

WASTE MINIMIZATION IN THE OIL FIELD



**RAILROAD COMMISSION
OF TEXAS**

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TABLE OF CONTENTS

LIST OF APPENDICES	v
LIST OF TABLES	vi
RAILROAD COMMISSION OF TEXAS WASTE MINIMIZATION PROGRAM GOALS	vii
RAILROAD COMMISSION JURISDICTION	viii
ACKNOWLEDGEMENTS	ix
CHAPTER 1	
INTRODUCTION	1-1
Waste Minimization - A Worthwhile Goal.....	1-1
What Benefits Does Waste Minimization Produce?	1-1
Is Waste Minimization Economically Feasible?	1-2
Waste Management Hierarchy of Preference	1-3
CHAPTER 2	
WASTE MANAGEMENT PLANS (The API Ten-Step Process)	2-1
CHAPTER 3	
HAZARDOUS AND NONHAZARDOUS OIL AND GAS WASTES	3-1
Oil and Gas Wastes.....	3-1
RCRA and the E&P Exemption	3-2
Scope of the E&P Exemption.....	3-2
Exempt Wastes.....	3-5
Nonexempt Wastes.....	3-5
Hazardous Oil and Gas Wastes.....	3-8
Nonexempt Listed Hazardous Oil and Gas Wastes.....	3-8
Nonexempt Characteristically Hazardous Oil and Gas Wastes.....	3-10
Mixing Exempt and Nonexempt Wastes.....	3-13
Management of Nonhazardous Oil and Gas Wastes.....	3-15
Management of Hazardous Oil and Gas Wastes.....	3-15
CHAPTER 4	
POTENTIAL WASTE GENERATION IN OIL AND GAS OPERATIONS	4-1
Drilling Operations.....	4-1
Oil Field Production Operations.....	4-3
Gas Field Production and Gas Plant Operations.....	4-6
Pipeline Operations.....	4-11
Operations in General.....	4-12
API Generic List of Hazardous Chemical Categories for the E&P Industry.....	4-13

CHAPTER 5

WASTE MINIMIZATION AND MANAGEMENT IN OIL AND GAS OPERATIONS 5-1

- Source Reduction: An Ounce of Prevention... 5-1
- Recycling: Once is Never Enough..... 5-2
- Waste Minimization Opportunities in Oil and Gas Operations 5-2
 - Drilling Operations 5-3
 - Production and Workover Operations 5-9
 - Natural Gas Treating and Processing Operations..... 5-16
 - Pipeline Operations 5-20
 - Opportunities Applicable To All Oil and Gas Operations..... 5-23
- Recycling Resources 5-29
- Treatment 5-30
- Disposal 5-30
- A Note on the Importance of Segregating Wastes..... 5-31

CHAPTER 6

SUCCESS STORIES..... 6-1

- Drilling Operations..... 6-2
- Production and Workover Operations 6-3
- Natural Gas Processing Plant Operations 6-6
- Pipeline Operations..... 6-9
- All Oil and Gas Operations 6-11

LIST OF REFERENCES R-1

LIST OF APPENDICES

- APPENDIX A** REGULATORY DETERMINATION FOR OIL AND GAS AND GEOTHERMAL EXPLORATION, DEVELOPMENT AND PRODUCTION WASTES
53 Federal Register 25446-25459 (July 6, 1988)
- APPENDIX B** CLARIFICATION OF THE REGULATORY DETERMINATION FOR WASTES FROM THE EXPLORATION, DEVELOPMENT AND PRODUCTION OF CRUDE OIL, NATURAL GAS AND GEOTHERMAL ENERGY
58 Federal Register 15284-15287 (March 22, 1993)
- APPENDIX C** LIST OF E&P WASTES: EXEMPT AND NONEXEMPT
Exempt Wastes
Nonexempt Wastes
Questionable Status Wastes
Special Category Wastes
- APPENDIX D** TNRCC REGULATION OF WASTE
TNRCC Waste Classifications
Disposal of Oil and Gas Wastes at Municipal Landfills Permitted by the TNRCC
- APPENDIX E** LIST OF SARA TITLE III CHEMICALS
- APPENDIX F** MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN OIL AND GAS OPERATIONS
- APPENDIX G** HAZARDOUS WASTE MANAGEMENT SYSTEM; IDENTIFICATION AND LISTING OF HAZARDOUS WASTE; RECYCLED USED OIL MANAGEMENT STANDARDS
59 Federal Register 10550-10560 (March 4, 1994)
- APPENDIX H** SOURCE REDUCTION AND RECYCLING RESOURCES
Railroad Commission of Texas
Other State of Texas Agencies
Other States' Agencies
Federal Agencies
Universities and Colleges
Libraries
Industry Associations and Societies
- APPENDIX I** GLOSSARY AND ACRONYMS

LIST OF TABLES

Table 1 Oil and Gas Wastes Exempt From RCRA
Hazardous Waste Regulation.....3-8

Table 2 RCRA Nonexempt Oil and Gas Wastes3-11

Table 3 Listed RCRA Hazardous Oil and Gas Wastes.....3-14

Table 4 RCRA Hazardous Waste Characteristics.....3-16

RAILROAD COMMISSION OF TEXAS WASTE MINIMIZATION PROGRAM GOALS

The objective of the Railroad Commission's Waste Minimization Program is to increase environmental protection by significantly reducing the potential for pollution of the State's land, water, and air in the exploration and production of oil and gas. Voluntary industry initiatives to reduce the volume and hazards of wastes generated and to recycle wastes that are generated can play a major role in the achievement of this objective. Therefore, the *primary* emphasis of the Commission's program is on providing oil and gas operators with training and technical assistance on source reduction and recycling, which is also known as waste minimization.

The Railroad Commission is committed to promoting source reduction and recycling in the oil field. The Commission will continue its outreach efforts by making this manual available to operators on request and by conducting workshops around the state. Also, the Commission will incorporate information on pollution prevention through source reduction and recycling into its annual series of Water Protection Seminars. Commission staff will continue to be trained on the job to deliver source reduction and recycling information and assistance to oil and gas operators. The Commission will also work to eliminate regulatory barriers and to establish regulatory incentives to source reduction and recycling.



RAILROAD COMMISSION JURISDICTION

In addition to regulating a wide range of oil and gas operations for the purpose of conserving oil and gas resources, the Railroad Commission of Texas regulates oil and gas exploration and production operations to protect the state's water resources. The scope of the Commission's environmental programs for oil and gas exploration and production operations is determined by section 91.101 of the Texas Natural Resources Code, which lists various oil and gas activities subject to the Commission's jurisdiction. Generally, the Railroad Commission of Texas has jurisdiction over the discharge, storage, handling, transportation, reclamation, or disposal of waste materials that result from activities associated with the exploration, development, or production of oil, gas, or geothermal resources. A more detailed explanation of the wastes under the Commission's jurisdiction is included in Chapter 3.

Railroad Commission Statewide Rule 30, "Memorandum of Understanding Between the Railroad Commission of Texas (RRC) and the Texas Natural Resource Conservation Commission (TNRRC)," clarifies jurisdiction over waste associated with oil and gas operations.

The Commission worked with the Texas Legislature in developing legislation to encourage waste minimization in oil and gas operations. As a result, section 91.110 of the Texas Natural Resources Code directs the Commission to encourage oil and gas waste reduction and minimization by implementing a program to:

- 1) provide operators with training and technical assistance on oil and gas waste reduction and minimization;
- 2) assist operators in developing oil and gas waste reduction and minimization plans; and
- 3) by rule establish incentives for oil and gas waste reduction and minimization.

The Waste Minimization Program was developed to meet these goals.

ACKNOWLEDGEMENTS

The Railroad Commission of Texas acknowledges the U.S. Environmental Protection Agency (EPA) for its support of the Waste Minimization Program. The EPA provided the Commission with a grant that partially funded the development and distribution of this manual. Continued support from EPA partially funded the revision and continued distribution of this manual.

Texas' oil and gas companies and associations were instrumental in the development of this manual. Waste management plans provided by Texaco E&P Inc., Amoco Production Company, and Warren Petroleum were valuable sources of information. Numerous companies and associations responded to the Commission's pollution prevention survey in May, 1993, and participated in the subsequent Pollution Prevention Workshop. These companies and associations also reviewed drafts of this manual and provided valuable suggestions and comments regarding its final content.

In particular, the oil and gas companies who provided the case histories of successful waste minimization are acknowledged for their contribution. Case histories are the "backbone" of the Waste Minimization Program!

NOTES

1***INTRODUCTION*****WASTE MINIMIZATION - A WORTHWHILE GOAL**

Historically, management of large quantities of produced water, as well as drilling fluids and associated wastes, was perceived as an unavoidable, everyday fact-of-life in the oil field. As a result, environmental protection efforts by both industry and regulators generally concentrated on the most effective methods for treatment and disposal of wastes after the wastes had been generated. Prior to the early 1980's there were relatively few practical incentives to focus on reducing or eliminating wastes in oil field processes and practices.

In the past several years, however, significant changes in environmental regulations and industry perspectives have made an "end-of-pipe" approach to waste management much less desirable. More stringent state and federal waste management regulations have resulted in substantially increased treatment and disposal costs. These new costs, coupled with a heightened awareness of environmental impacts and an expanded emphasis on environmental protection, have provided a greater incentive for operators to improve oil field processes and practices to reduce or eliminate wastes.

WHAT BENEFITS DOES WASTE MINIMIZATION PRODUCE?

The Commission recognizes that about 98% by volume of the oil and gas waste produced in Texas consists of produced water. Drilling fluids and associated wastes make up about 1.6% and 0.4%, respectively, of Texas oil and gas wastes. Although large volume reductions may not be expected for produced water using today's technologies, some waste minimization technologies - predominately recycling by injection in enhanced recovery projects - do exist for produced water. Produced water can also be treated to reduce contaminate concentrations. Many possibilities already exist for reducing the volumes and toxicity of drilling fluids and associated wastes. A voluntary waste minimization program offers the best opportunity for an individual company to reduce the pollution potential of oil and gas wastes.

The Commission can provide oil and gas operators with information and technical assistance that can make it easier for them to identify waste minimization opportunities and, therefore, easier for them to comply with ever-changing, increasingly complex and costly, environmental regulations. Voluntary waste minimization efforts by oil and gas operators can help reduce the call for additional future regulation.

The potential benefits to a company that implements a waste minimization program include:

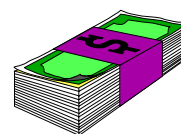
- increased revenue;
- reduced costs of operating, materials, waste management and disposal, energy, and facility cleanup;
- improved operating efficiency;
- reduced regulatory compliance concerns;
- reduced potential for both civil and criminal liability; and
- enhanced public perception of the company and the industry as a whole.

Numerous waste minimization opportunities exist for oil and gas operations. Initiation of a waste minimization program does not have to be expensive or complicated. With some advance planning and effort, there are many inexpensive, common sense practices that are feasible for even the smallest company.

IS WASTE MINIMIZATION ECONOMICALLY FEASIBLE?

WHAT IS THE POTENTIAL - AND THE INCENTIVE - FOR E&P OPERATORS TO REDUCE THE VOLUME AND TOXICITY OF WASTE THEY GENERATE?

This question is gaining more attention in Texas and the nation, especially as Congress considers reauthorizing the Resource Conservation and Recovery Act (RCRA) Subtitle C and possibly subjecting all oil and gas wastes to hazardous waste regulation. Even if



Congress imposes no additional restrictions on oil and gas waste management options, waste management costs have already risen dramatically, not only in terms of disposal fees, but also in terms of regulatory compliance costs and potential future liability. In many instances source reduction and recycling are cheaper in the long run than treatment or disposal of wastes, particularly when the time and cost of regulatory compliance is considered. In addition, the cost of remediating just one site where improper waste disposal or a spill has occurred can be a significant incentive to reduce or eliminate waste.

Today, many companies are performing detailed internal assessments to identify products that are used, waste generating processes, and waste streams. Wastes are classified and managed according to waste management plans, which are developed by considering environmental conditions in specific geographic areas. A waste minimization program is an important element of any comprehensive waste management plan.

This manual has been prepared as an aid to the oil and gas operator in recognizing effective waste minimization options, and using those options in the development of a waste management plan.

WASTE MANGEMENT HIERARCHY OF PREFERENCE

Today, in order to protect the environment, reduce waste management costs, and increase compliance, our focus on waste management must shift from the end-of-the-pipe to the very beginning.

The first step in shifting our focus on waste management is for individual waste generators to adopt the Waste Management Hierarchy of Preference endorsed in the federal Pollution Prevention Act of 1990. The overriding principle of the hierarchy is the reduction ... if not elimination ... of both the volume and toxicity of waste that is introduced into the environment. From an environmental perspective, disposal is the least preferred waste management option. To the extent practicable, waste management choices should be based upon the following hierarchy of preference:

WASTE MANAGEMENT HIERARCHY

Most Preferred

SOURCE REDUCTION

RECYCLING

TREATMENT

DISPOSAL

Least Preferred

SOURCE REDUCTION

Source reduction is given the highest priority in the waste management hierarchy because avoiding waste generation altogether, or generating the least toxic waste possible, minimizes the problems associated with waste management. Waste that is not generated need not be managed. Waste that is generated, but is of the lowest possible volume and/or toxicity, can be managed most cost-effectively.

RECYCLING

In some cases, reduction at the source will not yet be technically possible or economically feasible. Therefore, recycling opportunities should be investigated for all wastes that are unavoidably generated. Recycling involves reclaiming useful constituents of a waste material, or removing contaminants from a waste so that it can be reused. Recycling may also involve the use or reuse of a waste as a substitute for a commercial product, or as feedstock in an industrial process. Recycling helps to preserve raw materials and reduces the amount of material that requires disposal.

SOURCE REDUCTION AND RECYCLING EQUAL WASTE MINIMIZATION

SOURCE REDUCTION AND RECYCLING MINIMIZE THE QUANTITY OF OIL AND GAS WASTE THAT REQUIRES SUBSEQUENT TREATMENT AND DISPOSAL.

TREATMENT

Treatment should be investigated for any waste that is unavoidably generated and that cannot be recycled in its current form. Treatment is any method, technique, or process that changes the physical, chemical, or biological character of a waste. Treatment renders the waste less hazardous and, therefore, recyclable or safer to transport, store, and dispose of. Note that treatment does not prevent the creation of pollutants. Treatment involves changing the nature of the waste or reducing or eliminating the pollutants in a waste.

DISPOSAL

Waste disposal generally is the discharge, deposition, injection, dumping, spilling, leaking, or placing of any waste into or on land, water, or air. In the waste management hierarchy, disposal is the least preferred waste management option. Disposal also involves the greatest potential liability.

NOTES

2

WASTE MANAGEMENT PLANS

There is increasing emphasis on pollution prevention in oil and gas operations. This emphasis has resulted in numerous efforts to define the elements of a successful waste management plan. The American Petroleum Institute (API)^{1, 2}, C.T. Stilwell³, and EPA⁴ have published guidelines for waste management plans which include waste minimization as an integral part of the plan. The following pages present an overview of the ten steps recommended by API² for developing a waste management plan.

STEP 1: COMPANY MANAGEMENT APPROVAL

Management approval should include established goals, such as a specific waste volume reduction in a set time frame. Key personnel and resources to be committed to the plan should be defined. Additionally, management should develop a mission statement. An example of a mission statement used by a major E&P company is provided below.

**WASTE MANAGEMENT POLICY AND ENVIRONMENTAL POLICY**

At (Company), we recognize the importance of safeguarding the environment wherever we conduct our business. This extends from the production of crude oil and other energy sources through the manufacture and distribution of our products.

Therefore, in keeping with the (Company's) Guiding Principles and Objectives, (Company's) Environmental Policy is as follows:

- *To comply* with environmental laws and regulations.

- *To conduct* our operations in a manner that demonstrates respect for the quality of the environment.
- *To cooperate* with federal, state, and local governments in analyzing emerging environmental issues, finding solutions to environmental problems, and developing cost-effective, scientific environmental standards.
- *To maintain* effective environmental procedures and equipment, consistent with available technology.
- *To respond* quickly and effectively to environmental incidents involving (Company's) facilities, equipment, or products under our control.
- *To endorse* research to advance scientific knowledge concerning the causes and prevention of environmental deterioration.
- *To encourage* development of new technology which inherently provides improvement in the quality of the environment.
- *To provide* environmental training programs for employees, emphasizing individual responsibility for sound environmental management.
- *To maintain* corporate and departmental environmental monitoring programs to ensure compliance with (Company's) policy and governmental requirements.

STEP 2: AREA DEFINITION

The selection of an area for a specific waste management plan generally should account for variations in regulations and types of operations. In most cases, the area will be within one state.

STEP 3: REGULATORY ANALYSIS

Evaluate federal, state, and local laws and regulations. Evaluate landowner and lease agreement conditions. Using these evaluations, define operating conditions and requirements.

