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

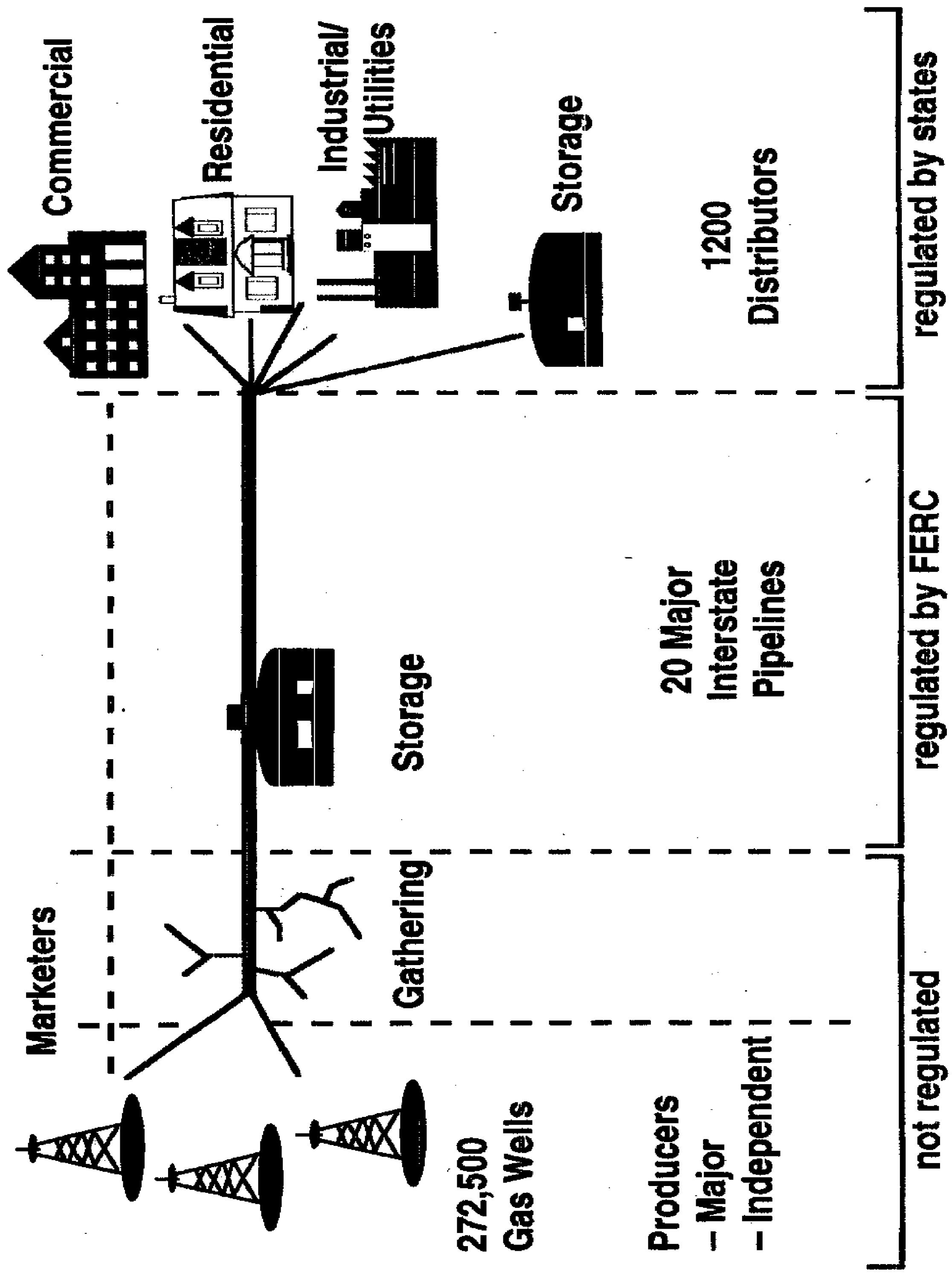
Most gathering and long-distance pipelines in the U.S. are owned by pipeline companies whose sole function is to operate a pipeline system. Historically, natural gas in the U.S. was purchased by the pipeline company from the producer, transported to market, then resold to a local distribution company. 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 s 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 Incidents	Property Damage	Percent of Total Damages	Deaths	Injuries
Internal Corrosion	9	3.69	$282,000	0.50	0	0
External Corrosion	38	15.57	$1,833,043	3.25	0	0
Defective Weld	21	8.61	$4,320,680	7.65	0	0
Incorrect Operation	8	3.28	$15,600	0.03	0	0
Defective Pipe	11	4.51	$2,154,000	3.82	0	0
Outside Damage	57	23.36	$35,593,513	63.05	0	1,853
Malf.. of Equipment	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 Corrosion	20	25.0	$2,632,812	583	0	0
External Corrosion	13	16.25	$2,028,835	4.49	0	1
Damage from Outside Forces	23	28.75	$32,127,680	71.13	0	16
Construction/ Material Defect	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.

