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Briefing Report to the Chairman, Environment, Energy, and Natural Resources Subcommittee, Committee on Government Operations, House of Representatives

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ENERGY MANAGEMENT

Extent of Crude Oil Contamination Is Uncertain

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Resources, Community, and
Economic Development Division

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The Honorable Mike Synar
Chairman, Environment, Energy,
and Natural Resources Subcommittee
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

This report responds to your June 13, 1989, request that we examine allegations that crude oil in Oklahoma and elsewhere in the United States may be contaminated with hazardous wastes and/or other noncrude substances.[1] Some substances occur naturally in crude oil, while others could be intentionally or unintentionally added when the oil is produced and transported. The substances include organic chlorides, sulfur, waste oil, and PCBs.

You were concerned whether the presence of such wastes could, among other things, increase the risk of fires and explosions in refineries that process the crude oil and increase air pollution. As agreed with your office, we are providing information on

-- instances of crude oil contamination, the substances found in the crude oil, the circumstances involved, the safety and environmental effects of refining contaminated crude, and the extent to which refinery fires and explosions can be linked to the processing of contaminated crude oil;

-- what impact the Resources Conservation and Recovery Act (RCRA) and the Hazardous Liquid Pipeline Safety Act have on the crude oil contamination issue; and

-- what government and industry actions are being taken to address the contamination issue.

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[1]As defined in this report, crude oil contamination refers to the presence of substances in crude oil which could potentially impair refinery operations or result in unusual safety, health, or environmental risks.

We also agreed with your office to generally limit the scope of our work to (1) reviewing the cases reported in a series of articles appearing in the Tulsa Tribune and (2) obtaining information on each of the three issues from federal agencies and from state and industry officials in California, Louisiana, Oklahoma, and Texas.

In summary, industry officials at 9 companies we contacted, including 6 companies identified in the Tulsa Tribune, disclosed 40 cases of crude oil contamination which occurred between 1981-89. Thirty-three of these cases were reported by 1 company. The contaminants found included chlorides, iodine, alcohol, bromine, nitrogen, and iron. Three of the cases resulted in damage to refinery equipment, including one that led to a fire that caused millions of dollars in damages.

The extent to which crude oil contamination is occurring is uncertain. Industry officials we contacted had differing views on how much crude oil contamination is taking place, while federal officials had little awareness of contamination problems. Industry officials advised us that contamination is not a problem when they know about it and can act to reduce its effect. While federal, state, and industry officials we spoke with believed that refining certain noncrude substances could damage refinery equipment, they generally did not believe that the refining of noncrude substances was likely to create unusual safety, health, or environmental risks. Industry and government officials we contacted had not carried out an analysis to determine whether there was a link between refining contaminated crude oil and the occurrence of fires and explosions.

Hazardous wastes must be controlled and disposed of in accordance with the hazardous waste provisions of Subtitle C of RCRA, which is implemented by the Environmental Protection Agency (EPA) or authorized state agencies. Since RCRA prohibits the disposal of hazardous wastes except in a permitted treatment, storage, or disposal facility, the disposal of hazardous wastes in crude oil is not allowed. Certain hazardous wastes generated from oil and gas exploration, development, and production are exempt from RCRA, however, and these wastes may remain in and contaminate crude oil in pipelines without violating RCRA. The transportation of hazardous liquids, such as petroleum products, crude oil, and anhydrous ammonia in pipelines is monitored by the Department of Transportation (DOT) Office of Pipeline Safety. According to Office of Pipeline Safety

officials, however, pipeline safety regulations prohibit pipeline operators from transporting hazardous liquids that would corrode the pipeline system.

The government agencies we contacted generally had not gotten involved in the crude oil contamination issue. It is difficult to determine the extent to which crude oil contamination is occurring because overall industry testing for contaminated crude oil varies both in terms of the number of companies with testing procedures in place and the substances for which the tests are being performed. According to industry officials, it would be cost prohibitive to test for every substance that could possibly be in the crude oil.

WHY CRUDE OIL MAY CONTAIN NONCRUDE SUBSTANCES

Crude oil may contain noncrude substances for various reasons. Crude oil contains naturally occurring substances, including naphthenic acids, iron, vanadium, nickel, and copper. These substances can damage refineries by reacting with and neutralizing the catalysts in the refining process.

Some noncrude substances, such as organic chlorides, may also be intentionally mixed with crude oil. For example, as part of normal exploration and production activities, chlorinated solvents may be used to treat oil wells and dissolve paraffin in well piping. In addition, organic chlorides may be used to treat pipelines, to dissolve sludge and heavy sediment from the bottom of crude oil storage tanks, and to clean equipment. During these processes, small amounts of these chlorides may become mixed with crude oil. Industry officials we talked to said there may also be incentives for those parties involved in the crude oil production and transportation process to blend noncrude substances such as chlorides with crude oil to increase the volume of crude oil available for sale, and in the case of hazardous substances, avoid the cost of proper disposal.

CASES OF CRUDE OIL CONTAMINATION, AND GOVERNMENT AND INDUSTRY VIEWS

Through our contacts with industry officials, we verified five cases of crude oil contamination that were reported in the Tulsa Tribune. Refinery equipment was damaged in three instances, including a fire that caused $7 million in

damages at a Beaumont, Texas, Mobil Oil Company refinery in 1982. Refinery operations were affected in the two remaining instances. In the first, the contaminated crude oil was held in a separate tank so that it could be diluted and refined. In the second, the refinery was shut down so that the distillation columns could be cleaned.

Industry officials informed us of 35 other cases between 1982 and 1989 in which contaminated substances were detected through tests run on oil that is removed before it goes into the pipeline.

The contaminants found in all 40 cases included chlorides, iodine, alcohol, bromine, nitrogen, and iron. Industry officials we spoke with were particularly concerned with the existence of organic chlorides, which become highly corrosive in the refining process. The concentration of organic chlorides that refineries can tolerate before damage occurs varies. The officials said that although crude oil is routinely monitored, contaminants are not always identified because not all shipments of crude oil are tested for all possible contaminants.

There was no consensus among the officials we spoke with from EPA, DOT's Office of Pipeline Safety, and industry on the extent to which the contamination is occurring. They were aware that the refining of crude oil contaminated with certain noncrude substances could damage refinery equipment, but these officials did not think that the refining of any noncrude substances created unusual safety, health, or environmental risks. Because EPA's Office of Solid Waste does not regulate the production or refining of crude oil, the officials we spoke with there did not know how refining contaminated crude oil would affect safety and the environment. However, the general opinion of the EPA staff we interviewed was that refining contaminated crude would probably not pose any unusual health or environmental risks.