STEP 4: WASTE IDENTIFICATION

Identify the type, amount, and frequency of generation of each waste generated within the plan's area. A brief description of each type of waste should be provided.

Note: A general overview of drilling operations, oil field production operations, gas production and gas plant operations, and pipeline operations is presented in Chapter 4. Examples of wastes potentially generated by each type of operation are included in the overview. This overview may help you in preparing a waste management plan.



STEP 5: WASTE CLASSIFICATION

Classify each waste stream with respect to its regulatory status (e.g., hazardous or nonhazardous and exempt or non exempt from regulation as a hazardous waste under the Resource Conservation and Recovery Act (RCRA)).

STEP 6: LIST AND EVALUATE WASTE MANAGEMENT AND DISPOSAL OPTIONS

List all waste management practices and determine the environmental acceptability of each. Consider regulatory restrictions, engineering limitations, economics, and intangible benefits to determine the feasibility of a practice.

STEP 7: WASTE MINIMIZATION

Analyze each waste generating process for opportunities to reduce the volume generated, reduce the toxicity, recycle, reclaim, or reuse. Apply the Waste Management Hierarchy presented in Chapter 1.



Waste management plans are an important component of successful waste management. An effective plan will emphasize waste minimization, and, in turn, promote more effective waste management.

STEP 8: SELECT PREFERRED WASTE MANAGEMENT PRACTICES

Choose the management practice for each waste stream. Implement waste minimization options identified in Step 7 whenever feasible. Provide specific instructions for the implementation of the selected practice.

STEP 9: PREPARE AND IMPLEMENT AN AREA WASTE MANAGEMENT PLAN

Compile all the preferred waste management and minimization practices and write waste management summaries for each waste. Implement the plan on a field level.

STEP 10: REVIEW AND UPDATE WASTE MANAGEMENT PLAN

Establish a procedure to periodically review the plan and evaluate new or modified waste management and minimization practices. Revise the plan as necessary.

3***HAZARDOUS AND NONHAZARDOUS
OIL AND GAS WASTE*****OIL AND GAS WASTES**

The Railroad Commission has jurisdiction over oil and gas wastes, which include all wastes generated in association with the following activities:

- drilling, operation, and plugging of wells associated with the exploration, development, or production of oil and gas, including oil and gas wells, fluid injection wells used in enhanced recovery projects, and disposal wells;
- separation and treatment of produced fluids in the field or at natural gas processing plants;
- storage of crude oil before it enters a refinery;
- underground storage of hydrocarbons and natural gas;
- transportation of crude oil or natural gas by pipeline;
- solution mining of brine; and
- storage, hauling, disposal, or reclamation of wastes generated by these activities.

The Railroad Commission regulates *all* oil and gas waste in Texas, both hazardous and nonhazardous. Statewide Rule 30, “Memorandum of Understanding Between the Railroad Commission of Texas (RRC) and the Texas Natural Resource Conservation Commission (TNRCC),” provides additional guidance for determining jurisdiction over waste in Texas.

RCRA AND THE E&P EXEMPTION

The federal Resource Conservation and Recovery Act (RCRA), originally enacted in 1976, authorizes EPA to regulate the management of wastes resulting from industrial, commercial, mining, agricultural, and community activities. RCRA Subtitle C contains a comprehensive program for the regulation of hazardous wastes. Nonhazardous wastes are subject to regulation under RCRA Subtitle D. Railroad Commission Statewide Rule 98, “Standards for Management of Hazardous Oil and Gas Wastes,” establishes equivalent requirements for generators and transporters of hazardous oil and gas waste.

Recognizing the unique characteristics of oil and gas wastes, in 1980, Congress specifically exempted “drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas or geothermal energy”⁵ from regulation under RCRA Subtitle C as hazardous wastes. This exemption is commonly called the “E&P Exemption.” Statewide Rule 98 also provides the E&P exemption. The E&P exemption is explained in the following section.

Produced waters make up about 98% of all oil and gas wastes. In Texas, we estimate that 98% of these produced waters are injected in wells regulated under the federally approved underground injection control program administered by the Railroad Commission. Drilling fluids and other associated wastes make up about 1.6% and 0.4% of oil and gas wastes, respectively.

The exempt oil and gas wastes are unique, which is the rationale for the exemption. They are generated in large quantities, but are relatively low in toxicity. Exempt oil and gas wastes are generated by a large number of individual oil and gas operations—around 250,000 wells and 12,500 operators in Texas. Oil and gas wastes are generated in diverse operational and environmental settings—compare the Gulf Coast to the Panhandle, or the Permian Basin to the East Texas Field. Finally, exempt oil and gas wastes are adequately regulated under state and federal programs (other than RCRA Subtitle C) that have evolved over the years.

SCOPE OF THE E&P EXEMPTION

On July 6, 1988, after performing the study of oil and gas wastes mandated by Congress, EPA published its regulatory determination⁶ (see Appendix A). In its regulatory determination, EPA concluded that the exemption for produced water, drilling fluids, and associated wastes should continue. EPA also made its first efforts

to define the scope of the exemption. EPA reviewed both the statutory language and the legislative history and determined that the exemption for wastes associated with the exploration, development, and production of oil and gas covers only those wastes **uniquely associated** with **primary field operations**. Primary field operations include primary, secondary, and tertiary production of oil or gas.

With respect to **oil production**, primary field operations include activities occurring at or near the wellhead or production facility, but before the point where the custody of the oil is transferred from an individual field facility or a centrally located facility to a carrier for transport to a refiner. In the event no custody transfer occurs, the primary field operation ends at the last point of separation. Crude oil stock tanks are considered separation devices for the purpose of defining areas of primary field operations.

With respect to **natural gas production**, primary field operations are those activities occurring at or near the wellhead, production facility, or gas plant (including gathering lines to the plant), but before the point of transfer of the gas from an individual field facility, a centrally located facility, or a gas plant to a carrier for transport to market, or before the point of the use of natural gas in a manufacturing process.

In order to be covered under the E&P exemption, wastes from primary field operations must also be unique to E&P operations. Clearly, wastes such as produced water and drilling fluid are unique. However, other wastes commonly generated in E&P operations are used in other types of industries. For example, cleaning wastes, painting wastes, and waste lubricating oil are commonly generated in activities other than E&P activities (i.e., are not unique) and are, therefore, not covered by the E&P exemption.

In March 1993⁷, EPA provided clarification of the regulatory determination regarding the status of certain oil and gas wastes (see Appendix B). In that clarification, exempt waste was more precisely defined:

In particular, for a waste to be exempt from regulation as a hazardous waste under RCRA Subtitle C, it must be associated with operations to locate or remove oil and gas from the ground or to remove impurities from such substances and it must be intrinsic to and uniquely associated with oil and gas exploration, development or production operations (commonly referred to as exploration and production or E&P); the waste must not be generated by transportation or manufacturing

operations ... One common belief is that any wastes generated by, in support of, or intended for use by the oil and gas E&P industry ... are exempt. This is not the case; in fact, only wastes generated by activities uniquely associated with the exploration, development or production of crude oil or natural gas ... (i.e., wastes from down-hole or wastes that have otherwise been generated by contact with the production stream during the removal of produced water or other contaminants from the product) are exempt from regulation under RCRA Subtitle C ...

In its March 1993 clarification, EPA addressed the applicability of the E&P exemption to wastes generated by crude oil reclaimers, service companies, gas plants and feeder pipelines, crude oil pipelines, and underground gas storage fields. The clarification included the following explanations of the E&P exemption.

- For the purpose of defining primary field operations, the change of custody criterion refers to product (e.g., crude oil and natural gas), not waste.
- The off-site transport of exempt waste from a primary field site for treatment, reclamation, or disposal does not negate the exemption.
- Wastes derived from the treatment of an exempt waste, including any recovery of product from an exempt waste (e.g., crude oil reclamation from tank bottoms), generally remain exempt from the requirements of RCRA Subtitle C.
- Vacuum truck and drum rinsate from trucks and drums transporting or containing exempt waste is exempt, provided that the trucks or drums only contain E&P exempt wastes and that the water or fluid used in the rinsing is not subject to RCRA Subtitle C (i.e., is itself nonhazardous).
- Wastes generated by a service company that do not meet the basic criteria listed in the regulatory determinations (i.e., are not uniquely associated with oil and gas E&P operations) are not exempt from Rule 98 and Subtitle C. However, an oil and gas waste generated by a service company in primary field operations, and that is also uniquely associated with E&P, is an exempt oil and gas waste.
- The removal of elemental sulfur from hydrogen sulfide gas at a gas plant is considered treatment of an exempt waste.
- Wastes uniquely associated with operations to recover natural gas from underground gas storage fields are covered by the exemption.

EPA included a list of exempt wastes and a list of nonexempt wastes in its regulatory determination. These lists are not comprehensive. They were intended only to provide examples of the types of wastes that fall under the exempt and nonexempt categories. Generators will need to make individual determinations regarding the status of a number of other incidental wastes. The Railroad Commission or the EPA should be contacted for guidance in the event the regulatory status of a waste is in doubt.

Exempt Wastes

Exempt wastes make up the bulk (over 99.9%) of all wastes that are regulated by the Railroad Commission. Table 1 is a list of wastes designated as exempt in EPA's regulatory determination dated July 6, 1988⁶. It is a listing of most, but not all, oil and gas wastes that are exempt from hazardous waste regulation.

Although many oil and gas wastes are exempt from hazardous waste regulation, other regulations will apply, such as Railroad Commission Statewide Rule 8.

Nonexempt Wastes

The wastes that EPA has determined are not covered under the exemption may be hazardous wastes subject to regulation under Rule 98 and RCRA Subtitle C. Nonexempt wastes include, no matter where generated, those wastes that *are not uniquely associated* with an exploration and production activity, such as cleaning wastes or lubricating oil. Further, *all* wastes that are not associated with primary field operations, such as wastes associated with pipeline transportation or manufacturing (e.g., refining) activities, are nonexempt. Table 2 provides the list of nonexempt wastes in EPA's regulatory determination⁶. This is a listing of most, but not all, oil and gas wastes that are not exempt from regulation as hazardous wastes.

Not all nonexempt wastes are hazardous wastes. For example, empty drums and insulation will probably not be hazardous waste. However, some wastes, such as paint wastes, spent solvents, unused fracturing materials that can no longer be used for their intended purpose, and contaminated media resulting from a spill from a transportation pipeline, may be hazardous. The following section, "Hazardous Oil and Gas Wastes," explains how an operator may identify a nonexempt waste as hazardous or nonhazardous.

TABLE 1. OIL AND GAS WASTES EXEMPT FROM RCRA HAZARDOUS WASTE REGULATION*

- Produced water
- Drilling fluids and drill cuttings
- Drilling fluids and cuttings from offshore operations disposed on-shore
- Rigwash
- Well completion, treatment, and stimulation fluids
- Workover wastes
- Basic sediment and water and other tank bottom sludge from storage facilities that hold product and exempt waste
- Accumulated materials such as hydrocarbons, solids, sand, and emulsion from production separators, fluid treating vessels, and production impoundments
- Pit sludges and contaminated bottoms from storage or disposal exempt wastes
- Gas plant dehydration wastes, including glycol-based compounds, glycol filters, filter media, backwash, and molecular sieves
- Gas plant sweetening wastes for sulfur removal, including amine, amine filters, amine filter media, backwash, precipitated amine sludge, iron sponge, and hydrogen sulfide scrubber liquid and sludge
- Cooling tower blowdown
- Spent filters, filter media, and backwash (assuming the filter itself is not hazardous and the residue in it is from an exempt waste stream)
- Packing fluids
- Produced sand
- Pipe scale, hydrocarbon solids, hydrates, and other deposits removed from piping and equipment prior to transportation
- Hydrocarbon-bearing soil
- Pigging wastes from gathering lines
- Wastes from subsurface gas storage and retrieval, except for the listed nonexempt wastes
- Constituents removed from produced water before it is injected or otherwise disposed of
- Liquid hydrocarbons removed from the production stream but not from oil refining
- Gases removed from the production stream, such as hydrogen sulfide and carbon dioxide, and volatilized hydrocarbons
- Materials ejected from a producing well during blowdown
- Waste crude oil from primary field operations and production
- Light organics volatilized from exempt wastes in reserve pits or impoundments or production equipment

*Note: All exempt waste *must* be generated in primary field operations. A more descriptive listing of exempt wastes, as well as lists of wastes subject to laws other than RCRA, is provide in Appendix C.

TABLE 2. RCRA NONEXEMPT OIL AND GAS WASTES*

- Unused fracturing fluids or acids
- Gas plant cooling tower cleaning wastes
- Painting wastes
- Oil and gas service company wastes, such as empty drums, drum rinsate, vacuum truck rinsate, sandblast media, painting wastes, spent solvents, spilled chemicals, and waste acids
- Vacuum truck and drum rinsate from trucks and drums transporting or containing nonexempt waste
- Liquid and solid wastes generated by crude oil and tank bottom reclaimers**
- Used equipment lubrication oils
- Waste compressor oil, filters, and blowdown
- Used hydraulic fluids
- Waste solvents
- Waste in transportation pipeline-related pits
- Caustic or acid cleaners
- Boiler cleaning wastes
- Boiler refractory bricks
- Boiler scrubber fluids, sludges, and ash
- Incinerator ash
- Laboratory wastes
- Sanitary wastes
- Pesticide wastes
- Radioactive tracer wastes
- Drums, insulation, and miscellaneous solids

(EPA also included refinery wastes in this list. However, refinery wastes are not under the jurisdiction of the Railroad Commission.)

*NOTE: A more descriptive listing of nonexempt wastes, as well as lists of wastes subject to laws other than RCRA, is provided in Appendix C.

**NOTE: Residual material from reclamation of crude oil from exempt waste is also exempt (see third bullet item on page 3-4).

Implementing a waste minimization program can simplify compliance with the requirements of Rule 98 and RCRA and may reduce costs and future liability for the disposal of hazardous and nonhazardous wastes.

HAZARDOUS OIL AND GAS WASTE

RCRA required EPA to establish procedures for identifying wastes as either hazardous or nonhazardous, and promulgate requirements for the management of both. In order for a waste to be a hazardous waste, it must also be a solid waste as defined under federal law (40 CFR 261.2). A solid waste may be solid, semi-solid, liquid, or a contained gas. A nonexempt solid waste is classified as a hazardous waste if EPA has specifically listed it as such or if it tests positive for one of four hazardous waste characteristics. Rule 98 adopts the federal hazardous waste identification rules.

Nonexempt Listed Hazardous Oil and Gas Wastes

EPA has listed numerous solid wastes as hazardous wastes because they:

- typically exhibit one or more of the characteristics of hazardous waste (described below);
- have been shown to meet certain human toxicity criteria; or
- contain any one of the chemical compounds or substances listed by EPA as hazardous constituents.

EPA's regulations contain four lists of hazardous wastes (refer to Table 3, Listed RCRA Hazardous Oil and Gas Wastes). These lists contain over 400 hazardous wastes. Some are considered acutely hazardous wastes, which are wastes that EPA has determined to be so dangerous that small amounts of them are regulated the same way as larger amounts of other hazardous wastes.

If a nonexempt oil and gas waste is identified on any of these four lists, the waste must be managed as a listed hazardous waste. For example, waste solvent from use of the solvent as a degreaser on surface equipment is nonexempt; and if it is found to be a "listed" hazardous waste, it must be managed as such. Remember, however, that

the same solvent used to remove paraffin in a well is an exempt oil and gas waste when it is recovered. If an oil and gas waste is exempt, it is an exempt waste even if it appears on one of the four lists. Though the waste is not subject to regulation as a hazardous waste, other regulations apply and good waste management practices (including waste minimization) should be employed.

TABLE 3: LISTED RCRA HAZARDOUS OIL AND GAS WASTES

EPA LIST	TYPE OF WASTE	EXAMPLES OF OIL AND GAS WASTES THAT MIGHT BE FOUND ON EPA LISTS *
F List	Hazardous wastes from non-specific sources	Spent solvents (trichloroethylene, methylene chloride, tetrachloroethylene, xylene, acetone, benzene, ethyl benzene, methyl ethyl ketone, nbutyl alcohol, methanol, toluene, and solvent mixtures/blends that contain more than 10% of these solvents)
K List	Hazardous wastes from specific sources	None identified
P List	Acute hazardous wastes (Commercial chemical products that become acute hazardous waste when disposed of)	Acrolein, beryllium, carbon disulfide, parathion, vanadium pentoxide
U List	Toxic hazardous wastes (Commercial chemical products that become toxic hazardous wastes when disposed of)	Acetone, benzene, carbon tetrachloride, chloroform, chrysene, formaldehyde, formic acid, hydrogen fluoride, hydrogen sulfide, lindane, mercury, methanol, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene, xylene

* Note: The examples given are not a complete list. Additional oil and gas wastes may be found on one of the four lists, depending upon the operations.

