) 519-1866	Members: 75 Staff: 2

The Association of Waste Hazardous Materials Transporters represents carriers that transport PCBs, used oil, and hazardous and radioactive waste by truck and rail.

National Tank Truck Carriers 2200 Mill Road Alexandria, VA 22314 Phone: (703) 838-1960 Fax: (703) 864-5753	Members: 260 Staff: 7 Budget: $1,000,000

The National Tank Truck Carriers (NTTC) was founded in 1945 and represents common or contract tank truck carriers transporting liquid and dry bulk commodities, chemicals, food processing commodities, petroleum, and related products. NTTC promotes Federal standards of construction, design, operation, and use of tank trucks and equipment. NTTC sponsors schools, conducts research, and produces periodicals, including the annual *Cargo*

Tank Hazardous Materials Regulations and *Hazardous Commodities Handbook*.

Regional and Distribution Carriers Conference 2200 Mill Road, Suite 540 Alexandria, VA 22314 Phone: (703) 838-1990 Fax: (703) 836-6870	Members: 375 Staff: 5

The Regional and Distribution Carriers Conference (RDCC) consists of companies participating in trucking for hire, including local cartage and short haul. RDCC was founded in 1943 and represents motor haul carriers rendering distribution services beyond commercial zones. RDCC is affiliated with ATA and conducts an executive management seminar and exhibit. RDCC produces a monthly newsletter and several informational phamplets.

Interstate Truck Carriers Conference 2200 Mill Road, 3rd Floor Alexandria, VA 22314 Phone: (703) 838-1950 Fax: (703) 836-6610	Members: 800 Staff: 7 Budget: $800,000

The Interstate Truck Carriers Conference (ITCC) consists of contract carriers, irregular route common carriers, shippers, and others related to the motor carrier industry. ITCC was founded in 1983 and serves as an industry spokesperson for this part of the trucking industry. ITCC represents their members' interests before Congress, the Interstate Commerce Commission, and the courts. ITCC is affiliated with ATA and has a refrigerated carrier division as well as a political action committee. ITCC conducts a management development seminar at Notre Dame University and produces bulletins and newsletters.

Pipelines

Interstate Natural Gas Association of America 555 13th Street, NW, Suite 300 West Washington, DC 20004 Phone: (202) 626-3200 Fax: (202) 626-3249	Members: 35 Staff: 30

The Interstate Natural Gas Association of America (INGAA) represents transporters of natural gas. INGAA has established committees on issues regarding regulatory and government affairs, policy analysis, and the environment. INGAA produces *Interstate Natural Gas Association of*

American - Washington Report, a weekly newsletter that covers legislative and regulatory developments affecting the industry which is available to both members and non-members.

American Petroleum Institute 1220 L Street, NW Washington, DC 20005 Phone: (202) 682-8000 Fax: (202) 682-8030	Members: 300 Staff: 500

The American Petroleum Institute (API) works to ensure cooperation between industry and government on all matters of mutual concern. API conducts research, sets standards, provides information services, and maintains a large library. API was founded in 1919 and represents corporations in the petroleum and allied industries, including producers, refiners, marketers, and transporters of crude oil, lubricating oil, gasoline, and natural gas. API has committees on industry technical issues, health, environment and safety, and government affairs and produces many standards, periodicals, books, and manuals.

Association of Oil Pipe Lines 1101 Vermont Avenue, NW, Suite 604 Washington, DC 20005 Phone: (202) 408-7970 Fax: (202) 408-7983	Members: 80 Staff: 3

The Association of Oil Pipe Lines (AOPL), founded in 1947, consists of oil pipeline companies which are generally regulated carriers. AOPL compiles and presents statistical and other data related to the pipeline industry to Congress, government departments, agencies and commissions, trade associations, and the public. AOPL is affiliated with API and produces several publications, including *Oil Pipelines of the United States: Progress and Outlook*.

Page 120 intentionally left blank.

XI. RESOURCE MATERIALS/BIBLIOGRAPHY

For further information on selected topics within the transportation industry sectors profiled in this document, a list of publications is provided below:

General Profile

Transportation in America, Eno Transportation Foundation, Inc., 1994.

National Transportation Statistics, U.S. Department of Transportation, 1995.

1992 Census of Transportation, Communications, and Utilities: Geographic Area Series Summary, U.S. Department of Commerce.

1992 Census of Transportation, Communications, and Utilities: Subject Series (Establishment and Firm Size), U.S. Department of Commerce.