RCRA'S SUBTITLE C PROGRAM

RCRA was enacted in 1976 to address a problem of enormous magnitude--how to safely manage and dispose of high volumes of municipal and industrial solid waste generated nationwide. To control hazardous wastes, Subtitle C requires EPA first to identify which wastes are to be regulated as hazardous and to establish standards to regulate those that handle such waste. The standards for handlers include recordkeeping and labeling practices, manifest systems, and reporting requirements, which are

designed to identify the specific hazardous waste from generation to ultimate disposition.

RCRA's Subtitle C generally prohibits the disposal of hazardous wastes except in a permitted facility, thus its disposal in crude oil is not allowed. Contamination may occur without violating RCRA, however, since certain types of wastes are exempted, in whole or in part, from RCRA Subtitle C Regulation under the following conditions:

-- The wastes are generated from oil and gas exploration, development, and production operations.

-- Used oil is recycled and blended with crude oil and shipped to a refinery for processing.

-- A small amount of waste ranging from more than 100 kilograms but less than 1,000 kilograms of hazardous waste is generated by a business in any calendar month.

ACTIONS TAKEN TO ADDRESS CRUDE OIL CONTAMINATION

Officials from all nine refineries and oil companies we spoke with routinely test crude oil for temperature, gravity, and basic sediment and water. These basic properties define the quality and price of the crude oil. If the crude oil purchased is not of the level of quality expected, then the refinery will suffer an economic loss due to inadequate product yield. Samples are also periodically taken before the crude oil enters the pipeline so that tests can be conducted when complaints are received from refineries or when there are indications of contaminants.

All of the companies we contacted are aware of the potential for crude oil contamination, and eight of them have implemented crude oil-testing programs to detect certain noncrude substances. As a result of a growing awareness of crude oil contamination, these programs now include tests for such substances as organic chlorides and metals, which can damage refinery equipment and reduce yield and profit. Three companies we contacted have either warned, banned, or sued suppliers when these suppliers were suspected of providing contaminated crude.

Federal and state regulatory agencies we contacted are taking little, if any, action specifically aimed at addressing the issue of crude oil contamination.

SCOPE AND METHODOLOGY

As agreed with your office, we conducted our work in the states of California, Louisiana, Oklahoma, and Texas. To obtain information on the substances being added, the circumstances involved, and the extent to which refinery fires and explosions can be linked to the processing of contaminated crude oil, we interviewed federal officials from the Departments of Energy, Transportation, and Labor, and the EPA; state officials representing state corporation commissions, tax commissions, and environmental and pipeline safety offices; as well as officials representing the oil industry. Also, as agreed with your office, we contacted officials about these same issues in Kansas, Michigan, and New Jersey, although we did not visit their states. Our discussions also concerned the actions taken or being taken to address crude oil contamination.

We discussed segments of this report with EPA's Office of Solid Waste, DOT's Office of Pipeline Safety, and the Department of Labor's Occupational Safety and Health Administration (OSHA) officials. They generally agreed with the facts presented and suggested changes that were incorporated where appropriate. However, as requested by your office, we did not obtain official agency or industry comments on this report.

Section 1 of this report presents information on the means through which noncrude substances may be present in crude oil; how crude oil is tested, transported, and refined; and additional details on our scope and methodology. Section 2 identifies cases of crude oil contamination and government and industry views. Section 3 discusses RCRA Subtitle C provisions and provides information on the regulations within DOT's Office of Pipeline Safety governing crude oil transportation. Section 4 discusses government and industry actions that address the crude oil contamination issue, including more extensive testing programs by certain refineries we identified.

As arranged with your office, unless you publicly announce its contents earlier, we will make no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to the Secretaries of Energy, Transportation, and Labor; the Administrator,

Environmental Protection Agency; and other interested parties. Copies will also be made available to others upon request. If you have any further questions, please contact me at (202) 275-1441.

Sincerely yours,

Victor S. Rezendes
Director, Energy Issues

CONTENTS

ABBREVIATIONS

ACT	automatic custody transfer
API	American Petroleum Institute
DOT	Department of Transportation
EP	extraction procedure
EPA	Environmental Protection Agency
FBI	Federal Bureau of Investigation
LDEQ	Louisiana Department of Environmental Quality
MCPL	Mid-Continent Pipeline Company
NPRA	National Petroleum Refiners Association
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
ppm	parts per million
RCRA	Resource Conservation and Recovery Act

SECTION 1

INTRODUCTION

According to allegations made in a series of articles in the Tulsa Tribune, noncrude substances including hazardous wastes have been added to crude oil and delivered by pipeline to refineries. The articles indicate that refining such contaminated crude oil increases the risk of refinery fires and explosions and causes environmental harm.

There are various reasons why crude oil may contain noncrude substances. Crude oil naturally contains some noncrude substances, while other substances can be introduced into crude oil as a result of industry practices and accidental or intentional disposal of wastes.

Because various parties handle crude oil from the time of production until it reaches a refinery, it is difficult to determine where and when noncrude substances are introduced into the crude oil.[1] Although oil companies periodically test crude oil to ensure that the oil is not contaminated, not all crude oil entering pipelines is tested because of the large number of receipt points, manpower constraints, and the cost of such testing.

WHY CRUDE OIL CONTAINS NONCRUDE SUBSTANCES

Crude oil may contain noncrude substances for various reasons. Crude oil contains various naturally occurring substances, including benzene, naphthenic acids, nitrogen, iron, vanadium, nickel, and copper. Napthenic acid, iron, vanadium, nickel, and copper can damage refineries by reacting with and neutralizing the catalysts in the refining process.

Some noncrude substances, such as organic chlorides, may also be intentionally mixed with crude oil. For example, as part of normal exploration and production activities, chlorinated solvents are used to treat oil wells and dissolve paraffin in well piping. In addition, organic chlorides are used to treat pipelines, to dissolve sludge and heavy sediment from the bottom of crude oil storage tanks, and to clean equipment. During these processes, small amounts of these chlorides may become mixed with crude oil.

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[1]Following production, pipelines are used to gather crude oil; transport it to refineries; and then distribute the refined products to process plants, retail markets, and other forms of transportation, such as railroads and trucking companies.

Industry officials said there may also be incentives for those parties involved in the crude oil production and transportation process to blend noncrude substances with crude oil to increase the volume of crude oil available for sale, and in the case of hazardous substances, avoid the cost of proper disposal.

HOW CRUDE OIL GETS TO REFINERIES

Crude oil pipelines move both imported and domestic crude oil from ports and producing oil fields, which may contain hundreds of oil wells, to refineries. Oil from the producing wells is accumulated in tanks. Small pipeline-gathering systems, or gathering lines, collect the crude oil from the tanks and transport the oil to the major crude oil pipeline systems, or trunk lines. These trunk lines link gathering systems to storage terminals and refineries. According to DOE's Energy Information Administration, in 1988, approximately 716 million barrels of crude oil was shipped via pipeline between the 5 petroleum districts in the United States.