Nonexempt Characteristically Hazardous Oil and Gas Wastes

If a nonexempt oil and gas waste is not listed, it must be determined if the waste exhibits a hazardous waste characteristic. Typically, characteristically hazardous oil and gas wastes are a more common concern to operators of E&P facilities. A nonexempt oil and gas waste is classified as hazardous if it exhibits any one of following four hazardous waste characteristics:

- ignitability,
- corrosivity,
- reactivity, and
- toxicity.

Table 4 provides a description of the four hazardous waste characteristics.

The generator can either test the waste material using an accepted EPA analytical method or can apply process knowledge in determining whether the waste in question is characteristically hazardous. A generator who relies on process knowledge in determining if a waste is characteristically hazardous should be prepared to demonstrate that this determination is reasonable in terms of the materials and process used. If there is any reasonable doubt as to whether a nonexempt oil and gas waste exhibits one or more hazardous waste characteristics, the generator is encouraged to verify the waste classification by testing so that the waste may be properly managed. It is prudent to determine whether or not a waste exhibits hazardous characteristics any time a change is made in process or materials. The generator is subject to civil and criminal penalties if a hazardous waste is misidentified and, thus not managed according to hazardous waste regulations.

A characteristically hazardous waste may be decharacterized; however, it will probably remain subject to land disposal restrictions of 40 CFR Part 268. As a general rule, the dilution of a hazardous waste for the purpose of eliminating the characteristic is prohibited. Dilution is not considered by EPA to be an acceptable treatment method for characteristically hazardous waste.

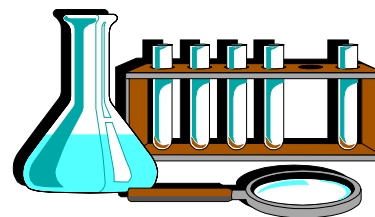


TABLE 4: RCRA AND RULE 98 HAZARDOUS WASTE CHARACTERISTICS**► IGNITABILITY**

- Liquids with a flash point less than 140°F
- Ignitable compressed gas
- Materials other than liquids that at standard conditions are capable of causing fire by spontaneous chemical changes, by absorption of moisture, or through friction.

Examples: certain cleaning solvents (may also be listed hazardous wastes), certain degreasers, certain transportation-pipeline pigging wastes, certain paint wastes

► CORROSIVITY

- Aqueous materials with a pH of less than or equal to 2.0 or greater than or equal to 12.5.
- Liquid materials that corrode steel (SAE 1020) at a rate greater than 0.250 inch per year at a test temperature of 130°F.

Examples: certain acid or caustic cleaning wastes, unused well acidizing fluids (that have not been down the borehole), certain rust removers, waste battery acid

► REACTIVITY

- Any waste that reacts violently with water, forms explosive mixtures with water, or generates any toxic fumes with water
- Any waste that is explosive at standard conditions or if heated
- Any waste that contains cyanide or sulfide at a concentration that will emit toxic cyanide or sulfide gases when exposed to a pH of 2.0 to 12.5.

Examples: certain waste oxidizers

► TOXICITY

Potential to contaminate ground water by leaching as determined in a laboratory using the Toxicity Characteristic Leaching Procedure (TCLP) Test.

Table 4 continues on the next page.

TABLE 4: RCRA HAZARDOUS WASTE CHARACTERISTICS (CONTINUED)

TCLP leachable components* that cause a waste to test hazardous are:

Organics:	Benzene	0.5 mg/l
	Carbon tetrachloride	0.5 mg/l
	Chlordane	0.03 mg/l
	Chlorobenzene	100.0 mg/l
	Chloroform	6.0 mg/l
	o-Cresol	200.0 mg/l
	m-Cresol	200.0 mg/l
	p-Cresol	200.0 mg/l
	Cresol	200.0 mg/l
	2,4-D	10.0 mg/l
	1,4-Dichlorobenzene	7.5 mg/l
	1,2-Dichloroethane	0.5 mg/l
	1,1-Dichloroethylene	0.7 mg/l
	2,4-Dinitrotoluene	0.13 mg/l
	Endrin	0.02 mg/l
	Heptachlor (and its epoxide)	0.008 mg/l
	Hexachlorobenzene	0.13 mg/l
	Hexachlorobutadiene	0.5 mg/l
	Hexachloroethane	3.0 mg/l
	Lindane	0.4 mg/l
	Methoxychlor	10.0 mg/l
	Methyl ethyl ketone	200.0 mg/l
	Nitrobenzene	2.0 mg/l
	Pentachlorophenol	100.0 mg/l
	Pyridine	5.0 mg/l
	Tetrachloroethylene	0.7 mg/l
	Toxaphene	0.5 mg/l
Trichloroethylene	0.5 mg/l	
2,4,5-Trichlorophenol	400.0 mg/l	
2,4,6-Trichlorophenol	2.0 mg/l	
2,4,5-TP (Silvex)	1.0 mg/l	
Vinyl chloride	0.2 mg/l	
Metals:	Arsenic	5.0 mg/l
	Barium	100.0 mg/l
	Cadmium	1.0 mg/l
	Chromium	5.0 mg/l
	Lead	5.0 mg/l
	Mercury	0.2 mg/l
	Selenium	1.0 mg/l
	Silver	5.0 mg/l

Examples of types of wastes that may test hazardous include:

- unused pipe dope (lead)
- unused biocides (chromium)
- cleaning wastes or solvents (benzene)
- transportation pipeline pigging wastes (benzene)

* Note: When at concentrations equal to or greater than the respective value given in the table.

MIXING EXEMPT AND NONEXEMPT WASTES

Mixing exempt and nonexempt wastes creates a special set of problems. Whenever possible, mixing nonexempt wastes with exempt wastes should be avoided because the resulting mixture may become a hazardous waste and require management under RCRA Subtitle C regulations. Furthermore, mixing a characteristically hazardous waste with a nonhazardous or exempt waste *for the purpose of rendering the hazardous waste nonhazardous or less hazardous* is considered by EPA to be a treatment process; which is subject to the appropriate RCRA Subtitle C hazardous waste regulations, including permitting requirements.

Below are some basic guidelines for determining the status of a mixture of exempt and nonexempt wastes.

- ◆ Mixing a nonhazardous (exempt or nonexempt) waste with an exempt waste results in a mixture that is nonhazardous.

Example: If nonhazardous wash water from rinsing road dust off equipment or vehicles is mixed with the contents of a reserve pit containing exempt drilling waste, the wastes in the pit are not subject to hazardous waste regulations regardless of the characteristics of the waste mixture in the pit.

- ◆ If, after mixing a nonexempt characteristically hazardous waste with an exempt waste, the resulting mixture exhibits any of the same hazardous characteristics as the hazardous waste (ignitability, corrosivity, reactivity, or toxicity due to a particular constituent), then the mixture is a nonexempt hazardous waste.

Example: If nonexempt caustic soda (corrosive) is mixed with exempt waste and the resultant mixture exhibits the hazardous characteristics of corrosivity as determined from pH or steel corrosion tests, then the entire mixture becomes a nonexempt hazardous waste.

Example: If a nonexempt solvent that is characteristically hazardous because of benzene toxicity is mixed with an exempt waste, and the resultant mixture exhibits the hazardous characteristic of benzene toxicity, then the entire mixture becomes a nonexempt hazardous waste.

- ◆ If, after mixing a nonexempt characteristically hazardous waste with an exempt waste, the resulting mixture does not exhibit any of the same hazardous

characteristics as the hazardous waste, the mixture is not subject to regulation as a hazardous waste. Even if it exhibits some other characteristic of a hazardous waste, it is still not subject to regulation as a hazardous waste. However, remember that the elimination of the hazardous characteristic(s) exhibited by the nonexempt waste as a result of mixing may be considered treatment. Treatment of a hazardous waste is strictly regulated under RCRA Subtitle C and may require a permit.

Example: If, after mixing nonexempt hydrochloric acid (corrosive characteristic only) with an exempt waste, the resultant mixture does *not* exhibit the hazardous characteristic of corrosivity, then the mixture is not subject to hazardous waste regulations (even if it exhibits some *other* hazardous characteristic, such as toxicity). Note, however, that such a mixture may be made only under specific hazardous waste regulation provisions.

Example: If, after mixing a nonexempt waste exhibiting the hazardous characteristic of lead toxicity with an exempt waste exhibiting the hazardous characteristic of benzene toxicity, the resultant mixture exhibits the hazardous characteristic for benzene but not for lead, then the mixture is not subject to hazardous waste regulations. Such a mixture may be made only under specific provisions of the hazardous waste regulations.

- ◆ Generally, if a *listed* hazardous waste is mixed with an exempt waste, regardless of the proportions, the mixture is a nonexempt hazardous waste.

Example: Adding collected nonhazardous stormwater to a partially filled drum of vanadium peroxide solution would result in a mixture that is the listed hazardous waste, vanadium peroxide.

As illustrated above, an operator's waste management practices should preclude mixing exempt and nonexempt nonhazardous oil and gas waste with any hazardous oil and gas waste. Such practice will help an operator avoid stricter regulatory control and higher waste management costs.

EPA's regulations also state that a solid waste (such as sludge or ash) *derived from* a listed hazardous waste is a hazardous waste. In addition, EPA's regulations require that a waste (such as soil or absorbent material) that *contains* a listed hazardous waste be managed as if it *were* a hazardous waste. Therefore, if an operator spills a listed hazardous waste, such as unused methanol, the contaminated soil "contains" a listed hazardous waste and must itself be managed as a hazardous waste.

MANAGEMENT OF NONHAZARDOUS OIL AND GAS WASTES

The Railroad Commission regulates both exempt and nonexempt oil and gas wastes. In Texas, oil and gas wastes must be managed in accordance with the Railroad Commission's rules and guidelines. Statewide Rule 8 governs the transportation, storage, and disposal (other than by underground injection) of exempt and nonexempt nonhazardous oil and gas wastes. Cleanup requirements for crude oil spills into soil in nonsensitive areas are contained in Statewide Rule 91. Statewide Rules 9 and 46 establish permitting requirements for underground injection. Reclamation of E&P tank bottoms and other exempt hydrocarbon wastes is regulated under Statewide Rule 57. The Water Protection Manual and Underground Injection Control Manual, both available from the Commission, contain the Commission's waste management rules and guidelines.

Some oil and gas wastes may be managed at facilities permitted by the Texas Natural Resource Conservation Commission (TNRCC). Appendix D provides, for your reference, a description of TNRCC waste classifications and the TNRCC and Railroad Commission's joint guidelines for disposal of oil and gas wastes in municipal landfills permitted by the TNRCC.

MANAGEMENT OF HAZARDOUS OIL AND GAS WASTES

As you now know, hazardous oil and gas wastes are those oil and gas wastes that are not RCRA-exempt and that are listed hazardous wastes or characteristically hazardous under RCRA Subtitle C and Rule 98. Because the Railroad Commission has not yet been delegated RCRA authority by the Environmental Protection Agency (EPA), these wastes are regulated both by the Railroad Commission under Rule 98 and by EPA under federal law. The Commission intends to obtain authorization from EPA to administer the federal hazardous waste program for hazardous oil and gas waste. (Note that until EPA's delegation of RCRA Subtitle C authority to the Railroad Commission, hazardous waste generated at natural gas processing plants, pressure maintenance plants, and repressurization plants are excluded from the definition of "oil and gas waste" and are solid waste subject to TNRCC jurisdiction.)

RCRA Subtitle C mandated that EPA develop and adopt regulations for management of hazardous wastes. The regulations adopted by EPA under RCRA Subtitle C are very complex and lengthy. These regulations are contained in 40 Code of Federal

Regulations (CFR) Parts 260 through 270. These regulations apply to the generation, transportation, treatment, storage and disposal of hazardous waste.

The Railroad Commission's Statewide Rule 98 establishes regulations for generators and transporters of hazardous oil and gas wastes. The Commission's hazardous waste rule tracks certain parts of EPA's hazardous waste regulations. The definition of hazardous waste and the standards applicable to generators and transporters of hazardous waste are prime examples. However, because the management of hazardous oil and gas wastes presents some special challenges, the Commission has tailored its hazardous waste rules accordingly.

An operator's status as a hazardous waste generator and the applicable hazardous waste management requirements will depend on the quantity of hazardous oil and gas waste generated. In general, the less nonexempt hazardous oil and gas waste generated, the less imposing the requirements and operational limitations of the hazardous waste regulations.

4

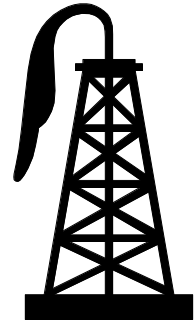
POTENTIAL WASTE GENERATION IN OIL AND GAS OPERATIONS

This chapter provides a general overview of the waste streams associated with various oil and gas operations. The overview is presented in an outline format for easy reference. Separate sections are presented for drilling operations, oil and gas production operations, gas plant operations, and pipeline operations. Examples of wastes potentially generated by each type of operation are included in the overview. The overview may help during a thorough audit of the wastes generated in each operation. Developing a list of the wastes generated in an operation, with a description of the regulatory status of each waste, is an important first step in preparing an effective waste management and minimization plan (Step 7 and Step 8 of the Waste Management Plan, Chapter 2).

DRILLING OPERATIONS 1,9,10

I. Drill site construction and rigging up are conducted in preparation for drilling activities.

- **Wastes: Debris, lubricating oil contaminated soil from heavy equipment (e.g., bulldozers), contaminated rainwater.**



II. Drilling activities include the operation of the rig, a drilling mud system, and drill string to make hole.

- A. The drilling rig is used to handle the drill pipe and bit and to set casing to complete the well. Rig operation and maintenance uses numerous systems and various types of machinery.

- **Wastes: Pipe dope, hydraulic fluids, used oils and oil filters, rigwash, spilled fuel, drill cuttings, drums and containers, spent and unused solvents, paint and paint wastes, sandblast media, scrap metal, solid waste, and garbage.**

B. Drilling fluid (“mud”) is used to maintain hydrostatic pressure for well control, carry drill cuttings to the surface, and cool and lubricate the drill bit. Drilling fluids may be fresh water-based, salt water-based, oil-based, or synthetic-based depending upon the conditions encountered.

1. Water used to make up the drilling fluid (make-up water) may require treatment to remove dissolved calcium and/or magnesium. Soda ash may be added to form a precipitate of calcium carbonate. Caustic soda (NaOH) is added to form magnesium hydroxide.

- **Wastes: Soda ash, calcium carbonate, caustic soda (NaOH), magnesium hydroxide.**

2. Drilling fluid treating chemicals and additives include:

- acids and caustics;
- bactericides;
- defoamers;
- emulsifiers;
- filtrate reducers;
- shale control inhibitors;
- thinners and dispersants;
- weighting materials; and
- lost circulation materials.

Solid additives are usually introduced into the mud system in a mixing (jet or “shotgun”) hopper.

- **Wastes: Drilling fluid additives (used and unused), spilled chemicals, empty containers.**

Other chemical additives for control of mud viscosity and gel strength are mixed in tanks connected to the mud stream.

- **Wastes: Surplus chemicals, spilled chemicals.**

3. Reserve pits receive drill cuttings and solids, used drilling fluids, rigwash, and surface runoff from the drilling location.

- **Wastes: Drill cuttings and solids, used drilling fluids, rigwash.**

(Note: Nonexempt hazardous oil and gas waste should not be allowed to enter the reserve pit.)

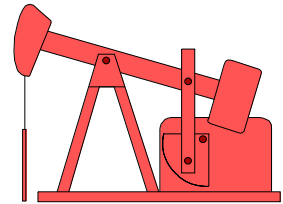
- C. Several devices are used to remove solids from the drilling fluid as it circulates. These include shale shakers, centrifuges, and cone-type desanders/desilters.

- **Wastes: Drill cuttings, sand, mud-weighting materials.**

OIL AND GAS PRODUCTION OPERATIONS ¹

- I. Wells produce oil and/or gas by natural flow or artificial lift.

- A. Flowing wells consist of the wellhead assembly and associated equipment used for well treatment.



- **Wastes: Paraffin, slop oil, oil and produced water-contaminated soils, produced water, scale, treating chemicals, sand, and paint.**

- B. Artificial lift is accomplished by use of beam pumps, gas lift, or submersible pumps.

- **Wastes: Used lubrication oil and filters, gas lift engine fuel, released crude oil (from stuffing box), paraffin, slop oil, produced water contaminated soils, produced water, scale, treating chemicals, sand, and paint.**

- C. Flare pits collect unburned materials from the flare.