1992 Census of Transportation, Communications, and Utilities: Nonemployer Statistics Series Summary, U.S. Department of Commerce.

Encyclopedia of Associations, 27th ed., Deborah M. Burke, ed., Gale Research Inc., Detroit, Michigan, 1992.

Enforcement Accomplishments Report, FY 1992, U.S. EPA, Office of Enforcement (EPA/230-R93-001), April 1993.

Enforcement Accomplishments Report, FY 1993, U.S. EPA, Office of Enforcement (EPA/300-R94-003), April 1994.

Enforcement Accomplishments Report, FY 1994, U.S. EPA, Office of Enforcement , April 1995.

Environmental Sources and Emissions Handbook, No. 2, Marshall Sitig, Noyes Data Corporation, 1975.

McGraw-Hill Encyclopedia of Science & Technology, 7th ed., vol. 8, McGraw-Hill Book Company, New York, New York, 1992.

Standard Industrial Classification Manual, Office of Management and Budget, 1987.

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

Rail Profile

Railroad Facts, 1995 Edition, Association of American Railroads, 1995.

Waste Minimization Assessment for a Manufacturer of Rebuilt Railway Cars and Components, F. William Kirsch and Gwen P. Looby, University City Science Center, Philadelphia, Pennsylvania and U.S. Risk Reduction Engineering Laboratory, Cincinnati, Ohio, July, 1991. EPA/600/M-91/017.

Ensuring Railroad Tank Car Safety, Transportation Research Board, National Research Council, 1994.

Association of American Railroads Catalogue of Publications: 1995-1996, AAR.

Railroad Information Handbook, AAR, 1994.

Trucking Profile

Source Assessment: Rail Tank Car, Tank Truck, and Drum Cleaning, State-of-the-Art, Monsanto Research Corporation, Dayton, Ohio, 1978.

One Hundred Years of Infrastructure: 1892-1992. July 1992.

General Pipeline Profile

Oil and Gas Pipeline Fundamentals, Second edition, John L. Kennedy, Pennwell Books, 1993.

"U.S. Interstate Pipelines Ran More Efficiently in 1994," *Oil and Gas Journal*, November 27, 1995.

Gas Pipeline Profile

Natural Gas 1995: Issues and Trends, Energy Information Administration, 1995.

Energy Policy Act Transportation Study: Interim Report on Natural Gas Flows and Rates, Energy Information Administration, 1995.

Natural Gas Technologies: Energy Security, Environment and Economic Development: Conference Proceedings, 1993, International Energy Agency, 1993.

Reporting Requirements of Interstate Natural Gas Pipelines (Report No. 93-1), INGAA, 1993.

Overview of Natural Gas Storage Operations (Report No. 91-6), INGAA, 1991.

Analyses Related to the Impact of Air Quality Regulation on the Natural Gas Transmission Industry, INGAA Foundation, 1992.

New Directions: Natural Gas Supply, Natural Gas Council, 1992.

New Directions: Natural Gas Energy, Natural Gas Council, 1992.

Natural Gas Reliability, Natural Gas Council, 1993.

New Directions: Natural Gas Technology Research and Development, Natural Gas Council, 1993.

Natural Gas Reliability Principles, Natural Gas Council, 1995.

New Directions: Natural Gas, Energy and the Environment, Natural Gas Council, 1993.

America's Natural Gas Pipelines: A Network Built on Safety, INGAA.

Pipeline to Clean Energy: An Introduction to Interstate Natural Gas Association of America Legislative Affairs, 104th Congress, INGAA.

Going the Extra Mile for Safety: America's Interstate Natural Gas Pipelines, INGAA Foundation.

Natural Gas Pipelines: The Safe Route to Energy Security, INGAA.

Factbook: Energy, the Environment, and Natural Gas, AGA, 1983.

Profiles of U.S. and Canadian Natural Gas Pipeline Companies, Third Edition, 1995.

Oil Pipeline Profile

International Petroleum Encyclopedia, Pennwell Publishing Co., 1994.

U.S. Oil Pipelines, George S. Wolbert, Jr., API, 1979.

U.S. Petroleum Strategies in the Decade of the Environment, Bob Williams, Pennwell Publishing Co., 1991.

Modern Petroleum: A Basic Primer of the Industry, Third Edition, Bill Berger and Ken Anderson, Pennwell Books, 1992.

"Regulation of Underground Storage," *Petroleum Supply Monthly*, August, 1991.