According to a 1989 National Petroleum Council report, in 1987 the oil pipeline industry operated a network of over 108,000 miles of trunk pipelines, in all 50 states, carrying domestic and imported crude oil from producing fields and ports to refineries. On the other hand, the gathering systems pipelines are short compared with trunk pipelines and range from a few feet to several miles.

REFINERY OPERATIONS AND FINISHED PRODUCTS

Modern refineries include many process units and produce numerous products from crude oil including gasoline, jet fuel, liquified petroleum gases, kerosene, coke, lubricants, asphalt, fuel oil, and special naphthas. The process units in refineries vary according to the nature of crude oil feedstocks or product lines; however, most of the processes are designed to separate a particular chemical compound or a particular substance such as sulfur. In addition, the separation processes remove contaminants such as metals from the crude oil.

Refined products are transported from refineries to areas of use largely by pipeline distribution systems. These systems are usually called "product pipelines" and, in 1987, there were 95,000 miles of product pipelines in the 50 states. The major products are gasolines of various grades, jet fuel, kerosene, heating oils, and liquified petroleum gases. Compared with crude oil, the refined fuels require much more precise separation of different grades and brands of fuels because they are less compatible with each other.

TESTING OF CRUDE OIL BY PIPELINES AND REFINERIES

Pipeline companies generally do not test all crude oil entering the pipeline for noncrude substances because of the large number of receipt points, personnel constraints, and the cost of such testing. For example, the Mid-Continent Pipeline Company (MCPL), just one of several intrastate trunk pipelines located in Oklahoma, has 6 major receipt points, 11 major delivery points, 210 automatic custody transfer (ACT) units,[2] and about 2,300 lease oil connections[3] through which crude oil enters the pipeline.

Crude oil entering from lease oil connections and storage tanks is not regularly sampled or tested unless problems with receiving nonconforming crude oil have been experienced.

Crude oil entering trunk pipeline systems passes through ACT units at all major receipt and delivery points. Small ACT units are located at trunk pipeline-gathering facilities, and samples are periodically taken and retained. Retained samples are tested when refineries file complaints or when there are other indications of nonconforming material. Random samples from smaller ACT units are also taken and tested to get an indication of the materials being shipped. Testing for crude oil contamination is discussed in more detail in sections 2 and 4.

OBJECTIVES, SCOPE, AND METHODOLOGY

In light of several allegations that contaminated crude oil was flowing through pipelines, the Chairman, Environment, Energy, and Natural Resources Subcommittee, House Committee on Government Operations, asked us to determine the extent to which contamination is occurring and whether it poses serious health, safety, or environmental risks. The June 13, 1989, request was based on a series of newspaper articles in the Tulsa Tribune which raised concerns that crude oil shipped by pipelines in Oklahoma and elsewhere in the United States may be tainted with noncrude substances, including hazardous wastes. According to the articles, the presence of such wastes could result in increased air pollution and increase the risk of fires and explosions.

As agreed with the Chairman's office, we are providing information on (1) instances of crude oil contamination, the substances being added to crude oil, the circumstances involved,

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[2]ACT units automatically measure the volume of crude oil being injected into crude oil pipelines, and take representative samples for testing purposes.

[3]These are the connections at the well sites.

the safety and environmental effects of refining contaminated crude, and the extent to which refinery fires and explosions can be linked to the processing of contaminated crude oil; (2) the impact of the Resource Conservation and Recovery Act (RCRA) and the Hazardous Liquid Pipeline Safety Act on crude oil contamination; and (3) government and industry actions being taken to address the contamination issue. In conducting our work, we agreed to visit the states of California, Louisiana, Oklahoma, and Texas and to telephone officials in Kansas, Michigan, and New Jersey to determine if they were aware of pipeline contamination problems.

To determine the extent to which crude oil contamination is occurring, the substances added, the circumstances involved, and the extent to which refinery fires and explosions can be linked to the processing of contaminated crude oil, we obtained and summarized the views of federal, state, industry, and other officials, and obtained and analyzed supporting documentation when available. As agreed with the Chairman's office, we did not interview comparable officials in all of the states because of time constraints.

We interviewed industry officials from the National Petroleum Refiners Association (NPRA); the Oklahoma Independent Petroleum Association; the Petroleum Industrial Security Council; the American Petroleum Institute (API); the Sun and Conoco Refineries; the Sun, Permian, Mobil, and Shell Oil companies; and the Sun Pipeline Company.

We interviewed Oklahoma State officials from the Corporation Commission, Department of Health, Department of Pollution Control, Tax Commission, Office of Pipeline Safety, and Bureau of Investigation; Texas officials from the Railroad Commission; Louisiana officials from the Department of Environmental Quality and Department of Natural Resources, Office of Conservation; California officials from the Department of Health Services, Air Resources Board, and Department of Conservation; Kansas officials from the Corporation Commission and Department of Health and Environment; New Jersey officials from the Department of Environmental Protection and the Petroleum Council; and a Michigan official from the Department of Natural Resources.

We interviewed federal officials in headquarters and field offices from the Environmental Protection Agency (EPA); Department of Energy; Office of Pipeline Safety, Department of Transportation (DOT); Occupational Safety and Health Administration (OSHA), Department of Labor; and Federal Bureau of Investigation (FBI).

Other officials interviewed were the Tulsa Tribune reporters who wrote the newspaper articles about crude oil contamination in Oklahoma. We obtained information and points of contact on the alleged cases of crude oil contamination described in the articles and identified by the reporters. We did not collect documentation

for other cases we became aware of because of time constraints; however, we verified the instances of contamination during discussions with officials of the companies involved.

To determine the impact of RCRA and the Hazardous Liquid Pipeline Safety Act on the crude oil contamination issue, we contacted those federal and state officials indicated above. In addition, we obtained and reviewed applicable federal and state regulations on pipeline safety, hazardous and toxic waste, and small-quantity generators of hazardous wastes. Also, we obtained and reviewed studies on the composition and management of used oil generated in the United States; management of wastes from the exploration, development, and production of crude oil; API environmental concerns; and used oil, oily waste water, oily sludge, and other wastes resulting from the use of oil products.

To determine what government and industry actions have been taken to address crude oil contamination, we obtained information on crude oil-testing programs, and changes in current federal regulations now being considered.

We performed our work from May to December 1989 in accordance with generally accepted government auditing standards. The views of responsible industry and state officials are incorporated where appropriate. We also obtained and incorporated EPA officials' views regarding how crude oil contamination relates to RCRA regulations.