- **Wastes: Overflow hydrocarbon condensate, produced water (condensed from flare).**

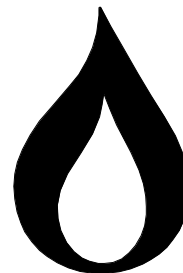
- II. Flowlines (gathering systems) are used to move produced oil to treatment and storage facilities (e.g., tank batteries).
- **Wastes: Paraffin, produced water, treating chemicals, contaminated soil, scale, and other materials collected in pig traps. Scale may be contaminated by naturally occurring radioactive material (NORM).**
- III. Separation and processing are often conducted at points along the gathering system.
- A. Two-phase separation of produced liquids from gases, three-phase separation of produced water from liquid hydrocarbons, and/or gas floatation treatment may be installed.
- **Wastes: Separator bottoms, blowdown, produced sand and scale, skim oil.**
- B. Free water knockouts are used to separate oil and water at appropriate locations in the gathering system.
- **Wastes: Produced water, produced sand and scale, bottom sludges.**
- C. Heater treaters and electrostatic treaters separate emulsified oil and water.
- **Wastes: Produced water, produced sand and scale, bottom sludges, oil absorption media.**
- D. Filtering improves the quality of liquids and produced water.
- **Wastes: Used filters, filter media, backwash.**
- E. Centrifugal desanders remove excessive volumes of produced sand and other solids.
- **Wastes: Produced sand, scale.**

- IV. Tank batteries consist of separation and treatment equipment and storage tanks.
- A. Stock tanks are used to store treated crude oil and produced water. The tanks require periodic cleaning to remove tank bottoms or basic sediment and water (BS&W).
- **Wastes: Produced sand, scale, BS&W.**
- B. Crude oil custody transfer is typically accomplished by moving the oil onto tank trucks via a loading line or into a pipeline.
- **Wastes: Spilled crude oil, crude oil-contaminated soil.**
- V. Handling of produced water is often required in preparation for recycling or proper disposal.
- A. Produced water may be stored in pits for remaining solids and oil separation.
- **Wastes: Solids and additional oil.**
- B. Underground injection, using electric or gas engine powered pumps to pressurize water, is a common method for management of produced water.
- **Wastes: Used lubricating oil and filters, produced water filters and filter media, filter backwash, produced water-contaminated soil, and unused or spent chemicals.**
- VI. Completions and workovers are conducted to facilitate the production of a well.
- A. Workover rigs are used for well completions and well workovers (i.e., treatment and/or stimulation). Workover rigs are generally mobile units.
- **Wastes: Hydraulic fluids, rigwash, spent solvents, used lubricating oil and filters.**
- B. Well workovers may involve recompleting in a different pay zone by deepening the well or plugging back. Operations may generate wastes with the volume and characteristics of drilling operation waste.

- **Wastes: Refer to drilling operations.**
- C. Well treatment and stimulation use various chemicals and products to improve the producing characteristics of a well.
- **Wastes: Drums and containers, weighting agents, surfactants, muds, produced water, acids, frac fluids, inhibitors (scale/corrosion), gel, solvents, and other materials.**
- D. Workover pits are sometimes constructed to receive oil and gas wastes generated during workover operations.
- **Wastes: Drilling solids, drilled cement, liners or contaminated soil and metal (e.g., bridge plugs).**
- VII. Enhanced oil recovery operations (EOR) typically involve the injection of water into a producing formation, as well as injection of certain chemicals.
- **Wastes: Unused or spent chemicals, polymers, etc.**
- VIII. Thermally enhanced oil recovery (TEOR) operations use injected steam for enhanced recovery of crude oil. Steam generators are fueled by crude oil, fuel oil, or natural gas. Feed water is conditioned (softened) to prevent scaling.
- **Wastes: Fuel oil filters, refractory waste, combustion scale, flue duct ash, sulfur dioxide and particulate matter air emissions, sulfur dioxide liquor, spent water-softening resin, water-softener regeneration brine, soft water blowdown, surplus deionized water.**

GAS PRODUCTION AND GAS PLANT OPERATIONS ^{1, 11, 12}

- I. Well treatment is conducted to optimize production and waste such as produced water and sand must be separated from the production stream.
- A. Corrosion inhibitors are chemicals used to counter the reaction between the acid in the gas and the iron of the



tubing or other equipment. Usually it is accomplished at the wellhead, either by batch treatments or continuous injection.

- **Wastes: Surplus chemicals, spilled chemicals.**

B. Hydrate inhibition at the wellhead is accomplished by injection of glycol, ammonia, methanol, or brine.

- **Wastes: Surplus inhibitor chemicals, spilled inhibitor chemicals.**

Also, hydrate inhibition may be accomplished by the use of indirect heaters that use bath solutions containing calcium chloride or glycol.

- **Wastes: Surplus bath chemicals or solution.**

C. Impurities such as sand and excessive amounts of water are sometimes separated at the wellhead.

- **Wastes: Produced sand, produced water.**

II. Gathering systems are used to transport produced gas to a central treatment facility (i.e., gas plant).

A. Scraping or slug catching equipment (separators) on the pipeline removes slugs of liquid (hydrocarbons and/or water). Facilities for handling liquid hydrocarbons may be installed at these locations.

- **Wastes: Produced water and wastes associated with processing of hydrocarbon liquids.**

B. Hydrate inhibition is conducted at appropriate locations in the gathering system.

1. Glycol, ammonia, methanol, or brine are injected to lower the freezing point of water in the flow line.

- **Wastes: Surplus inhibitor chemicals, spilled inhibitor chemicals.**

2. Indirect heaters sometimes use bath solutions containing calcium chloride or glycol.

- **Wastes: Surplus chemicals or solution.**

C. The produced gas is compressed to facilitate its transport to the gas plant.

- **Wastes: Engine cooling water, used lubricating oil, used lubricating oil filters, oil-contaminated soil, spent solvents, oily rags and sorbents.**

III. Gas plant processing removes impurities from the produced gas and, in some cases, includes the fractionation of the treated gas.

A. Oil absorption plants remove hydrocarbon products from natural gas. Oil absorption plants include:

- Stage separators (Economizers)
- Gas chillers
- Rich oil flash tank
- Presaturators
- Accumulators
- Rich oil demethanizers (RODs)

- **Wastes: Surplus or spilled chemicals for hydrate and corrosion inhibition, vessel blowdown.**

B. Dehydration is the removal of water from the produced natural gas and is accomplished by various methods.

1. Ethylene glycol (glycol injection) systems use: a) filters to remove solids from solution prior to reboiler (that removes water) and b) charcoal filters on glycol pump discharge, if the glycol separator is not efficiently removing hydrocarbons.

- **Wastes: Glycol, filters, solids, activated charcoal filter media, filter backwash.**

2. Triethylene glycol (TEG) and diethylene glycol (DEG) systems use an absorber tower (contactor tower).

Also, stripping gas is used for additional water removal to get very high TEG concentration into the contactor tower. Excess stripping gas will increase TEG losses.

Excessively high reboiler temperature may cause decomposition of glycol.

- **Wastes: TEG, DEG (decomposed glycol).**

3. Dry-bed dehydrators use desiccants for the adsorption of water:

Silica gel	Sorbead
Activated alumina	Molecular sieves

Regeneration of desiccants is accomplished by application of hot gas (vaporizes water).

- **Wastes: Spent filter media, spent molecular sieve.**

C. Recovery of natural gas liquids (NGL) is sometimes conducted at the gas plant.

1. Cryogenics may be used to remove NGL. Natural gas liquids (e.g., propane) are used as refrigerants and fuels. Filters are used for gas preparation (gas that is free of impurities is required for process). Electrostatic precipitators are sometimes used. Filtered substances include FeS₂, crude oil, wax, and lube oil.

- **Wastes: FeS₂, slop oil, wax, lube oil, filter media.**

2. Absorption may be used to remove NGL. An absorption oil removes the heavier compounds from the process stream.

- **Wastes: Spent or degraded absorption oil, vessel blowdown.**

D. Gas and product treating includes the removal of sulfur compounds (primarily H₂S) and CO₂ from gas. "Sweetening" processes include adsorption using various amines or a dry bed adsorbent.

1. Amine adsorption is accomplished by passing the gas through the amine liquid where the impurity is dissolved or captured by chemical reaction. The amine can be regenerated. The most common systems use MEA (monoethanolamine) or DEA (diethanolamine). Lean amine is filtered.

- a. The reclaimer removes solids and heat-stable salts (amine degraded in the presence of air) and other MEA/DEA degradation products.
 - b. Charcoal filters may be used to remove liquid contaminants when foaming is a problem. Defoamers may also be added to control foaming.
 - c. The largest amine losses are usually due to: carry-over from contactor due to foaming; continuous small leaks in piping, pump packing, and other fugitive emission points; and sulfur compounds (e.g., COS, CS₂; compounds that cannot be regenerated, see reclaimer above).
 - d. Charcoal filter beds are used to remove corrosion inhibitors, amines, absorber oils, glycol and other sieve contaminants.
- **Wastes: Released amine, amine filters, filter backwash, reclaimer solids (bottoms), heat-stable salts, other MEA degradation products, iron sponge, charcoal filter media, defoamers, acid gases.**
2. Dry bed adsorption uses one of a variety of absorbent materials (iron sponge is commonly used) to selectively remove sulfur compounds and CO₂.
 - **Wastes: Spent absorbent materials, spent iron sponge, iron sulfide scale.**

IV. Sulfur is removed from the H₂S recovered from the produced gas.

The Claus process is typically used to remove elemental sulfur from the H₂S (acid gas). Tail-gas cleanup systems remove remaining sulfur from the exhaust.

- **Wastes: Emissions resulting from the burning of H₂S gas (e.g. SO₂), released acid gas, catalysts (e.g., activated natural bauxite, aluminum oxide), vessel blowdown, spilled elemental sulfur.**

V. Other Possible Sources of Waste

Volatile organic compound (VOC) emissions - VOCs may be released from the gas processing systems as fugitive emissions and by venting.

Mercury and mercury-contaminated soil - mercury used in instrumentation may be released due to improper storage or maintenance and breakage.

Mercaptans - any of a series of compounds of the general formula RSH, analogous to alcohols and phenols, but containing S in place of O. Mercaptans are added to gas as an odorant.

Slop oil - may include any mixture of oil produced at various locations in the gas processing plant which must be rerun or further processed to be suitable for use.

Plant wastewater - cooling tower blowdown, water-softener blowdown, boiler water blowdown, produced water removed at inlet separator.

PIPELINE OPERATIONS

I. Pipelines transport crude oil and natural gas from the wellhead to storage tanks, gas processing plants, and to market.

A. Routine maintenance on pipelines includes painting, repairing, pigging, and replacing.

- **Wastes: Paraffin, solvents, sand blast media, asbestos, hydrotest water, NORM, hydrocarbon contaminated soil, iron sulfide, scale, pigging waste, scrap pipe, welding wastes, produced sand, produced water, BS&W, and paint waste.**

B. Compressor stations boost the fluid in pipelines to help it travel long distances.

- **Wastes: Lube oil, filter media, hydrocarbon contaminated soil, chemicals, solvents, sand blast media, used filters, filter media,**

scale, NORM, sorbent pads, air emissions, antifreeze, batteries, and stormwater.

C. Corrosion inhibitors are used to minimize the reaction between acid in the fluid and iron in the tubing.

- **Wastes: Surplus chemical, spilled chemicals.**

D. Lead acetate tape is commonly used for detection of acid gases (e.g., H₂S) in pipelines:

- **Wastes: Spent lead acetate tape.**

OPERATIONS IN GENERAL

Several wastes are common to most, if not all, types of oil and gas operations:

- **Contaminated soil:** Any uncontrolled release of chemicals, brine, oil, drilling fluid, or other materials, will result in soil contamination.
- **Used or spent solvents:** Solvents are used in tasks such as cleaning, degreasing, and painting. Unused solvent intended for disposal is considered a waste.
- **Used oil and used oil filters:** Engines and other machinery in all areas of operations require lubricating oil and oil filters.
- **Drums and containers:** Drums and containers are required for delivery and storage of chemicals and materials used in all areas of operations.
- **Sandblast media:** Sandblasting is typically used to prepare equipment for painting and to remove scale from equipment.
- **Paint and paint wastes:** Painting is generally required for maintenance of equipment. Paint thinners, solvents, and unused paint are generated wastes.
- **Pesticides and herbicides:** These chemicals are used to control insects and vegetation at various locations (e.g., drilling locations).

- **Vacuum truck rinsate:** Vacuum trucks recover waste liquids generated by various operations.
- **Radioactive tracers:** Tracers are used to observe downhole fluid or gas movements.
- **Scrap metal:** Scrap metal consists of damaged tubulars or other equipment, crushed drums, remnants of welding operations, cut drill line, etc. Scrap metal may contain naturally occurring radioactive materials (NORM).

API GENERIC LIST OF HAZARDOUS CHEMICAL CATEGORIES FOR THE E&P INDUSTRY

Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) requires industries to report the use of certain “hazardous” chemicals. The American Petroleum Institute (API) and the Independent Petroleum Association of America (IPAA) have published a guidance document⁸ to assist E&P operators with the preparation of reports required by SARA Title III (311 and 312). This guidance document includes a generic listing of chemicals used in the oil and gas industry. This list is provided as Appendix E and may be used as an additional guide for identifying wastes that can be minimized.

Note: The list refers to the chemicals as “hazardous.” For the purposes of SARA Title II, “hazardous” indicates any chemical required to have a material safety data sheet (MSDS). All chemicals listed in Appendix E are not necessarily hazardous waste as defined by regulations adopted under RCRA.

NOTES

CHAPTER 5

WASTE MINIMIZATION AND MANAGEMENT IN OIL AND GAS OPERATIONS

As discussed in Chapter 1, the goal of the Waste Minimization Plan is the elimination, reduction in volume and/or toxicity, or the recycling of generated wastes wherever possible. Numerous products, processes, and types of equipment have been shown to be effective in waste minimization.

This chapter presents waste minimization and management in oil and gas operations following the Waste Management Hierarchy presented in Chapter 1. The chapter begins with a general overview of source reduction and recycling and then provides a discussion of numerous opportunities for waste minimization in the various areas of oil and gas operations. The information provided in the chapter should help you in your waste minimization efforts.

SOURCE REDUCTION: AN OUNCE OF PREVENTION...

As noted in Chapter 1, source reduction (sometimes called pollution prevention) involves the use of processes, practices, or products to reduce or eliminate the generation of pollutants and wastes. In other words, source reduction is anything that acts to reduce the volume and or toxicity of waste that is generated. It includes, but is not limited to, changes in products (substitution and composition) and source control (process changes, equipment modification, increased automation, and material handling changes). Source reduction minimizes pollutants released to the environment and potential hazards to human health.

Opportunities for waste volume reduction in certain oil and gas operations may be limited. For example, volumes for some wastes such as produced waters, are primarily a function of activity level and age or state of depletion of a producing property. Nevertheless, every effort should be made to take advantage of those opportunities that do exist for source reduction.

Some source reduction opportunities are very simple. Others are extremely complex and may require a large capital outlay. Simple source reduction activities include product substitution, inventory control, reduction of water use, good housekeeping, equipment maintenance or replacement, in-process recycling, and careful selection of third party contractors. The section, "Waste Minimization Opportunities in Oil and Gas Operations" (below) provides a discussion of these various source reduction opportunities for each area of oil and gas operations. Also, a table of source reduction options for specific waste streams is provided as Appendix F.

RECYCLING: ONCE IS NEVER ENOUGH



There are many opportunities for recycling oil and gas waste. Industry has practiced recycling of some oil and gas wastes for years, such as the use of produced water in enhanced recovery projects and reclamation of oil-based drilling fluid. However, as recycling becomes more popular, recycling opportunities for other oil field wastes, such as solvents, metals, filters, and coolants, are also increasing. The table provided in Appendix F includes recycling options for specific waste streams. Also, Appendix G provides the 59 Federal Register 10550 (March 4, 1994), which addresses regulatory requirements for recycling of used lubricating oils (Note that the TNRCC has equivalent regulatory standards for handlers of used oil). Information on recycling resources is included on page 5-30.

WASTE MINIMIZATION OPPORTUNITIES IN OIL AND GAS OPERATIONS

The following sections provide discussions of source reduction and recycling opportunities for the various oil and gas operations. This section addresses source reduction and recycling in: drilling operations, production operations, natural gas treating and processing operations, and pipeline operations. In addition, waste minimization opportunities applicable to all oil and gas operations are discussed.

The Waste Minimization Program maintains, and continually updates, a list of technical papers and articles which address waste minimization opportunities. See Appendix H for program contact information.

DRILLING OPERATIONS

Source Reduction Opportunities in Drilling Operations

Preplanning



The best place to start waste minimization efforts for a drilling operation is in the planning stages. The drilling plan should be evaluated for potential waste generation and modified to take advantage of the other source reduction and recycling options discussed below. A discussion of anticipated waste generation and management should be an integral part of the pre-spud meeting. This preplanning can make a significant impact on the waste management requirements of the drilling operation.

Drill Site Construction and Rigging-Up: A preplanning opportunity for a drilling operation is in the construction of the location and roads. The drilling location and the associated roads should be planned so that they are constructed such that stormwater runoff is diverted away from the location, and that the location's stormwater runoff, which may be contaminated, is collected. Construction of the location and roads should be planned so that erosion is minimized. These steps will help minimize the volume of contaminated stormwater runoff to be managed. Also, the location size should be only as large as absolutely necessary. Location construction costs, including the cost of the disposition of cleared trees and vegetation, can be reduced. As well, the image of such an operation, as perceived by the general public, is enhanced.