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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

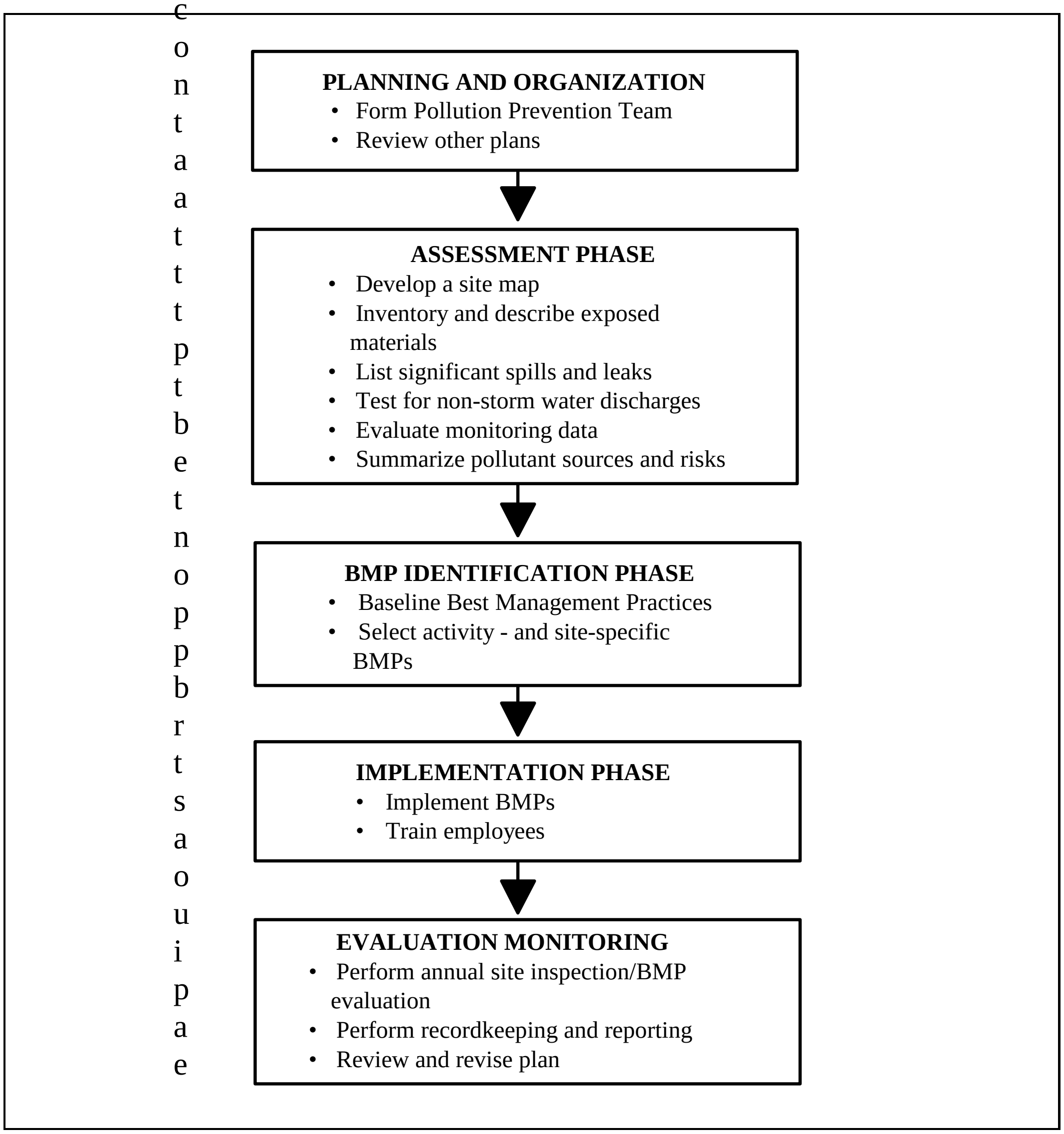
- Management of shop drains (sometimes connected to an oil-water separator) which may accumulate oil, grease, and other shop wastes
- Vehicle washing operations
- Storage of scrap tires and batteries.

The American Trucking Associations has developed a flowchart, duplicated as Exhibit 21, that directs the attention of facility managers to the sources of

e n v i c o n t a a t t t p t b e t n o p p b r t s a o u i p a e

r a o f

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

NPDES Permits	Stormwater Discharge Permits	SPCC Plans and Spill Reporting
• 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.