SECTION 2

GOVERNMENT AND INDUSTRY OPINIONS ON CRUDE OIL CONTAMINATION VARY

Our discussions with oil industry officials identified 40 cases of crude oil contamination, including the 5 instances reported in the Tulsa Tribune. Three of the cases we identified resulted in damage to refinery equipment, including one that led to a fire causing millions of dollars in damages. We found little consensus among the government and industry officials regarding the extent of crude oil contamination. While the federal, state, and industry officials we spoke with believed that refining certain noncrude substances could hinder refinery operations, they generally did not think that the refining of noncrude substances was likely to create unusual safety, health, or environmental risks.

CASES OF CONTAMINATION THAT WE VERIFIED, 1981-89

Through our contacts with industry officials, we verified five cases of crude oil contamination involving six companies that had been identified by the Tulsa Tribune reporters. Refinery equipment was damaged in three instances, including a fire that caused $7 million in damages at a Beaumont, Texas, Mobil Oil Company refinery in 1982. Refinery operations were affected in the two remaining instances. In the first, the contaminated crude oil was held in a separate tank so that it could be diluted and refined. In the second, the refinery was shut down so that the distillation columns could be cleaned.

Industry officials informed us of 35 other cases between 1982 and 1989 in which contaminated substances were detected through tests run on oil that is removed before it goes into the pipeline.

The contaminants found in the 40 cases included chlorides, iodine, alcohol, bromine, nitrogen, and iron. Industry officials we spoke with were particularly concerned with the existence of solvents such as organic chlorides, which become highly corrosive in the refining process. They said that although crude oil is routinely monitored, contaminants are not always identified because not all shipments of crude oil are tested for all possible contaminants.

The cases of contamination we identified are listed in tables 2.1 and 2.2. Table 2.1 lists those cases of contamination, including one that led to a fire causing millions of dollars in damages, in which the contaminant was not detected until it reached the refinery. Table 2.2 lists those cases in which the

contaminant was detected at the pipeline. In addition, a more detailed description of the cases we identified is included in appendix I.

Table 2.1: Number of Crude Oil Contamination Cases at the Refineries

Year	Company(s) involved	Type of contaminant(s)	Effect of contamination	Damage reported by industry
1989	Quaker State's Congo Refinery, Newell, W.Va.	Carbon tetra-chlorides	Affected refinery operations[a]	None
1987	Sun Refinery, Tulsa, Okla.	Alcohol	Damaged refinery equipment (not refined)	$20,000 to 30,000
	Sinclair Refinery, Tulsa, Okla.	Alcohol		
1987	Atlas Refinery, Shreveport, La.	Bromine, iodine, chlorides, nitrogen	Operational problems[b]	Unknown
1982	Mobil Oil Co., Beaumont, Tex.	Chlorides	Fire and refinery shutdown	$7 million
1981	Conoco Oil Co., Ponca City, Okla.	Organic chlorides	Damaged refinery equipment	Cost of replacing pipe

[a]The contaminated crude oil had to be placed in a holding tank and diluted with other crude oil before it was refined.

[b]Distillation columns had to be cleaned before the refinery could be reopened.

Table 2.2: Number of Crude Oil Contamination Cases Detected at the Pipeline

Year	Company involved	Number of cases	Contaminants
1982-1989	Mid-Continent Pipeline Co., Tulsa, Okla.	33	Chlorides, iron, gasoline
1984	Conoco Oil Co., Guernsey, Wyo.	1	Used solvents
1989	Shell Oil Co., New Orleans, La.	1	Chlorides

GOVERNMENT AND INDUSTRY OPINIONS DIFFER ON EXTENT OF CONTAMINATION

There was no consensus among the officials we spoke with from EPA, DOT's Office of Pipeline Safety, and industry officials on the extent to which crude oil contamination is occurring.

Officials from EPA's Office of Solid Waste, who provide policy and technical guidance for the implementation of Subtitle C of RCRA (which addresses the management and disposal of hazardous solid waste), had heard of no reported instances of crude oil contamination and were not aware that crude oil contamination was occurring. EPA officials in Dallas, Texas, however, said they had heard of one or two instances of contamination but had not been officially notified of nor taken any action on these instances. Additionally, officials from DOT's Office of Pipeline Safety said they do not test crude oil in the pipelines for contaminants and are not aware of any instances where contaminated crude oil shipped via the pipelines to the refineries has caused health or safety risks.

API officials believed that crude oil contamination with waste material was not a problem because of federal and state waste disposal requirements for the industry, and because of industry equipment that is capable of mitigating the effects of contamination before operating problems occur. API officials told us that although they understand that various noncrude substances may become mixed with crude oil, they were not aware of any incidences, at least within the last 3 years, in which noncrude substances mixed with crude oil caused any safety or environmental problems. A spokesperson from NPRA was not aware of any general contamination problem and thought that the cases of contamination identified in the Tulsa Tribune involved a few unique circumstances. An official from the Petroleum Industrial Security Council, Austin, Texas, on the other hand, said that the crude oil

contamination issue has been one of the featured topics at recent Council conferences, and he believes contamination is a problem. Although he did not have any supporting documentation, the official said he has heard of about 8 cases of contaminated crude oil in 1989 compared to 3 cases in 1987 and 1988. He said that most of these cases had been discussed in the Tulsa Tribune articles, while the other cases were not made public by the companies involved.

Industry officials at the nine oil and pipeline companies we spoke with were aware of the existence of solvents such as organic chlorides, which become highly corrosive in the refining process. However, the officials in four of these companies did not think that crude oil contamination is currently a problem because these companies routinely monitor whether the crude oil they receive contains chlorides. An official from one of the four companies, though, was concerned that contamination could become a major problem in the near future. His opinion was based on a belief that the current practice of disposing of refinery wastes called "land farming" might be banned by EPA. Two of the nine companies believed that crude oil contamination may be a major problem. According to an official from one of the companies, his concern was just based on a "gut feeling," while the other company's concern was based on actions taken against shippers suspected of shipping contaminated oil. The other three companies did not have comments regarding the magnitude of the problem.

CRUDE OIL TESTING IS LIMITED

It is difficult to determine the extent to which crude oil contamination is occurring because industry testing for contaminated crude oil varies both in terms of the number of companies with testing procedures in place and the substances for which the tests are being performed.

All nine refineries and oil companies we spoke with routinely test crude oil for temperature, gravity, and basic sediment and water. These basic properties define the quality and price of the crude oil. If the crude oil purchased is not of the level of quality expected, then the refinery will suffer an economic loss due to inadequate product yield.

Seven of the oil and pipeline companies we contacted perform tests for organic chlorides, and two of the seven also test for metals. However, the frequency with which these tests are performed varies. (Sec. 4 contains a further discussion of various industry testing programs.) Additionally, the tests that are performed may not necessarily identify the existence of toxic materials, such as polychlorinated biphenyls (PCBs). According to a pipeline company engineering superintendent, for instance, any PCBs in the oil would show up as chlorides. Hence, further tests would be needed to identify the chlorides specifically as PCBs.