Drilling Fluid Systems: An operator should design the drilling fluid system with waste minimization in mind. Several waste minimization opportunities for drilling fluid systems, such as improved system monitoring, substitute fluids and improved solids control, are discussed under the remaining opportunities. These waste minimization techniques should be integrated into the drilling fluid system portion of the drilling plan.

Pit Design: Another consideration in preplanning for a drilling operation is the design of the reserve pit (also see "closed-loop" drilling fluid systems under procedural changes). A major oil company has designed a V-shaped pit that provides advantages with respect to waste generation and operational costs. The open end of the "V" faces the drilling rig and the cross-sectional view looks like a squared-off funnel (about 10 feet deep with the upper 5 feet having slanted walls to a width of about 20 feet). This V-shape design prevents mud from channeling from the discharge point to the suction point, as it must travel the full length of the pit. Also, because the V-shaped pit is long and narrow (each leg is about 110 feet long), it is easier to construct and line, if necessary. In an actual

comparison to a conventional reserve pit (for drilling similar wells using the same drilling rig), the company determined that pit construction time was reduced by about 40%, water costs for the well were reduced by about 38%, and the liner costs were reduced by about 43%. The total cost savings were about \$10,800. Also, the use of water was minimized (which is applicable under the waste minimization opportunity “Reduction In Water Use”). The V-shaped pit also leaves a smaller “footprint.”

Product Substitution



Product substitution is one of the easiest and most effective source reduction opportunities. Vendors are becoming more attuned to operators’ needs in this area and are focusing their efforts on providing less toxic, yet effective, substitutes. Some operators, such as the one featured in the case history on page 6-11, have found that vendors and suppliers will start offering less toxic substitutes in response to a company establishing inventory control procedures. A few examples of effective and beneficial product substitution for drilling operations are provided below.

Drilling Fluids: Many companies have found that the substitution of low toxicity glycols, synthetic hydrocarbons, polymers, and esters for conventional oil-based drilling fluids is an effective drilling practice. The use of substitute drilling fluids eliminates the generation of oil-contaminated cuttings and other contamination by the oil-based fluid (e.g., reserve pit and accidental releases). Drill site closure concerns are also reduced. Drilling engineers have published numerous technical papers that describe the successful application of substitute drilling fluids. In many instances, this substitution has resulted in significant cost savings. Also, substitute spotting fluids are available for freeing differentially stuck drill pipe.

Drilling Fluid Additives: Many of the additives used in the past for drilling fluids have contained potential contaminants of concern such as chromium in lignosulfonates. Also, barite weighting agents may contain concentrations of heavy metals such as cadmium or mercury. The use of such additives has diminished. However, an operator should take care to select additives that are less toxic and that will result in a less toxic drilling waste. The design of the drilling fluid system is the best place to implement this product substitution opportunity.

Pipe Dope: Pipe connections require the use of pipe dope. American Petroleum Institute (API) specified pipe dope contains about 30% lead by weight and, therefore, can be of concern when disposed of. One simple waste minimization technique is to ensure that all pipe dope is used and containers are completely empty. However, lead-free, biodegradable pipe dopes are now available and, if feasible, should be substituted for

API specified pipe dope. Even if API specified pipe dope is necessary for making the required connections, pipe supply companies should be asked to provide pipe with lead-free pipe dope on the thread protectors. That way you can recycle the thread protectors with fewer regulatory concerns.

See also “Organic Solvents and Paints and Thinners” on page 5-24.

Equipment Modifications



Lubricating Oil Purification Units: The drilling rig’s diesel power plants typically generate large volumes of waste lubricating oil and lubricating oil filters. A lube oil testing program combined with extended operating intervals between changes is effective, as shown by the case history on page 6-2. However, an equipment modification also can effectively reduce the volume of waste lubricating oil and filters. Commercial vendors offer a device called a lube oil purification unit. See “Lubricating Oil Purification Units” on page 5-25 for a description.

Process or Procedural Modifications



“Slim Holes:” The drilling industry has improved the technology of slim hole drilling over the past few years. Slim hole drilling should be considered when planning a drilling project. If feasible and used, slim hole drilling reduces the volume of waste drilling fluid and the volume of drill cuttings. The total cost of a slim hole drilling operation may be considerably less than for conventional hole sizes due to the reduced fluid system and waste management costs. Also, smaller casing is required, which may help reduce the total cost of the operation.

Solids Control for the Drilling Fluid System: An effective way to reduce the volume of drilling fluid waste is the use of solids control. The efficient use of solids control equipment (e.g., hydrocyclones and centrifuges) in combination with chemical flocculants minimizes the need for makeup water to dilute the fluid system. An enhanced solids control system designed to compliment a specific drilling operation is a very effective waste minimization technique that can save money.

Material Balance and Mud System Monitoring: Companies have found that diligent and comprehensive monitoring of drilling fluid properties is effective in reducing the frequency of water and additive additions to the system. Such a system is also referred to as “integrated drilling fluids management.” Monitoring devices at various points in the system allow the operator to immediately identify unwanted changes in the drilling fluid system and make the necessary corrections. This technique, in addition to the

solids control described above can significantly reduce the costs of the drilling fluid system and the volume of drilling waste remaining at the end of the operation.

Closed-Loop Drilling Fluid Systems: Closed-loop drilling fluid systems provide many advantages over conventional earthen reserve pits. Closed-loop drilling fluid systems use a series of steel tanks that contain all drilling fluid and equipment used to remove cuttings. These systems enhance the operator's ability to monitor fluid levels and characteristics. The result is more efficient use of the drilling fluid and less drilling waste remaining at the end of the operation. Also, the operator may more easily recycle the waste drilling fluid (also see "Recycling"). Even though it is not always cost effective, some companies have elected to use only closed-loop drilling fluid systems in their operations. Other companies, such as the one featured in the case history on page 6-2, have found that use of this system is cost-effective under certain circumstances. Regardless, whenever a closed-loop system is used, the operator reduces his potential future liability associated with a conventional earthen pit and the waste management and site closure costs. It's also good for the company image and public relations.

Mud Runoff From Pulled Drill String: Running drill pipe into and out of the hole can contribute to the volume of waste in the reserve pit. Lost drilling mud and the excess rigwash required for cleaning it from the rig floor can be major contributors and can be minimized. Devices are available that wipe clean the inner diameter of the drill pipe as it is pulled so that the mud does not run onto the rig floor (about 0.4 bbls of mud can be lost per 1,000 feet of pipe pulled). Thus, drilling mud losses and the need for rigwash are reduced.

Cementing "On-the-Fly": When conducting cementing operations, a significant volume of unused premixed cement may remain after obtaining returns. Of course, one way to prevent excess cement is careful preplanning. However, service companies now provide systems that mix neat cement and additives on-the-fly. These systems are also referred to as automatic density control systems. The advantage of mixing on-the-fly is that the mixing process can be stopped as soon as the cementing job is complete. Also, the mixing system can be shut down if the cementing job is interrupted for some reason, thus saving the generation of a much larger volume of unusable premixed cement. The only unused cement mixture is that remaining in the mixing system. The unused neat cement and additives are not wastes and can be returned to the service company for use in the next cementing job.

Reduction In Water Use



Rig Wash Hoses: A simple way to minimize the volume of waste rigwash is to use high-pressure/low-volume nozzles on the rigwash hose. A rigwash hose left running can contribute significantly to the volume of waste in a reserve pit and the water needs for the drilling operation. If feasible, collection and treatment of rigwash for reuse is a good waste minimization technique.

Drilling Fluid Systems: Improved design and operation of drilling fluid systems can also reduce the need for water. Waste minimization opportunities, such as solids control and detailed system monitoring, have been proven effective in reducing the amount of makeup water needed in a drilling operation (see “Process or Procedural Modifications” above).

Dewatering Waste Drilling Fluids: An operator can reclaim water from waste drilling fluids by using mechanical or chemical separation techniques. Large bowl centrifuges, hydrocyclones, and/or chemical flocculants may be used to dewater waste drilling fluids. The reclaimed water may then be reused, thus reducing the demand on, and cost of, new water sources. Proper application of dewatering can result in a reduction of the volume of drilling waste to be managed, thus saving waste management costs, easing site closure concerns and costs, and reducing future potential liability concerns.

Good Housekeeping and Preventative Maintenance



Drill Site Construction and Rigging-Up: Drill site construction and rigging-up involve the use of heavy equipment, such as bulldozers. Heavy equipment should be well maintained to reduce the potential for fuel and lubricating oil leaks that may contaminate the site. Preventative maintenance and good housekeeping during the construction phase can help prevent the generation of contaminated soil and water. For example, secondary containment beneath fuel storage drums can prevent accidental releases to soil and water.

See also “Drip Pans and Other Types of Containment,” “Preventive Maintenance,” and “Chemical and Materials Storage” on pages 5-26 and 5-27.

Inventory Control



Inventory control is one of the most effective ways to reduce waste generation, regulatory compliance concerns and operating costs. Especially, when combined with proper chemical and materials storage. The case history on page 6-11 illustrates the

impact an inventory control system can have on an operation. An inventory control system is easy to implement, especially with the use of computer programs now available. An operator who tracks his chemicals and materials can use them more efficiently and reduce the volume of unusable chemical that must be managed as waste. (Note: Commercial chemical products that are returned to a vendor or manufacturer for reclamation or recycling are not solid wastes. Therefore, it is to the operator's advantage to require vendors to take back empty and partially filled containers for reclamation or reuse.)

Selection of Contractors



Operators should choose contractors who recognize the value of waste minimization and make efforts to apply it in their service. The operator may consider inspecting the drilling rigs being considered for contract to appraise the general condition of the rigs. The contractor should be instructed to minimize maintenance operations on the drilling location (e.g., sand blasting and painting). Any oil and gas waste generated at the operator's drill site is the operator's regulatory responsibility. Therefore, an operator who uses contractors who practice waste minimization can expect reduced waste management concerns, reduced regulatory compliance concerns, and reduced operating costs. The drilling contractor may be instrumental in implementing the waste minimization opportunities discussed above.

Recycling Opportunities in Drilling Operations



Drilling Fluids: Drilling fluids comprise the largest waste stream associated with a drilling operation. The cost of closing a drilling site is increased if waste drilling fluid in a reserve pit must be dewatered and/or stabilized prior to closure. A better alternative is to recycle or reuse the waste drilling fluid. If feasible, reuse the waste drilling fluid in another drilling project. One company designed a multi-well drilling project where the same drilling fluid was used for drilling each successive well. The result was significant cost savings and greatly reduced waste management concerns. If reuse within your company is not feasible, there are several companies in Texas who take waste drilling fluids for reconditioning and reuse. Another cost effective alternative for reuse of waste drilling fluid is in plugging or spudding of other wells.

Reserve Pit Water: A drilling operation should consider reclaiming water from the reserve pit by using a dewatering technique. The reclaimed water can then be used as rigwash water, makeup water for the drilling fluid system, and other rig water usage. Additionally, collected stormwater runoff may be suitable for use. This technique can reduce the need for fresh water and save money.

See also “Paint Solvent Reuse” and “Commercial Chemical Products” on page 5-28 and 5-29.

PRODUCTION AND WORKOVER OPERATIONS

Source Reduction Opportunities in Production and Workover Operations

Preplanning



Production Site Design and Construction: One of the first opportunities for waste minimization is in the design and construction of the production site and lease roads. The site and the associated roads should be planned so that they are constructed such that stormwater runoff is diverted away from the site and that any stormwater runoff, which may be contaminated, is collected. Construction of the location and roads should be planned so that erosion is minimized. These steps will help minimize the volume of contaminated stormwater runoff to be managed. Also, the location size should be only as large as absolutely necessary. Location construction costs, including the cost of the disposition of cleared trees and vegetation, can be reduced. As well, the image of such an operation, as perceived by the general public, is enhanced.

Spill Prevention and Control: A site should be constructed such that any releases of crude oil are contained, even if the site is not subject to the federal Spill Prevention Control and Countermeasure (SPCC) requirements (40 CFR Part 112). As well, the spill containment should be designed to capture releases of produced water. Such planning will help an operator recover most spilled crude oil and minimize the extent of soil contamination that must be remediated under applicable environmental regulations.

Site Equipment: An operator can also include in a production facility’s design tanks, separators, and other associated equipment to enhance waste minimization. Features such as drip pans, elevated flowlines, drip or spill containment devices (e.g., beneath load line connections), stock tank vapor recovery systems, and constructed storage areas for containers of chemicals and wastes are good waste minimization ideas. Many of these opportunities are discussed further in the following sections.

Workovers and Well Servicing: A preplanning opportunity for workover and well treatment operations is to carefully design the operation so that only the volume of chemicals necessary for the operation are brought to the site. An operator who takes this step can reduce the amount of leftover chemicals (e.g., acids) that may have to be managed as waste. Also, the potential for contamination from spills is reduced. The

selection of contractors for conducting workovers is an important step and is discussed under “Selection of Contractors” on page 5-27.

Product Substitution



Organic Solvents: Solvents such as xylene and toluene, which may become hazardous wastes, have been commonly used for dissolution and removal of organic deposits (e.g., paraffin) in well bores and producing formations. Service companies have developed non-toxic solvents that will substitute for xylene and toluene. Check with your service company or chemical vendor for these substitute solvents before purchasing aromatic solvents such as xylene and toluene. See also additional discussion of “Organic Solvents” and “Paints and Thinners” on page 5-24.

Pipe Dope: When running tubing, connections require the use of pipe dope. American Petroleum Institute (API) specified pipe dope contains about 30% lead by weight and, therefore, can be of concern when disposed of. One simple waste minimization technique is to ensure that all pipe dope is used and containers are completely empty. However, lead-free, biodegradable pipe dopes are now available and, if feasible, should be substituted for API specified pipe dope. Even if API specified pipe dope is necessary for making the required connections, pipe supply companies should be asked to provide pipe with lead-free pipe dope on the thread protectors. That way you can recycle the thread protectors with fewer regulatory concerns.

Equipment Modifications



Lubricating Oil Purification Units: In certain situations, production and workover operations use engines that typically generate large volumes of waste lubricating oil and lubricating oil filters. An equipment modification that can effectively reduce the volume of waste lubricating oil and filters is discussed under “Lubricating Oil Purification Units” on page 5-25.

Basic Sediment and Water, or Tank Bottoms: Many operators have used simple techniques to minimize the volume of BS&W that accumulates in tanks and sediments that accumulate in other production vessels. Devices such as circulating jets, rotating paddles, and propellers may be installed in crude oil stock tanks to roll the crude oil so that paraffin and asphaltene remain in solution (or at least suspension). Also, emulsifier can be added to the stock tank to accomplish the same result. Another method used is to circulate the tank bottoms through a heater treater to keep the paraffin and asphaltene in solution.

One operator in west Texas used an extra stock tank to collect tank bottoms from the regular crude oil stock tanks. The tank was painted black so that in the hot summer months the temperature would rise high enough to dissolve the paraffin and asphaltene, which would separate from the water. The heavy oil would then be transferred in appropriate amounts to the crude oil stock tank for sale. This simple solution reduced the ultimate volume of BS&W the operator had to manage as waste and added revenue from crude oil sales.

Vapor Recovery from Stock Tanks: The regulation of emissions of toxic air pollutants has become stricter since passage of the Clean Air Act Amendments in 1992. Many crude oil tank batteries may qualify as major sources, thus triggering Title V permitting, control, and monitoring requirements. A good way to avoid this situation is to install a vapor recovery system. Vapor recovery systems that use vacuum pumps are commercially available. One system has been designed and marketed that is simple and low-cost. That system uses only a pump and a venturi. The system pumps produced water from the tank through the venturi, which in turn draws a slight vacuum on the tanks. The vapors are entrained in the produced water which is sent to the separator. There the vapors are separated and returned to the production stream.

See also "High Energy Ion Plating," "Chemical Metering, or Dosing, Systems," and "Conventional Filters" on pages 5-24 and 5-25.

Process or Procedural Modifications



Cementing "On-the-Fly:" When conducting cementing operations, a significant volume of unused premixed cement may remain after completing the job. Of course, one way to prevent excess cement is careful preplanning. However, service companies now provide systems that mix neat cement and additives on-the-fly. These systems are also referred to as automatic density control systems. The advantage of mixing on-the-fly is that the mixing process can be stopped as soon as the cementing job is complete. Also, the mixing system can be shut down if the cementing job is interrupted for some reason, thus saving the generation of a much larger volume of unusable premixed cement. The only unused cement mixture is that remaining in the mixing system. The unused neat cement and additives are not wastes and can be returned to the service company for use in the next cementing job.

Frac Jobs "On-the-Fly:" Oil field service companies now offer equipment that mixes fracturing fluids on-the-fly, just as for the cements described in the preceding example. The on-the-fly system will continuously mix dry gel at a selected concentration or mix a liquid concentrate that is later diluted to the required concentration. Significant

advantages of this type of system are elimination of the need for diesel-based liquid gel concentrates and reduced waste subject to more strict regulation. The process is also more efficient.