According to one industry official, the cost of the crude oil tests limits the number of tests performed and the specific substances for which the tests are conducted. The industry typically tests for those substances, such as organic chlorides, that are known to cause operational problems. (The cost of the tests for these substances is also discussed in detail in sec. 4.) According to industry officials, it would be cost prohibitive to test for every substance that could possibly be put into the crude oil.

EFFECTS OF REFINING CONTAMINATED CRUDE

The industry and government officials we spoke with were aware that the refining of crude oil contaminated with certain noncrude substances could hinder refinery operations, but these officials did not think that the refining of any noncrude substances created unusual safety, health, or environmental risks. Although refinery equipment was damaged as a result of refining contaminated crude in three cases that we identified, in only one case did the contamination cause a fire or explosion.

Refinery officials, as well as officials from API and NPRA agreed that refining certain noncrude substances could cause refinery damage and lower product yield. According to a refinery official, the refining of organic chlorides creates hydrochloric acid, which is highly corrosive to refinery pipes. An official of a pipeline company said that some refineries, with advance notice, can tolerate organic chloride concentrations up to seven parts per million in total crude volume, while other refineries cannot tolerate concentrations which exceed one part per million. Substances such as heavy metals and chlorides can react with and neutralize the catalysts in the refining process. If the catalyst has been neutralized, certain reactions cannot take place.

On the other hand, officials from API did not think that refining noncrude substances causes unusual health or environmental harm, and officials from NPRA were unaware of any specific health or environmental risks associated with refining contaminated crude. Because EPA's Office of Solid Waste does not regulate the production or refining of crude oil, the officials we spoke with there did not know how refining contaminated crude oil would affect safety and the environment. However, the general opinion of the EPA staff we interviewed was that refining contaminated crude would probably not pose any unusual health or environmental risks.

Industry and government officials we contacted provided us with little information linking contamination to the occurrence of fires and explosions. However, no one we contacted had carried out an analysis to determine whether such a link exists. According to OSHA officials, OSHA usually would not investigate refinery fires

or explosions unless a worker was killed or if at least five workers were hospitalized. Its investigation might not determine whether contamination caused the fire. According to an OSHA official, OSHA's investigation would look into whether refinery pipes had been regularly monitored for corrosion, but would not necessarily focus on what was being transported in the pipes. OSHA investigators investigating a fire or explosion would only become aware of contamination if someone told them about it. While API collects information on refinery fires, the information is incomplete because reporting is voluntary. The Director of API's Fire and Safety Group said that, in his opinion, there is no link between refinery fires and contaminated crude oil.

According to a refinery official, once a contaminant is detected, the source of contamination is often hard to prove. Crude oil may be delivered from many sources, i.e., a crude oil pipeline may be accessed by many smaller gathering lines which transport oil from many small gatherers. These small gatherers receive their oil from numerous leases or possibly oil reclaimers.[1] According to an Oklahoma State Bureau of Investigation attorney, crude oil contamination cases are difficult to investigate because it is almost impossible to trace contaminated crude oil to its initial source. A prior FBI investigation was dropped because the evidence (i.e., the contaminant) was destroyed when the crude was diluted and refined.

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[1]Reclaimers collect crude and used oil and make it suitable for further use by removing insoluble contaminants.

SECTION 3

HOW RCRA AND THE HAZARDOUS LIQUID PIPELINE SAFETY ACT PERTAIN TO CRUDE OIL CONTAMINATION

Hazardous wastes must be controlled and disposed of in accordance with the hazardous waste provisions of RCRA. Since RCRA prohibits the disposal of hazardous wastes except in a permitted treatment, storage, or disposal facility, the disposal of hazardous wastes in crude oil is not allowed. Certain hazardous wastes generated from oil and gas exploration, development, and production are exempt from RCRA, however, and these wastes may remain in and contaminate crude oil in pipelines without violating RCRA.

The Hazardous Liquid Pipeline Safety Act of 1979 governs, among other things, the transportation via pipeline of petroleum products, including crude oil, and is primarily concerned with pipeline safety. According to DOT officials, pipeline safety regulations prohibit pipeline operators from transporting hazardous liquids that would corrode the pipeline system.

RCRA'S SUBTITLE C PROGRAM

RCRA was enacted in 1976 to address a problem of enormous magnitude--how to safely manage and dispose of high volumes of municipal and industrial solid waste generated nationwide. RCRA directs EPA to, among other things, develop and implement a program to protect human health and the environment from improper hazardous waste management practices. To control hazardous wastes, Subtitle C requires EPA first to identify which wastes are to be regulated as hazardous and to establish standards to regulate those that handle such waste. The handlers include generators, transporters, and facilities that treat, store, and dispose of hazardous waste. The standards for handlers include recordkeeping and labeling practices, manifest systems, and reporting requirements, which are designed to identify the specific hazardous waste from generation to ultimate disposition.

As defined by RCRA, a solid waste includes any solid, semisolid, liquid, or contained gaseous material that is discarded or intended to be discarded. Solid wastes are considered hazardous if they could cause injury or death, or pollute land, air, or water. Under RCRA, EPA was required to establish standards for two approaches that would identify which wastes are hazardous and need to be controlled. Under one approach, EPA was to identify the characteristics, or properties, that make a waste hazardous. Under the second approach, EPA was to identify and list specific wastes. In 1980, EPA promulgated regulations that established criteria for determining which wastes are hazardous. These regulations identified four characteristics--ignitability, corrosivity,

reactivity, and toxicity--and listed several hundred known and generally agreed-upon commercial products and production-process wastes that are hazardous. (The four identified characteristics are described and illustrated in app. II.)

EPA considers wastes to be hazardous if they contain one of these four characteristics unless they are exempted from RCRA regulation. Further, EPA considers that any mixture containing a listed hazardous waste, regardless of the percentage, is a hazardous waste and must be managed accordingly. Also, an EPA official in the Office of Solid Waste said that the mixing of listed hazardous wastes may be subject to specific management standards or permit conditions.

The responsibility of determining if a particular solid waste is hazardous falls on the generators of the waste. They must determine whether they generate a listed hazardous waste, or must test their waste using standard methods or have sufficient knowledge about their waste to assess whether it exhibits any of the four characteristics. If the waste does exhibit a characteristic, then it is hazardous and must be managed accordingly. According to EPA officials, a characteristically hazardous waste can be blended or mixed with a nonhazardous waste so that the resulting mixture is no longer characteristically hazardous; however, as with listed waste, this mixing may be subject to specific management standards.

SOME WASTES ARE EXEMPT FROM RCRA

Certain types of solid wastes are exempted in whole or in part from regulation under Subtitle C. These exemptions include wastes generated from oil and gas exploration and production, some characteristically hazardous used oil, and wastes generated by small-quantity generators.[1]

Exemption for Oil and Gas Exploration and Production Wastes

In the 1980 amendments to RCRA, wastes generated from oil and gas exploration, development, or production operations were exempted from Subtitle C. The various types of exempt oil and gas wastes include drilling fluids, produced water, well treatment and stimulation fluids, and storage tank bottoms containing basic sediment and water from holding product and exempt waste. Under the amendments, EPA was directed to study such wastes and either determine that the exemption should continue or recommend

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[1]Exempted wastes also include common solid wastes such as household wastes and agricultural wastes that do not present a significant threat to human health or environment, or are managed under other programs.

appropriate regulatory action. On the basis of that study, EPA decided that the exemption was warranted, considering factors such as the adequacy of existing federal and state regulations, the danger to human health and environment, and the economic impact on industry. However, in an attempt to fill certain gaps and strengthen the regulations, EPA is currently collecting data to support the development of additional management standards for these wastes under Subtitle D of RCRA, which pertains to EPA's solid waste disposal program.

Exemption for Used Oil

In 1985, EPA published a proposal to list used oil as a hazardous waste.[2] However, in response to comments on the proposal, in 1986 EPA decided not to list used oil destined for recycling as a hazardous waste and decided to defer its decision regarding the disposal of used oil, even though EPA recognized that used oil may contain listed hazardous wastes such as chlorinated solvents or exhibit one of the four characteristics of a hazardous waste. According to EPA Office of Solid Waste officials, EPA decided that listing used oil could be environmentally counter productive because it would deter recycling and result in increased dumping into the environment.

In October 1988, the U.S. Court of Appeals for the District of Columbia rejected EPA's rationale for not listing recycled used oil as a hazardous waste because it was based on a factor not allowed by RCRA, and ordered EPA to reevaluate its earlier position. That reevaluation is currently in process.

Exemption for Small-Quantity Generators

A business that generates more than 100 kilograms but less than 1,000 kilograms of hazardous waste in any calendar month is considered to be a small-quantity generator. Small-quantity generators must test, properly store, and dispose of their hazardous wastes at approved facilities, but are exempt from certain reporting requirements. According to EPA, small-quantity generators account for less than 1 percent of the hazardous waste generated and do not warrant extensive federal regulation.

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[2]Used oil is defined as any oil that has been refined from crude oil, which is used and, as a result of such use, is contaminated by physical or chemical impurities. Unused oil generally becomes a waste oil when it is spilled, when it mixes with other wastes, or when it fails specifications for its intended use and is discarded. Unused petroleum wastes are also classified as waste oils.

HOW RCRA RELATES TO CRUDE OIL CONTAMINATION

Hazardous wastes must be controlled and disposed of in accordance with the hazardous waste provisions of Subtitle C of RCRA. Since RCRA prohibits the disposal of hazardous wastes except in a permitted treatment, storage, or disposal facility, the disposal of hazardous wastes in crude oil is not allowed. Certain hazardous wastes generated from oil and gas exploration, development, and production are exempt from RCRA, however, and these wastes may remain in and contaminate crude oil in pipelines without violating RCRA. In addition, used oil that is hazardous could be reintroduced into a crude oil pipeline and refined at a petroleum refinery, provided the used oil was from normal operations and refined along with the normal crude oil process since such oil is exempt under the RCRA regulations.

When hazardous substances are detected in crude oil, the source and specific intent to improperly dispose of the substance must be established to determine if RCRA regulations have been violated. According to EPA, this determination is difficult to make because different crude oils are commingled in tanks and pipelines, hazardous substances are generally found in trace amounts, and some hazardous wastes are exempt from RCRA regulations.

According to industry officials, the introduction of used oil and wastes from oil and gas exploration and production into a crude oil pipeline is considered an appropriate management practice. According to EPA Office of Solid Waste officials, used oil offers the potential for disposing of hazardous and nonhazardous substances because used oil cannot be detected when blended with crude oil. However, the presence of used oil may be detected by identifying contaminants in the used oil such as chlorinated solvents, metals, zinc, and detergents. These EPA officials did not believe RCRA exemptions contribute significantly to crude oil contamination.

SOME STATE ENVIRONMENTAL REGULATIONS ARE MORE STRINGENT THAN RCRA

Like many other environmental laws, RCRA provides for states to assume the responsibility of implementing and enforcing the RCRA hazardous waste program and requires EPA to oversee the states' programs by monitoring the states' activities. The rationale for encouraging the states to implement the RCRA program is that each state is more familiar with regulating its own community and, therefore, is in a better position to more effectively administer the program and respond to local needs than the federal government.

To receive authorization from EPA, a state program must be at least equivalent to the federal program and provide for adequate enforcement. However, states may impose more stringent regulations to provide broader coverage than the federal program. EPA directly administers RCRA in states that have not assumed the responsibility to administer the Subtitle C program.

According to EPA officials in the Office of Solid Waste, 45 of 56 states and territories, including 3 of the states we visited (Louisiana, Oklahoma, and Texas), have approved RCRA programs. California, the fourth state we visited, does not have an approved RCRA program, but is currently implementing RCRA provisions under an agreement with EPA. California's Hazardous Waste Control Law provides that RCRA regulations will operate as state regulations until RCRA authorization is obtained. In contrast, Louisiana has adopted more stringent environmental regulations on small-quantity generators than those provided in RCRA regulations. This includes assigning state hazardous waste identification numbers, filing annual reports, and including the waste on the manifest before transporting it to a state-approved disposal facility. Additionally, Louisiana laws prohibit a "product" from contaminating a crude oil pipeline. A "product" is any commodity made from oil or gas such as refined crude oil, lubricating oil, gas oil, and blends or mixtures of oil with one or more liquid products or by-products derived from oil or gas.

In California, used oil is regulated as a hazardous waste if it does not meet federal standards to be recycled and burned for energy recovery. According to EPA Office of Solid Waste officials, RCRA's Subtitle C regulations do not classify used oil as a hazardous waste unless the used oil exhibits a hazardous characteristic and is destined for disposal. Also, California laws are more stringent in that they reduced the limit for lead content to 50 parts per million (ppm) (compared with the 100 ppm under RCRA used oil fuel specifications) and total halogens to 3,000 ppm or less (compared with the 4,000 ppm under RCRA used oil fuel specifications) for used oil recycled and burned for energy recovery. California does not allow the blending of crude oil with used oil until tests and verification show that the used oil meets the standards. Also, California does not recognize the exemption for small-quantity generators. Therefore, every generator in California is covered by state environmental regulations.