Remote Monitoring of Production Operations: Although it does not appear so, the remote monitoring of production operations is a source reduction technique. Microcomputer-based monitoring of parameters such as pumping unit load, stuffing box leaks, polished rod temperature, gun barrel water level, heater treater temperature and pressure, and tank levels and temperatures can be transmitted to the field office by microwave transmission. Because the system immediately alerts the operator of any upset condition or imminent equipment failure, the operator can quickly address the problem. By doing so, the operator can avoid unnecessary waste generation. For example the operator can prevent equipment failures that would require a workover (workovers generate waste), replace stuffing box rubbers prior to failure (oil leaking from a stuffing box may contaminate soil), prevent tank overflows, and detect loss of fluid from tanks (e.g., leaks or theft). Remote monitoring systems are offered commercially and according to vendors may replace, at a comparable cost, the routine manual measurements.

Workovers Using Coiled Tubing Units: Operations using conventional workover rigs typically generate wastes that must be managed after completion of the workover. An alternative to using workover rigs is to use coiled tubing units for through tubing workovers. Over the past several years, service companies have developed suitable through tubing tools for this purpose. A coiled tubing unit workover eliminates the need for pulling tubing, displacing well fluids, and well blowdown, all of which generate wastes. When feasible, coiled tubing units are a good choice for well workovers.

Paraffin Control: Paraffin deposition can cause operational problems and result in unwanted waste generation. Paraffin deposition can cause sticking and parted rods in the well bore, plugging and rupture of surface flowlines, increased tank bottom generation, and reduced crude oil quality at the sales point. Frequently, the results are ongoing hot oil and solvent treatments, cleanups of crude oil and salt water-contaminated soils, and dissatisfied crude oil purchasers. At the bottom line, the operator realizes reduced operating efficiency, reduced revenue, and increased regulatory compliance concerns.

Several techniques exist for reducing paraffin deposition and the related problems. One technique uses a device known as a magnetic fluid conditioner, or MFC. MFC's have been used in the oil field for some time, and not always successfully. However, in recent years, MFC technology has improved, and operators are finding success in their

application (see the case history on page 6-3 for an example). An MFC may be installed in a producing oil well (e.g., on the downhole rod pump) for which it is specifically designed. Parameters such as pump dimensions, crude oil and water characteristics, and production parameters are accounted for in the design of the MFC. The MFC works by altering the properties of the crude oil and water as it passes through the intense magnetic field of the MFC's permanent rare earth magnet. As a result, the crude oil's pour point, yield point, and viscosity are reduced; and the temperature at which paraffin will deposit is lowered. Also, the MFC may also help inhibit scale formation.

Another technique for controlling paraffin deposition is the application of microbes in the well. Bacteria introduced into the producing well bore and formation biodegrade the high carbon chain paraffins, which in turn improves the properties of the crude oil with respect to paraffin deposition. The authors of one technical paper (Society of Petroleum Engineers 22851) suggest that microbial treatment is "potentially limited to wells that produce water, are pumping wells, and have bottom hole temperatures below 210°F." Reports in that technical paper and in other technical papers indicate microbial control of paraffin deposition is effective.

See also the case history, "Drilling Rig Lubricating Oil," on page 6-2 for a lube oil testing program combined with extended operating intervals between changes.

Control and Reduction of NORM Deposition



Naturally occurring radioactive materials (NORM) that are produced with formation waters may cause troublesome waste management and regulatory compliance concerns. When NORM contaminates production equipment and sites, it poses a special waste management problem and falls under Rule 94 regulation. While much of the NORM contamination in the oil field is historical, future NORM contamination may be reduced using any of several techniques which apply the source reduction opportunity categories discussed above.

Deposition of NORM is primarily controlled by pressure and temperature changes and commingling of incompatible formation waters. Radon gas co-produced with natural gas is also a source of NORM. While the presence of NORM in reservoir water and gas cannot be eliminated, the volume of NORM-contaminated waste that is generated can be reduced through control of its deposition. Source reduction methods for NORM include: well completions or formation treatments designed to reduce water-cut and sand production; scale inhibitor squeezes that help control deposition of NORM-contaminated scale in the well and in surface equipment; chemical coating or high-energy ion plating of material surfaces at critical points in the production system to

reduce the availability of nucleation points for scale formation; piping and equipment design that minimizes turbulent flow and pressure drops, thereby reducing the precipitation of scale; and segregation of incompatible formation waters that result in NORM-contaminated scale deposition (e.g., mixing of waters containing barium and sulfates will cause precipitation of barium sulfate scale).

Reduction In Water Use



Water Floods for Enhanced Recovery: In some instances, operators of water floods for enhanced recovery use fresh water from surface sources or from water wells. If feasible, an operator should find sources of produced water to replace fresh water injection. Adjacent operators may produce water that is compatible with the injection zone and is also economically and technically feasible to transfer between leases.

Good Housekeeping and Preventative Maintenance



Containment of Fluids Used in Workovers: As noted in the discussion “Selection of Contractors,” wastes generated by workover rigs may add to the management concerns of an operator. One of the most common problems is contamination of soil by tubing runoff and other spills on the workover rig floor. Several techniques can control this source of waste. First, a containment device beneath a raised rig floor can capture runoff and direct it to collection tanks or containers (the Waste Minimization Program offers an example). Also, heavy duty tarps (commercially available) laid over the well site will perform the same function.

Another solution to the problem of tubing runoff and spills is construction of an impermeable wellhead sump (i.e., a better cellar) during preparation for the original drilling operations. Later, when the well is completed and producing, the wellhead sump will collect any runoff or spills associated with workover operations. As well, the wellhead sump will collect any crude oil leakage from stuffing boxes, thus preventing contamination of soil around the wellhead. The wellhead sump is covered by a metal grate for safety. At least one firm offers a one-piece fiberglass model for about \$800.

See also “Drip Pans and Other Types of Containment,” “Chemical and Materials Storage,” and “Preventive Maintenance” on pages 5-26 and 5-27.

Inventory Control



Inventory control is one of the most effective ways to reduce waste generation, regulatory compliance concerns and operating costs. Especially, when combined with

proper chemical and materials storage. The case history on page 6-11 illustrates the beneficial impact an inventory control system can have on an operation. An inventory control system is easy to implement, especially with the use of computer programs now available. An operator who tracks his chemicals and materials can use them more efficiently and reduce the volume of unusable chemical that must be managed as waste. (Note: Commercial chemical products that are returned to a vendor or manufacturer for reclamation or recycling are not solid wastes. Therefore, it is to the operator's advantage to require vendors to take back empty and partially filled containers for reclamation or reuse.)

Selection of Contractors



Operators should choose contractors who recognize the value of waste minimization and make efforts to apply it in their service. Contracted workover rigs are a good example of the need for waste minimization efforts by contractors. A producer can find himself dealing with unnecessary oil and gas waste if the service company's workover rig crew does not take steps to control sources of waste such as tubing runoff, spilled chemicals, and other associated waste (e.g., thread protectors, rubber seals and cups, and pipe dope containers). An operator should select workover rig contractors who use containment devices beneath the rig floor, exercise control over chemicals and products brought on-site, and collect all associated wastes for proper management. Also, the contractor will bring on-site well maintained equipment that will not leak fuel or lubricating oil and that will not need maintenance which may generate wastes.

Recycling Opportunities in Production and Workover Operations



Produced Water: Most produced water in Texas is injected in Class II wells. The largest proportion of produced water is injected in Class II wells that are permitted for disposal. Look for opportunities to redirect produced water to Class II wells that are permitted for enhanced recovery. Produced water that is injected for enhanced recovery is considered to be recycled. (Also, see "Reduction in Water Use.")

Tank Bottoms: Tank bottoms, or BS&W, are best managed by sending them to a crude oil reclamation plant. An operator should contact nearby RRC-permitted crude oil reclamation plants to determine if an economically feasible arrangement is possible before considering disposal options. The Waste Minimization Program can help operators locate reclamation plants in their area. Some of these plants also specialize in reclamation of waste paraffin.

Lubricating Oil and Filters: Currently, waste lube oil and waste lube oil filters are generally banned from landfill disposal. Recycling is now the primary method of managing these wastes. Companies that handle lube oil and filters for recycling are located in every area of Texas, so finding one is not difficult. The Waste Minimization Program will provide upon request a listing of these companies.

Also, an operator can recycle his waste lube oil by adding it to a crude oil stock tank. Amendments to 40 CFR (Code of Federal Regulations) Part 279 (regarding standards for management of used oil) provide for this option. (Note that certain states' regulations may be stricter than federal regulations.) There is a regulatory limit of 1% lube oil by volume. An important consideration in choosing this recycling option is the requirements of the crude oil purchaser and the receiving refinery. Make sure they will accept a crude oil and lube oil mixture. (Some refineries are not able to handle such mixtures and may suffer damage to catalysts and other processes.)

Cements: Leftover cement may be used for other purposes, such as construction of on-site erosion control structures or pads. Also, the Oklahoma Corporation Commission publication, "Oilfield Pollution Prevention," reports that one major service company has arranged to provide leftover cements to local governments for use in their construction projects.

See also "Sorbent Pads and Booms," "Spent Organic Solvents and Other Miscellaneous Spent Chemicals," "Paint Solvent Reuse," "Commercial Chemical Products," and "Scrap Metal and Drums" on pages 5-28 and 5-29.

NATURAL GAS TREATING AND PROCESSING OPERATIONS

Source Reduction Opportunities in Gas Treating and Processing Operations

Preplanning



The best place to start waste minimization efforts for natural gas treating and processing operations is in the planning stages. This is true whether you are preparing to build a new facility or preparing to work on smaller projects within an existing facility. An important component of the initial concept of the plan should be a discussion of the anticipated waste generation and waste management. As the project plan is developed it should be continually evaluated for potential waste generation and adjusted to take advantage of source reduction and recycling opportunities. This type of planning can significantly impact waste management requirements for the facility.

Site Construction: A preplanning opportunity for a new facility is the preparation of the site and the construction of associated roads. The site and roads should be planned so that they are constructed such that stormwater runoff is diverted away from the site and erosion is minimized. Stormwater runoff from the site itself, which may be contaminated, should be collected in an appropriate location on the site. These steps will help minimize the volume of contaminated stormwater runoff to be managed. Also, the site size should be only as large as absolutely necessary. Site construction costs, including the cost of the disposition of cleared trees and vegetation, can be reduced. As well, the image of such an operation, as perceived by the general public, is enhanced.

Installation of New Equipment: When planning for the installation of new equipment (e.g., to replace old equipment, expand a facility, or modify a process), consider the potential for waste generation in your selection of the equipment. For example, design glycol dehydrators with vapor recovery to control VOC emissions. If possible the equipment should be installed with a containment structure appropriately located to contain any spills, leaks, or drips. Also, if waste generation cannot be reduced, try to select a process that generates waste amenable to recycling.

Product Substitution



Amine Process Sludges: Amine sludges can contain a high sodium content. To eliminate sodium in amine process waste substitute potassium hydroxide for sodium hydroxide to maintain high pH in the process. Amine sludges have also been shown to have elevated levels of nickel and copper, probably as a result of corrosion while gas is being processed. The addition of potassium hydroxide to maintain pH during the process also helps minimize corrosion and the presence of these metals in the sludge.

See also “Organic Solvents,” “Mechanical Cleaning,” and “Paints and Thinners” on page 5-24.

Equipment Modifications



Flash Tank Separators on Dehydrators: Dehydrators remove water from gas by bringing the gas into contact with a desiccant (e.g. glycol) which absorbs water in the gas. The glycol water mixture is then sent to a regeneration unit where it is heated to drive off the absorbed water. The glycol also contains quantities of volatile organic compounds (VOCs) which are driven off with the water and vented to the air. A flash tank separator (FTS) can be installed on the dehydrator to reduce the amount of VOCs released to the air. The FTS removes gas absorbed in the desiccant by a rapid pressure reduction

which causes the gas to “flash out” of the desiccant. The gas may then be recovered and used to fuel the regenerating unit.

High-Bleed Pneumatic Control Devices: Many devices used throughout gas processing facilities use pneumatic devices such as valves and instruments to control and monitor the flow of gas. These devices need a pneumatic supply to drive their operating mechanisms. The most convenient supply is usually the natural gas in the line the device is monitoring or controlling. The typical pneumatic device uses a large volume of gas as a driving mechanism and then vents the gas to the atmosphere (thus the term “high-bleed”). There are two options to reduce the amount of gas which is vented. First, the supply could be changed to compressed air. This is not always a practical solution since supplying compressed air may not be feasible. The second option is to replace “high-bleed” devices with “low-bleed” devices to minimize the amount of vented gas. Generally, low-bleed devices operate slower than high-bleed devices; therefore, a replacement is not feasible in all cases.

See also “Lubricating Oil Purification Units,” “Conventional Filters,” “High Energy Ion Plating,” and “Chemical Metering, or Dosing, Systems” on pages 5-24 and 5-25.

Process or Procedural Modifications



Lubricating Oil Reduction: The Alaska Health Project (partially funded by the U.S. EPA) conducted a program to study the feasibility of determining oil change intervals for diesel engines by using a portable field monitor. Incidents of normal and abnormal oil degradation were recorded and correlated between field and laboratory tests. The result of the study indicated that oil change intervals can be extended with analysis and monitoring. The study concluded that one facility in the study could save over 2,000 gallons of lubricating oil per year, based on a 5,000 hour/year operational period. The case history on page 6-2 supports this procedural change.

VOC Emissions: Operators can reduce the VOC emissions from a glycol dehydration unit by optimizing the operation of the unit. In many cases, glycol dehydration units are over-sized, and the glycol circulation rate is too high. Many of these units can be optimized by reducing the glycol flow rate, though in some cases a glycol pump may need to be replaced with a smaller pump. A study conducted in Louisiana found that a dehydration unit with a glycol flow rate of 0.90 gal/min was too high for the gas flow through the unit. The glycol flow rate was reduced to 0.23 gal/min and the VOC emissions in the unit decreased proportionally to the reduction in the glycol rate.

Reduction In Water Use



Cooling tower blowdown generates large volumes of wastewater. In many instances, an operator can make modifications to the operation of the cooling water system that will reduce blowdown frequency, thus reducing the need for make-up water. As seen in the case history on page 6-6, one operator reduced the volume of cooling tower blowdown by using a substitute scale inhibitor and installing a chemical metering system.

Good Housekeeping and Preventative Maintenance



See “Drip Pans and Other Types of Containment,” “Preventive Maintenance,” and “Chemical and Materials Storage” under “Good Housekeeping and Preventative Maintenance” on pages 5-26 and 5-27.

Inventory Control



Inventory control is one of the most effective ways to reduce waste generation, regulatory compliance concerns and operating costs. Especially, when combined with proper chemical and materials storage. The case history on page 6-11 illustrates the impact an inventory control system can have on an operation. An inventory control system is easy to implement, especially with the use of computer programs now available. An operator who tracks his chemicals and materials can use them more efficiently and reduce the volume of unusable chemical that must be managed as waste. (Note: Commercial chemical products that are returned to a vendor or manufacturer for reclamation or recycling are not solid wastes. Therefore, it is to the operator’s advantage to require vendors to take back empty and partially filled containers for reclamation or reuse.)

Selection of Contractors



Operators should choose contractors who recognize the value of waste minimization and make efforts to apply it in their service. Any oil and gas waste generated at the operator’s facility is the operator’s regulatory responsibility. Therefore, an operator who uses contractors who practice waste minimization can expect reduced waste management concerns, reduced regulatory compliance concerns, and reduced operating costs.

Recycling Opportunities in Natural Gas Treatment and Processing Operations

Reuse of Spent Natural Gas Liquid Sweetening Solutions: Many gas plant facilities use sour gas fuel in their operations. These facilities use exhaust gas scrubbers to control sulfur dioxide (SO₂) emissions from units burning sour gas. SO₂ scrubbing units can use partially spent caustic solutions from natural gas sweetening processes as a reagent. A major oil company conducted a study in which partially spent caustic natural gas liquid sweetening solution was used in place of soda ash solution as a reagent in a SO₂ scrubber. To achieve acceptable performance using partially spent caustic solutions, they found that necessary changes to the scrubber operation were reagent feed rate, scrubber liquid pH and specific gravity, and blowdown rate. A cost savings was realized due to reduced off-site disposal and purchases of reagent. It was demonstrated that the SO₂ scrubber could be operated without negative effects on performance, compliance, or operating costs.

See also “Recycling Opportunities Applicable to All Oil and Gas Operations” on page 5-28.

PIPELINE TRANSPORTATION OPERATIONS

Source Reduction Opportunities in Crude Oil and Natural Gas Pipeline Operations

Preplanning

Preplanning the siting, construction, operation, and maintenance of pipeline used in crude oil and natural gas pipeline operations is an important time to consider waste minimization techniques. Preplanning the pipeline construction should include consideration of pipeline location and access roads to minimize storm runoff and erosion. If possible, locate the pipeline along an existing line to reduce construction of new access roads.