PIPELINE SAFETY PROGRAMS

DOT's Office of Pipeline Safety is responsible for implementing the Hazardous Liquid Regulations. These regulations are based on the Hazardous Liquid Pipeline Safety Act of 1979, which governs the transportation of hazardous liquids such as petroleum products, crude oil, and anhydrous ammonia.

The primary function of the Office of Pipeline Safety is to monitor the design, construction, operation, and maintenance of natural gas and hazardous liquid pipelines or pipeline systems. Office regulations do not govern pipelines at a refinery or pipelines at crude oil-gathering facilities. According to Office of Pipeline Safety officials, Office regulations do not address the quality of products or liquids transported in the pipeline nor do they test for contaminants in the pipeline.

According to Office of Pipeline Safety officials, Office regulations prohibit the transportation of any hazardous liquid that would corrode the pipe or other components of the pipeline system, unless the pipeline operator has investigated the corrosive effect of the hazardous liquid on the system and has taken adequate steps to mitigate internal corrosion. The regulations are based on substances that occur naturally in crude oil and do not specifically identify any other corrosive contaminants.

The regulations require pipeline operators, at least twice each calendar year, to examine their monitoring equipment to determine the extent of any corrosion. The Office of Pipeline Safety relies on the test conducted by the pipeline operators to identify the existence of corrosive substances. Office inspectors review tests conducted by the pipeline operators but do not conduct their own tests.

SECTION 4

ACTIONS TAKEN TO ADDRESS CRUDE OIL CONTAMINATION

All nine companies we contacted are aware of the potential for crude oil contamination, and eight have implemented crude oil-testing programs to detect certain noncrude substances. These programs now include tests for such substances as organic chlorides and metals, which can damage refinery equipment and reduce yield and profit. Three of the companies we contacted have either warned, banned, or sued suppliers when these suppliers were suspected of providing contaminated crude. Federal and state regulatory agencies we contacted are taking little, if any, action to address the issue of crude oil contamination.

TESTING PROGRAMS INITIATED BY INDUSTRY

As discussed in section 2, all of the companies that we contacted test samples of the oil for temperature, gravity, and basic sediment and water. However, crude oil-testing programs for noncrude substances were being used in eight of the nine companies we contacted. Industry action with regard to crude oil testing has been focused on the detection of contaminants that cause economic loss.

Officials of those companies with noncrude-testing programs we contacted stated that they have emphasized testing of crude oil for two reasons:

-- Contaminated crude oil adversely affects the product yield and results in an economic loss to the refinery. Crude oil containing noncrude substances such as chlorides, high sulfur, and heavy metals does not produce the same quantities of gasoline and kerosene as does virgin crude.

-- Distillation of crude oil containing organic chlorides results in an economic loss due to unscheduled shutdowns and the cost to replace refinery pipes. These organic chlorides react with the hydrocarbons in the crude to produce hydrochloric acid. Hydrochloric acid adversely affects the catalyst needed in refining the oil and also causes excessive corrosion to the pipes in the refinery.

Shell Oil was the only company we contacted that did not have a testing program for noncrude substances. Shell is considering implementing one in the future. Two of the companies we contacted perform additional tests for nonchloride contaminants such as heavy metals. Conoco, for instance, conducts laboratory tests quarterly to determine to what degree metals, nitrogen, vanadium, and other noncrude substances contaminate its crude oil. Conoco officials

stated that these procedures and testing methods have proven effective in reducing contamination caused by organic chlorides as well as other contaminants.

Several oil companies provided us cost estimates for testing one sample of crude oil. A Mobil Oil official estimated the cost of testing one chloride sample at $50-75. Permian Oil company officials estimated each chloride test costs $65 and each test for sulfur content costs $35. MCPL's "finger print test" for sulfur, iron, reid vapor pressure, organic chlorides, and distillation costs $136 per sample. Also, according to MCPL, the gas chromatograph test for organic compounds and other substances costs $250 per sample.

Crude oil purchasers, a transporter, and refiners we contacted typically sample the crude at the point of sale and do not receive the results of the tested samples until after the crude is shipped through the pipelines and processed at the refineries. Mobil Oil Company, however, has instituted a testing program that allows Mobil refinery officials to stop shipments of crude oil that contain more than one part chlorides per million before it is processed in the refinery. Refinery personnel off-load the crude in question into a separate storage tank and conduct additional testing. If Mobil determines that the chloride level is acceptable, then the refinery will dilute the chloride-contaminated crude with noncontaminated crude until the mixture is at an acceptable level for processing. According to the regional manager, Mobil Crude Oil Department, this "early warning" system costs between $200,000 and $250,000 per year.

OIL COMPANY ACTIONS TAKEN AGAINST SUPPLIERS

Three of the companies we talked with have either warned, banned, or sued suppliers when these suppliers were suspected of providing contaminated crude.

According to Mobil's Regional Manager, Crude Oil Department, Mobil was able to link the 1982 Beaumont, Texas, refinery fire to a small trucking company that sold crude oil heavily contaminated with organic chlorides, and was awarded $7 million in damages from the supplier. As a result of the Beaumont refinery incident, Mobil established new testing procedures to reduce the risk of a recurrence.

Officials from MCPL, which is owned and operated by Sun Pipeline Company, informed us of 33 cases between June 6, 1982, and July 31, 1989, in which actions have been taken against suppliers. Twenty-seven of these cases involved high amounts of chloride contamination. Other cases involved high amounts of iron. Actions taken against suppliers led to written warnings being issued, pretesting of crude oil before shipment, indefinite

suspension, and permanent disconnection from the pipeline. Since 1987, MCPL has developed a progressive warning system designed to prevent crude oil contamination. If MCPL identifies or suspects a supplier of providing contaminated crude, that supplier will be placed on "pretest." Pretest is designed for those crude oil suppliers that have supplied "nonconforming" crude in the past or those suppliers that MCPL deems suspicious. During pretest, MCPL will sample and test the supplier's oil before purchase. Suppliers that significantly exceed the test limits or who receive three warnings for minor violations (small increases above test limits) are required to have a qualified laboratory test their crude oil at their expense before selling it to MCPL.

In 1982, Conoco sued a small gatherer after it was supplied contaminated crude. According to a Conoco official, Conoco did not win the court case because the jury determined that the evidence did not positively identify the accused gatherer as the supplier responsible for introducing the contaminated crude.