Product Substitution

See “Organic Solvents,” “Mechanical Cleaning,” and “Paints and Thinners” on page 5-24.

Equipment Modifications



Replacing High-Bleed Pneumatics: Many devices used throughout pipeline operations use pneumatic devices such as valves and instruments to control and monitor the flow of gas. These devices need a pneumatic supply to drive their operating mechanisms. The most convenient supply is usually gas in the line the device is monitoring or controlling. Many of these devices are high-bleed which use a large volume of gas as a driving mechanism and then vent it to the atmosphere. Replacement with a low-bleed device can minimize the amount of gas vented, thus the loss of valuable natural gas. Generally low-bleed devices operate slower than high-bleed devices; therefore, a replacement is not feasible in all cases.

Replacing Natural Gas with Compressed Air for Operating Pneumatic Devices: Many pneumatic devices in pipelines are controlled by gas in the line. During operation of the devices gas is vented to the atmosphere. Compressed air should be used as the driving force for pneumatic devices when feasible.

Replacing Reciprocating Engines with Turbines: Turbines are more efficient in their use of natural gas than are reciprocating (e.g., internal combustion) engines. Replacing a reciprocating engine with a turbine unit can reduce the emission of natural gas to the atmosphere. Also, turbines are more efficient than reciprocating engines in driving pumping units. When feasible, consider replacing reciprocating engines with turbines at sites such as compressor stations or pump stations.

Basic Sediment and Water, or Tank Bottoms: Many operators have used simple techniques to minimize the volume of BS&W that accumulates in tanks. Devices such as circulating jets, rotating paddles, and propellers may be installed in crude oil tanks to roll the crude oil so that paraffin and asphaltene remain in solution (or at least suspension). Also, emulsifier can be added to the stock tank to accomplish the same result. Another method used is to circulate the tank bottoms through a heater treater to keep the paraffin and asphaltene in solution.

See also “Lubricating Oil Purification Units,” “Chemical Metering, or Dosing, Systems,” and “Conventional Filters” on pages 5-25.

Reduction in Water Use



Large amounts of water are used when hydrotesting lines. To reduce water use and water disposal costs operators should, when feasible, reuse hydrotest water to test as

many lines as possible. In some instances, reuse of hydrotest water can result in the reduction of significant waste management costs and water purchase costs.

Also, some pipeline operators have found the use of ultrasonic (“smart”) pigs may reduce the need for hydrotesting. Smart pigs can assess the condition of pipe and, thus, may help in more efficient planning of hydrotesting.

Good Housekeeping and Preventative Maintenance



See “Drip Pans and Other Types of Containment,” “Preventive Maintenance,” and “Chemical and Materials Storage” on pages 5-26 and 5-27.

Inventory Control



See “Inventory Control” on page 5-27.

Selection of Contractors



Operators should choose contractors who recognize the value of waste minimization and make efforts to apply it in their service. The operator may consider inspecting the potential contractor’s equipment to appraise the general condition of the equipment. The contractor should bring on-site well maintained equipment that will not leak fuel or lubricating oil or that will need maintenance which may generate wastes. Any oil and gas waste generated at the operator’s site is the operator’s regulatory responsibility. Therefore, an operator who uses contractors who practice waste minimization can expect reduced waste management concerns, reduced regulatory compliance concerns, and reduced operating costs. The contractor may be instrumental in implementing the waste minimization opportunities discussed above.

Recycling Opportunities in Crude Oil and Natural Gas Pipeline Operations



The next preferred waste management option is recycling. Recycling is becoming a big business and more recycling options are available every day. The following discussion offers some recycling tips.

Tank Bottoms: Nonhazardous, nonexempt pipe line system tank bottoms (BS&W) are best managed by sending them to a crude oil reclamation plant. An operator should contact nearby RRC-permitted crude oil reclamation plants to determine if an economically feasible arrangement is possible before considering disposal options. The

Waste Minimization Program can help operators locate reclamation plants in their area. Many of these plants also specialize in reclamation of waste paraffin.

Lubricating Oil and Filters: Currently, waste lube oil and waste lube oil filters are generally banned from landfill disposal. Recycling is now the primary method of managing these wastes. Companies that handle lube oil and filters for recycling are located in every area of Texas, so finding one is not difficult. The Waste Minimization Program will provide upon request a listing of these companies.

Also, an operator can recycle his waste lube oil by adding it to a crude oil pipeline or storage tank. Amendments to 40 CFR (Code of Federal Regulations) Part 279 (regarding standards for management of lubricating oil) provide for this option. There is a regulatory limit of 1% lube oil by volume. An important consideration in choosing this recycling option is the requirements of the crude oil purchaser and the receiving refinery. Make sure they will accept a crude oil and lube oil mixture. (Some refineries are not able to handle such mixtures, and suffer damage to catalysts and other processes.)

Compressor Lubricating Oil: One inventive operator devised a procedure to optimize the use of lubricating oils in compressor units. According to the operator, used lubricating oil from the drive engine was of adequate quality to serve as lube oil in the compressor. So, the operator established a procedure where the used lube oil from the drive engine would be recovered and directed to the compressor. The result of this reuse option was reduced waste lube oil generation and reduced new lube oil purchases, making this a cost-effective waste minimization technique.

See also "Recycling Opportunities Applicable to All Oil and Gas Operations" on page 5-28

WASTE MINIMIZATION APPLICABLE TO ALL OIL AND GAS OPERATIONS

Source Reduction Opportunities Applicable to All Oil and Gas Operations

Product Substitution



Product substitution is one of the easiest and most effective source reduction opportunities. Vendors are becoming more attuned to operators' needs in this area and are focusing their efforts on providing less toxic, yet effective, substitutes. Some operators, such as the one featured in the case history on page 6-11, have found that

vendors and suppliers will start offering less toxic substitutes in response to a company establishing inventory control procedures. A few examples of effective and beneficial product substitution for all oil and gas operations are provided below.

Organic Solvents: Organic solvents, such as trichloroethylene and carbon tetrachloride, are commonly used for cleaning equipment and tools. These solvents, when spent, become listed hazardous oil and gas wastes and are subject to stringent regulation. Alternative cleaning agents, such as citrus-based cleaning compounds and steam may be substituted for organic solvents. By doing so, a hazardous waste stream may be eliminated, along with the associated waste management and regulatory compliance concerns. Another solvent commonly used is Varsol (also known as petroleum spirits or Stoddard solvent). While most Varsol has a flashpoint below 140°F, which is a characteristically ignitable hazardous waste when spent, some suppliers may provide a “high flash point Varsol” with a flash point greater than 140°F. Ask for non-toxic cleaners that reduce your regulatory compliance concerns.

Also, commercially available mechanical cleaning devices use high pressure and/or high temperature water-based solvents to clean equipment. This type of equipment in many cases recycles the cleaning fluid to get the maximum use out of the solvent being used and minimize the volume of the waste generated.

Paints and Thinners: Oil-based paints and organic solvents (i.e., thinners and cleaners) are used less frequently today, nonetheless they are still used. These paints and thinners provide an excellent product substitution opportunity. Water-based paints should be used whenever feasible. The use of water-based paints eliminates the need for organic thinners, such as toluene. Organic thinners used for cleaning painting equipment are typically listed hazardous waste when spent. This substitution can eliminate a hazardous waste stream and reduce waste management costs and regulatory compliance concerns.

Equipment Modifications



High Energy Ion Plating: High energy ion plating of metal surfaces is an effective technology application that can reduce fugitive emissions and leaks. Ion plating involves the application of metal alloys, such as gold and nickel, to a valve stem, pipe thread, or other metal surface. The metal alloy is applied to the metal surface under high energy in an argon atmosphere, and the metal alloy attaches to the atomic lattice of the metal surface. The result is a metal surface that resists galling and wear. The metal alloy actually performs as a “super lubricant.” This technology has been successfully applied to valve stems, pipe threads, and polished rods. An example of the

benefits provided is that a valve packing may be tightened to eliminate fugitive emissions, and the treated valve stem will last several times longer than an untreated valve stem.

Lubricating Oil Purification Units: A lube oil testing program used to extend operating intervals between oil changes is an effective waste minimization technique, as shown by the case history on page 6-2. (Even though the case history is from drilling operations, the concept may be applied anywhere.) However, an equipment modification also can effectively reduce the volume of waste lubricating oil and filters. Commercial vendors offer a device called a lube oil purification unit. These units use 1 micron filters and fluid separation chambers and are attached to the lube oil system of an engine. The unit removes particles greater than 1 micron in size and any fuel, coolant, or acids, that may have accumulated in the oil. The unit does not affect the functional additives of the lube oil. The lube oil is circulated out of the system and through the purifier. The purified lube oil is then returned to the engine's lube oil system. Many operators have found that use of lube oil purification units has significantly reduced the need for lube oil changes, waste lube oil management, and concurrently, the cost of replacement lube oil. Also, a new engine that has been fitted with a lube oil purification unit will break in better and operate more efficiently over time, in part because bearing surfaces and piston rings seat better due to the polishing action of particles less than 1 micron in size.

Chemical Metering, or Dosing, Systems: The occasional bulk addition of treating chemicals, such as inhibitors, can result in poor chemical performance and inefficient use of the chemical. A chemical dosing system that meters small amounts of the chemical into a system continuously can reduce chemical usage and improve its performance in the system. In many instances, this equipment modification can result in cost savings due to reduced chemical purchases and more efficient operation of the system.

Conventional Filters: A good target for waste minimization is the conventional filters that typically comprise a large part of an operation's waste stream. An operator can replace conventional filter units with reusable stainless steel filters or centrifugal filter units (spinners). These devices generate only filtrate as waste and eliminate from the waste stream the conventional filter media and filter body. Operators have found that the reduced costs of replacing lost oil, maintenance requirements, new filter purchases, and waste filter management recover the expense of installing these alternative filtering units. The case histories on pages 6-7 and 6-8 are good examples of filter reduction.

If conventional filters must be used, an operator should change filters based on differential pressure across the unit. Differential pressure is a good indicator of the effectiveness of a filter unit and can be used to determine the actual need for replacement. This is a simple change that can significantly reduce waste filter generation. The case history provided on page 6-6 proves this point.

Reduction in Water Use



One simple technique for reducing water use is to sweep surfaces with a broom or air rather than washing down surfaces with a water hose. Another simple technique is to use a low volume/high pressure nozzle on all water hoses.

Good Housekeeping and Preventative Maintenance



Drip Pans and Other Types of Containment: Tanks, containers, pumps, and engines all have the tendency to leak. A good housekeeping practice that can help reduce the amount of soil and water contamination that an operator has to remediate is installing containment devices. Even though a small investment is required, containment devices save money and regulatory compliance concerns in the long run. Also, they can capture valuable released chemicals that can be recovered and used. Some examples of containment include: drip pans beneath lubricating oil systems on engines; containment vessels beneath fuel and chemical storage tanks/containers; drip pans beneath the drum and container storage area; and containment, such as a half-drum or bucket beneath chemical pumps and system valves/connections. Numerous companies have implemented good housekeeping programs to reduce the amount of crude oil, chemicals, products, and wastes that reach the soil or water. These companies have found these programs to be cost effective in the long run (i.e., less lost chemical and product plus reduced cleanup costs). Also, their regulatory compliance concerns and potential future liability concerns are reduced.

Preventive Maintenance: The companion of good housekeeping is preventive maintenance. Regularly scheduled preventive maintenance on equipment, pumps, piping systems and valves, and engines will minimize the occurrence of leaks and releases of chemicals and other materials to containment systems; or if there are no containment systems, to the environment. Numerous companies have implemented preventive maintenance programs and found them to be quite successful. The programs have resulted in more efficient operations, reduced regulatory compliance concerns, reduced waste management costs, and reduced soil and/or ground water cleanup costs.

Chemical and Materials Storage: Another important aspect of good housekeeping is the proper storage of chemicals and materials. Chemicals and materials should be stored such that they are not in contact with the ground (e.g., on wooden pallets). Preferably, the raised storage area will include secondary containment and be protected from weather. All drums and containers should be kept closed except when in use. Federal Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1910) require that all chemical and material containers always be properly labeled so that their contents may be identified at any time. Also, OSHA regulations require that material data safety sheets (MSDSs) must be kept on file for all stored chemicals and materials. The use of bulk storage, rather than 55-gallon drums or smaller containers is a preferable way to store chemicals and materials. Compliance with OSHA regulations and implementation of the cited procedures allows quick and easy identification and classification of a chemical or material in the event of a leak or rupture. In some instances, that could save hundreds of dollars in soil sampling and laboratory analysis costs.

Inventory Control



Inventory control is one of the most effective ways to reduce waste generation, regulatory compliance concerns, and operating costs. Especially, when combined with proper chemical and materials storage. The case history on page 6-11 illustrates the beneficial impact an inventory control system can have on an operation. An inventory control system is easy to implement, especially with the use of computer programs now available. An operator who tracks his chemicals and materials can use them more efficiently and reduce the volume of unusable chemical that must be managed as waste. (Note: Commercial chemical products that are returned to a vendor or manufacturer for reclamation or recycling are not solid wastes. Therefore, it is to the operator's advantage to require vendors to take back empty and partially filled containers for reclamation or reuse.)

Selection of Contractors



Operators should choose contractors who recognize the value of waste minimization and make efforts to apply it in their service. The operator may consider inspecting the contractor's equipment to appraise the general condition of the equipment. The contractor should bring on-site well maintained equipment that will not leak fuel or lubricating oil or that will need maintenance which may generate wastes. Any oil and gas waste generated at the operator's site is the operator's regulatory responsibility. Therefore, an operator who uses contractors who practice waste minimization can expect reduced waste management concerns, reduced regulatory compliance concerns,

and reduced operating costs. The contractor may be instrumental in implementing the waste minimization opportunities discussed above.

Training



Training is probably one of the best waste minimization opportunities. An operator's efforts to minimize waste and gain the associated benefits will only be effective if the people in the field understand waste classification and the concept of waste minimization. Also, people in the field should be empowered to implement waste minimization techniques as they are identified. Waste minimization training is becoming more common. Oil and gas associations have begun publicizing waste minimization successes, and technical societies, such as the SPE, are publishing more and more papers on effective waste minimization techniques. Also, the RRC offers inexpensive Waste Minimization Workshops at various locations across the state.

Recycling Opportunities Applicable to All Oil and Gas Operations



Lubricating Oil and Filters: Currently, waste lube oil and waste lube oil filters are generally banned from landfill disposal. Recycling is now the primary method of managing these wastes. Companies that handle lube oil and filters for recycling are located in every area of Texas, so finding one is not difficult. The Waste Minimization Program will provide upon request a listing of these companies.

Sorbent Pads and Booms: When cleaning up spills of crude oil and chemicals, use recyclable sorbent pads or booms. Try to avoid using granular adsorbent materials that must be disposed of. Several vendors offer sorbent pads and booms that are designed for repeated reuse.

Spent Organic Solvents and Other Miscellaneous Spent Chemicals: Many companies accept spent chemicals for recycling. In many instances the spent chemicals (especially organic solvents) are reclaimed for reuse or blended to make fuels for energy recovery. See "Recycling Resources" on the next page to learn how to find these companies.

Paint Solvent Reuse: A simple technique for reducing the volume of organic paint solvents is its reuse in stages. An organic solvent, such as toluene, may be used for cleaning painting equipment, but eventually it will become spent and ineffective. The "spent" solvent is not a waste if it is used for another intended purpose. A solvent spent from cleaning painting equipment is still suitable for use in thinning paint. This simple technique can greatly reduce the volume of waste paint solvent that would be subject to stringent hazardous waste regulation if disposed of.

Commercial Chemical Products: An operator should implement procedures that recycle any unused chemical products. Whenever a vendor is contracted to supply chemicals, the vendor should be required to take contractual responsibility for unused chemical products and the containers in which they were delivered. As noted under the source reduction opportunity, “Inventory Control,” commercial chemical products that are returned for reclamation or recycling are not solid wastes. An operator that manages chemical products properly will avoid the unnecessary generation of chemical waste. In many instances, those chemical wastes would be hazardous if disposed of and subject to stringent regulation.

Scrap Metal and Drums: Scrap metal is a relatively easy waste to recycle. Many operators have found that scrap metal recycling companies will collect and remove tanks, drums, and other types of scrap metal from the lease at no charge to the operator. An additional consideration is regulatory requirements. Scrap metal that is recycled is not subject to hazardous oil and gas waste regulation; but if disposed of, scrap metal is subject to hazardous waste regulation. For example, an old steel tank coated with lead-based paint would possibly be determined hazardous if disposed of; however, if recycled it is excluded from regulation as a hazardous oil and gas waste.

An excellent way to ensure that steel 55-gallon drums are recycled is to have in the contract with a vendor the requirement that the vendor take back any delivered drum, including drums that still contain some chemical or product. Note that empty drums and commercial chemical product that are recycled are generally excluded from regulation as hazardous oil and gas waste. (Also, see the discussions in “Good Housekeeping” and “Inventory Control.”)