LIMITED ACTIONS TAKEN BY FEDERAL AND STATE REGULATORY AGENCIESAGAINST SUPPLIERS

Seven of the eight state regulatory agencies in the states we visited have taken no direct action designed specifically to prevent crude oil contamination. State regulatory agencies in California, Louisiana, Oklahoma, and Texas have enacted laws and enforced regulations to better account for and control oil-reclaiming operations and used oil recyclers. Because these laws and regulations create a more accountable environment for tracking crude oil, they may have a favorable impact on crude oil contamination. According to officials from state regulatory agencies in California, Oklahoma, and Texas, they have not taken actions designed to specifically prevent crude oil contamination.

A Louisiana Department of Natural Resources, Office of Conservation, official did identify one regulation that was aimed, in part, at preventing crude oil contamination. He said that according to title 30 of Louisiana state regulations, products such as gasoline, kerosene, treated crude oil, benzene, wash oil, and other noncrude substances cannot be placed into a crude oil pipeline. He also said that violations of title 30 occur frequently but that the violators are rarely identified. According to a production audit analyst responsible for monitoring title 30 violations at the Louisiana Office of Conservation, only one documented case of noncompliance was ever filed against a suspected violator. This case has not yet been resolved, and no fine has been levied.

EPA, Department of Energy, and OSHA officials that we contacted were not aware of any direct actions their agencies have taken to prevent crude oil contamination. However, EPA will be

developing management standards under RCRA Subtitle D for oil and gas exploration and production wastes to strengthen existing regulations.

FORTY CASES OF CRUDE OIL

CONTAMINATION INVOLVING 9 COMPANIES

CASES OF CRUDE OIL CONTAMINATION AT THE REFINERY

-- According to a Quaker State Oil Company official, in February 1989, Quaker State's Congo Refinery in Newell, West Virginia, received a shipment of crude oil contaminated with carbon tetrachloride, which contaminated a 50,000-barrel tank. Carbon tetrachloride is sometimes used to clean paraffin (which is commonly found in large amounts in the oil in that region) from the wells. The official believed the oil came from a supplier in Ohio, but the specific source has not been identified. The contamination did not cause any damage at the refinery, although refinery operations were affected while the contaminated crude oil was held in a separate tank until it could be diluted and refined. Additional independent laboratory tests were needed to identify the contaminant.

-- According to the Federal Bureau of Investigation (FBI) and company officials, in February 1987, 800,000 gallons of contaminated crude oil was sold to Sun and Sinclair refineries in Tulsa, Oklahoma. Sun attempted to refine the crude and sustained $20,000-30,000 in damages to refinery equipment. After Sun determined that the mixture was not a hazardous waste, the mixture was diluted with other crude oil and refined. Sinclair did not refine the contaminated crude oil. According to the FBI in Tulsa, the contamination occurred when a shipment of alcohol was mistakenly identified as naphtha, mixed with crude oil, and sold to the refineries. The investigation was dropped when Sun refused to prosecute the supplier.

-- According to a Pennzoil plant manager, in 1987, Pennzoil's Atlas Refinery in Shreveport, Louisiana, was forced to shut down after experiencing operational problems in its distillation columns. Analysis of the crude oil being processed identified higher than normal quantities of bromine, iodine, chlorides, and nitrogen. Atlas officials were not able to identify the cause or specific source of the contaminants, although they think the contaminated crude came from one of their truck suppliers rather than the pipeline.

-- According to a Mobil Oil Corporation official, in 1982, Mobil's Beaumont, Texas, refinery experienced advanced corrosion leading to a large fire and refinery shutdown. Mobil determined the crude oil contained 65,000 parts per million of organic chlorides, including trichlorethane and trichlorethylene. Organic chlorides, even in concentrations as low as about five parts per million or less, can cause corrosion to the pipeline and refinery equipment. Mobil also identified oxygenated solvents, used lubricating oil, leaded gasoline, and tank bottom waste. The sludge from the shipment contained 65 percent alkyd resins used in paint plants as well as residual fuel oil, soap, water, and dirt. Mobil was awarded $7 million in damages from the trucking company that supplied the oil.

-- According to a Conoco Oil Company official, in October 1981, Conoco's refinery in Ponca City, Oklahoma, received a shipment of crude oil contaminated with organic chlorides. The contaminated crude corroded a small 3- to 4-foot section of pipe that had to be replaced in the hydro-desulfurization unit.

CASES OF CRUDE OIL CONTAMINATED DETECTED AT THE PIPELINE

-- Officials from Mid-Continent Pipeline Company (MCPL), which is owned and operated by Sun Pipeline Company, informed us that between June 6, 1982, and July 31, 1989, there were 33 instances of contamination in which actions have been taken against suppliers. MCPL's actions include issuing written warnings, requiring the supplier to pay for tests of the crude oil shipments, and suspension from the pipeline. The primary substances MCPL has found in the crude oil are chlorides. Other contaminants include iron and gasoline.

-- According to an 88 Oil Company official, in 1984, Conoco Oil Company in Guernsey, Wyoming, discovered a shipment of crude oil contaminated with carbon tetrachloride, a used solvent. The solvent came from a local strip mining operation and had been mixed in with a batch of used oil before being sold to a reclaimer. The contamination was detected at the Conoco laboratory before it reached the pipeline. The small gatherer filed a lawsuit against the reclaimer and recovered damages.

-- According to a Shell Oil Company official, the U.S. Attorney and the FBI in Louisiana have charged two independent companies, La Jet Petroleum and Challenger Petroleum USA, with introducing contaminated crude into Shell's Ship Shoal Pipeline. On the basis of an anonymous

tip, in July 1989, Shell tested the crude oil before and after the crude oil injection point on the pipeline shared by the companies and discovered that the crude contained chlorides. Fraud charges have been filed against the two companies.

HAZARDOUS WASTE CHARACTERISTICS

IGNITABILITY

Ignitable wastes can create fires under certain conditions. Examples of ignitable wastes include waste oils and used solvents that readily catch fire, and friction-sensitive substances.

CORROSIVITY

Corrosive wastes with high or low pH[1] can react dangerously with other wastes or cause toxic contaminants to migrate from certain wastes. Corrosive wastes include those that are acidic and those that are capable of corroding metal (such as tanks, containers, drums, and barrels).

REACTIVITY

Reactive wastes are unstable under normal conditions and can pose a problem at any stage of the waste management cycle. These wastes can create explosions and/or toxic fumes, gases, and vapors when mixed with water. Examples of reactive wastes include water from TNT operations and used cyanide solvents.

TOXICITY

Extraction procedure (EP) toxicity refers to a characteristic of a waste, and also to a test. The EP test is designed to identify wastes likely to leach hazardous concentrations of particular toxic constituents into the groundwater as a result of improper management. During the test, constituents are extracted and analyzed to determine if they exceed toxic constituent levels set by EPA. Toxic wastes are harmful or fatal when ingested or absorbed.

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[1]A measure of acidity and alkalinity ranging in scale from zero to 14. Numbers below 7 reflect increasing acidity.

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