RECYCLING RESOURCES



The Railroad Commission maintains a list of permitted crude oil reclamation plants. See Appendix H for more information.

The Texas Natural Resource Conservation Commission (TNRCC) offers Recycle Texas and RENEW on their web site at www.tnrcc.state.tx.us. Recycle Texas lists companies that recycle a wide variety of wastes. This service is helpful in finding options for recycling oil and gas wastes. RENEW (Resource Exchange Network for Eliminating Waste) is a waste exchange network.

The TNRCC also maintains a list of registered facilities that transport, store, process, and/or market used oil and used oil filters for recycling.

See Appendix H, page H-2, for TNRCC contact information.

If you have difficulty finding a company who will recycle your specific waste, call the Waste Minimization Program for assistance.

TREATMENT

Treatment can be employed to reduce the volume or relative toxicity of waste that has been unavoidably generated. Treatment is anything that changes the physical, chemical, or biological character of a waste. Stabilization, neutralization, precipitation, evaporation, incineration, and scrubbing are all examples of treatment activities. Land treatment using methods such as landfarming with proper mixing and/or management of nutrients, moisture, and oxygen as necessary, is a process that is an effective means of management of certain oily wastes.

Unlike source reduction, treatment does not eliminate the creation of pollutants. However, treatment can render the waste less hazardous and, therefore, safer to transport, store, and dispose of. Also, in some circumstances, treatment may render the waste recyclable. Operators are encouraged to investigate treatment options to decrease the potential long-term environmental and human health impacts of wastes that are generated.

DISPOSAL

As we noted in Chapter 1, disposal is the discharge, deposition, injection, dumping, spilling, leaking, or placing of any waste into or on land, water, or air. For purposes of the waste management hierarchy, disposal is the final placement of wastes into the environment; obviously the least preferred option. It does not include recovered materials from leaks or spills that do not reach the environment. It also does not include the storage, treatment, or recycling of such wastes.

Many times the generation of a waste is unavoidable. The choice of a disposal option for a particular waste that has been unavoidably generated should be made only after careful consideration of the type of waste, applicable state and/or federal regulations

impacting disposal options for the waste, the volume of the waste, the disposal environment, and short- and long-term liabilities. If a commercial disposal facility is used, the waste generator is encouraged to audit both the disposal facility and the oil and gas waste hauler to determine if they have the proper permits, good compliance histories, and environmentally sound waste management practices.

A NOTE ON THE IMPORTANCE OF SEGREGATING WASTES

Failure to segregate certain waste streams may lessen waste management options. In general, waste streams that are more regulated should be segregated from those that are less regulated. Hazardous oil and gas wastes should be segregated from exempt and nonexempt oil and gas wastes as explained in Chapter 3. For example, cleaning wastes, unused or unusable chemical products, and other nonexempt wastes should be segregated from exempt wastes where there is the potential of causing the exempt waste to become hazardous. Effective waste segregation can increase the volume of waste that is easily recycled and minimize the volume of waste that must be managed as hazardous oil and gas waste. In other words, the segregation of wastes allows an operator to follow the Waste Management Hierarchy to a greater degree, which can result in decreased waste management costs.

NOTES

6

SUCCESS STORIES

Many oil and gas companies are identifying and implementing waste minimization projects. This chapter presents summaries, of “case histories” of successful waste minimization projects in various areas of operation. All case histories presented in this chapter were submitted by oil and gas companies or presented in technical papers sponsored by oil and gas companies. The Waste Minimization Program may be contacted for additional information on the case histories in this chapter.



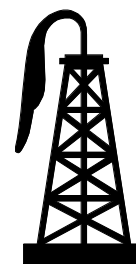
You may be able to identify a project in this chapter that can be implemented in your company’s operations. Also, a review of these case histories may help you think of similar waste minimization projects that would be worthwhile.

The Waste Minimization Program would like to receive information on any completed waste minimization project. If requested, the program will provide information regarding companies who submit case histories. However, if a company prefers to remain anonymous, that request will be honored. Additional case histories received by the program will be posted on the program’s Internet web site and considered for addition to this manual in future updates. The mailing address and phone number for the Waste Minimization Program is provided in Appendix H of this manual.

The following case histories are categorized by area of operation. However, all case histories should be reviewed in that a certain case history in one area of operation may be transferable to another area of operation. Each case history is formatted as “Problem,” “Solution,” and “Benefits.” First the problems associated with a particular waste stream are discussed. A waste minimization solution to that problem is then presented. Finally, the benefits gained are discussed. Each of the following case histories demonstrates that important benefits can be gained, such as cost savings and reduced regulatory compliance concerns. Waste minimization can be a good business decision!

The chapter concludes with an inventory control case history: a successful waste minimization technique that can be applied in all oil and gas operations.

CASE HISTORIES OF SUCCESSFUL WASTE MINIMIZATION IN DRILLING OPERATIONS



Closed Loop Drilling Fluid System

Problem: A small independent operator was concerned about the volume of drilling waste in conventional reserve pits at his drilling locations. Waste management costs were a concern, as well as the costs associated with impact on adjacent land due to pit failures. The operator was concerned about the potential for surface water or ground water contamination and the associated potential liabilities.

Solution: The operator was drilling relatively shallow wells in normally pressured strata. Because the drilling plan was relatively simple, the operator investigated the feasibility of using a closed-loop drilling fluid system for these wells. The use of a closed-loop system eliminated the need for a conventional reserve pit. The operator negotiated with drilling contractors to obtain a turn-key contract that required the drilling company to use a closed-loop system and take responsibility for recycling the waste drilling fluid.

Benefits: The turn-key contract was incrementally more expensive. However, because of reduced drillsite construction and closure costs; reduced waste management costs; and reduced surface damage payments, the operator realized a savings of about \$10,000 per well. Also, the operator reduced the potential for environmental impact and associated potential liability concerns.

Drilling Rig Lubricating Oil

Problem: A drilling company was concerned with the volume of waste lubricating oil and filters generated by diesel power plants on its rigs. Also of concern was the expense of replacement lubricating oil and filters and waste management costs. The drilling company recognized that the problem stemmed from performing oil and filter changes at 500-hour operating intervals as recommended by manufacturer. In general, the basis for the company's concerns was reducing the daily operating costs of its rigs.

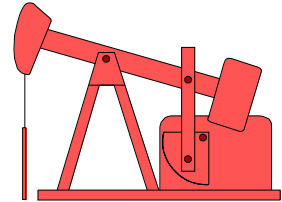
Solution: The company extended the operating interval between lube oil changes for the diesel power plants. They performed sampling and analysis of the lube oil to determine the need for a change. Specific analytes, such as contaminants, additives, and metals, were given threshold values. Whenever a threshold value was exceeded,

a lube oil and filter change was made. In any event, the maximum operating interval was set at 1,250 hours.

Benefits: The change in the procedure for determining the need for lube oil and filter changes resulted in a decrease in oil costs from \$64/day to \$41/day in two years, which translates to a 36% reduction in waste generation. Additional cost savings were realized due to decreased maintenance requirements, improved operating efficiency, and reduced waste management requirements. Importantly, no harm or unusual wear was experienced in the diesel power plants.

See also: **Screen Type Lube Oil Filters on Drive Engines** on page 6-8 and **Inventory Control** on page 6-10.

CASE HISTORIES OF SUCCESSFUL WASTE MINIMIZATION IN PRODUCTION AND WORKOVER OPERATIONS



Paraffin Control

Problem: A small independent operator was concerned about excessive paraffin deposition in the well tubing, flowline, and stock tank at a crude oil production site. The excessive paraffin deposition caused problems such as parted rods, ruptured flowlines, and turndowns by the crude oil purchaser. Additionally, the operator had to perform solvent/hot oil treatments every ten days to keep the well producing.

Solution: The operator installed a magnetic fluid conditioner (MFC) on the rod-pump. The installation of the tool required a capital investment of about \$5,000. The operator had to pull tubing from the well about seven weeks after installation of the MFC. Minimal paraffin deposition was observed. Also, minimal paraffin deposition was observed in the flowlines upon regular inspection. The MFC was performing as intended. (Note: A MFC is designed to direct the produced fluids through a strong permanent magnetic field which alters the depositional properties of paraffin, asphaltines, and minerals in the fluid. The MFC increases the solubility of the crude oil and affects its cloud point, pour point, and viscosity. Recent research in MFC technology has shown that a MFC must be specifically designed for the well in which it is to be installed, taking into consideration factors such as pump dimensions and crude oil and produced water characteristics.)

Benefits: The formation of paraffin, asphaltines, and scale was minimized. Therefore, the associated problems, such as parted rods, ruptured flowline, turndowns by crude

oil purchaser, and solvent/hot oil treatments, were also minimized. The cleanup of soil contaminated by crude oil and produced water from flowline ruptures was minimized. The installation of the MFC proved to be very cost effective. The capital investment was recovered in about six months, and more efficient production and reduced well servicing resulted in increased revenue. Numerous operators have noted that MFCs do not always perform as demonstrated by this case history. However, the technology may be applicable to certain situations.

Separator Coalescor Panels

Problem: A large oil and gas company was concerned about the use of coalescor panels (14 inches deep with ½ inch by ½ inch openings) in horizontal separators used in a large field (about 400 separators). The coalescor panels would plug with solids and ice, resulting in plugging of oil and water outlets and damage to the separator's internal components. The damage was costly to repair (about \$4,000). Frequent replacement of the panels resulted in high maintenance and waste management costs (15 to 20 separator coalescor change outs would generate about 25 cubic yards of waste costing about \$1,000 for disposal). Also, when a separator had to be serviced due to coalescor panel problems, the production had to be shut-in.

Solution: The operator's solution was to make a simple equipment modification. A ½ inch thick fiberglass baffle perforated with 1 inch by 1 inch holes was designed to replace the coalescor panels. The new baffle costs about \$200 to fabricate and install. The new baffle performed well in the separator. Flow characteristics were adequate for optimum performance of the separator.

Benefits: The elimination of the coalescor panels in turn eliminated all of the associated separator maintenance and waste management problems previously experienced. No vessel clean outs or repairs have been necessary for the modified separators. The operator did not provide the specific economics for this project. However, this equipment modification is obviously very cost effective. A simple \$200 modification has eliminated repair and maintenance expense as much as \$4,000. Therefore, it is apparent that the small capital investment was quickly recovered. In addition, the operator gained benefits such as increased production, reduced waste management costs, reduced regulatory compliance concerns, and improved worker safety due to reduced confined entry.

Automatic Rod-Pump Shut-Off

Problem: A small independent oil producer operates a shallow, 40-well oil field in an area subject to extremely cold winters. The operator's poly flowlines would freeze and rupture in the cold weather. Increased paraffin deposition also contributed to this problem. The flowline ruptures resulted in contaminated soil that had to be cleaned up under Statewide Rule 91. Also, to prevent rupture of the flowlines, the rod-pumps had to be shut down when freezing weather was predicted resulting in loss of production and revenue.

Solution: The operator designed and installed an automatic pump shut-off system on each well. A low cost system was designed (about \$75/well including parts and labor). The total investment for installing the devices on each of the 40 wells was about \$3,000 (\$75/well). The automatic shut-off system was made using an automotive brake light switch (pressure switch), copper tubing, hydraulic fluid, and a simple relay switch. The circuit was designed such that the pump must be manually restarted after the cause of shut-off is determined.

Benefits: Since installation of the automatic shut-off systems, the operator has not experienced a single flowline rupture. As a result, soil cleanups and loss of production and revenue have been eliminated. The operator did not provide the specific economics for this project. However, it is clearly cost effective. The savings from reduced soil cleanups and increased revenue from more efficient production would easily recover the nominal capital investment.

Pump-Jack Gear-Box Lube Oil

Problem: A small independent operator felt that the cost of replacing lube oil in pump-jack gear boxes, including maintenance and waste lube oil management, was excessive. The operator investigated opportunities to reduce these costs and the management of the waste lube oil.

Solution: The operator found a very simple solution. A service company was contracted to regenerate the gear box lube oil. The service company filters and treats (purifies) the lube oil on-site. The reclaimed lube oil is returned to the gear box for reuse. The cost is about \$35 to \$40 per pump jack.

Benefits: The operator's use of this service eliminated the generation and management of waste lube oil and the associated maintenance requirements. The change in procedure was cost effective. New replacement lube oil costs about \$175

per pump jack; therefore a savings of about \$135 per pump jack is realized. Additional savings are realized because of reduced waste management and maintenance costs.

Produced Water Filters

Problem: A small independent operator generated a large volume of waste filters from a produced water injection system for a water flood. About 14,000 barrels of produced water is reinjected each day. Two produced water filter units at 36 injection wells were replaced twice per month resulting in about 1,700 waste filters per year. The operator spent \$4,148 per year for new replacement filters (\$2.44 per filter x 1,700 filters). Additional expense was incurred from waste filter management and maintenance.

Solution: The operator changed the procedure by basing filter replacements on differential pressure, rather than on a twice-monthly schedule. Valves were installed on filter inlet and outlet to accommodate a temporary pressure gauge hookup for differential pressure measurement. A capital investment of \$1,800 was required for installation of the valves.

Benefits: The operator's procedure change and simple equipment modification resulted in a significant reduction in the volume of waste filters. In the year following the change, a total of 28 waste filters were generated. The change was very cost effective due to reduced maintenance requirements, reduced waste management, and reduced filter replacements. The operator saved about \$4,000 per year due to the reduced filter replacement costs. The capital investment was recovered in about five months, based only on the reduction in new filter costs. Additional savings were gained from the reduced maintenance and the reduced waste management.

See also **Inventory Control** on page 6-10.

CASE HISTORIES OF SUCCESSFUL WASTE MINIMIZATION IN NATURAL GAS PROCESSING PLANT OPERATIONS

Cooling Tower Blowdown

Problem: Frequent cooling tower blowdown due to poor solids dispersion generated a large volume of wastewater. This resulted in considerable waste management costs (disposal in a Class II well). The cooling water system used a scale



inhibitor sensitive to high pH; therefore, sulfuric acid was added to the system to maintain a lower pH. Additionally, the chemicals were added to the system in batches.

Solution: First, a substitute scale inhibitor was selected. The new scale inhibitor functions at a higher pH and has better solids dispersion qualities. A chemical dosing, or metering, system was installed so that chemicals were introduced into the cooling water system continuously, rather than in batches. Also, bromine was substituted for chlorine as a biocide.

Benefits: The new scale inhibitor provided improved solids dispersion resulting in reduced make-up water volume and reduced wastewater volume. The use of sulfuric acid was eliminated. The bromine biocide offered greater worker safety. The chemical dosing system resulted in more efficient use of chemicals and operation of the cooling water system. All of these improvements resulted in saving several thousands of dollars per year per cooling tower. (Note: The contributing operator did not provide specific dollar amounts.)

Heat Medium Oil Filters

Problem: A large volume of conventional filters was generated by a heat medium oil system in a natural gas processing plant. The system had three sets of filters: a 36-filter set changed weekly; a 3-filter set changed bi-weekly; and a 54-filter set changed bi-monthly. The costs associated with the filter change-outs, new filters, and lost oil were high. Also, the plant had changed to a new type of oil that more effectively cut deposits in the system, resulting in the need for more efficient filtering.

Solution: The operator installed spinner (i.e., centrifugal) filter units in place of the 36-filter set and the 3-filter set. The heat medium oil is circulated out of the system, cooled, and run through the spinner filter units. The spinner filter units require clean-out three times per week.

Benefits: The elimination of the conventional 36-filter set and 3-filter set resulted in elimination of 1,950 waste filters per year. The maintenance and waste management requirements were reduced. The cost savings were significant. Approximately \$18,500 per year was saved due to: reduced filter replacement costs; reduced labor and maintenance costs; and reduced lost oil costs. The operator is investigating the feasibility of replacing the 54-filter set with spinner filter units. The operator estimates that the savings could increase to about \$32,000 per year if all conventional filters can be replaced with spinner filters.

Screen Type Lube Oil Filters on Drive Engines

Problem: A natural gas processing plant operator was concerned about the volume of waste sock lube oil filters and lost lube oil created by filter changes on 16 drive engines. The seven sock filters on each drive engine were changed four times per year. Each filter change required about 40 gallons of new lube oil. For a sock filter change, each new filter cost \$7.71 and the replacement of the 40 gallons of lube oil cost \$107.00. The total cost per year for the 16 units was \$10,315.00.

Solution: The operator made a simple equipment modification. Oberg screen type filters were installed on each of the drive engines in series with the existing sock filters. The screen filters were installed in parallel so each could be bypassed for cleaning while the unit continued to operate. As a result of switching to the screen filters, the sock filters required replacement only once per year.

Benefits: This simple equipment modification was cost effective. The reduced sock filter changes saved \$7,736.00 per year, not including the savings from reduced management and disposal costs for the eliminated waste sock filters. The operator also gained the benefit of reduced regulatory compliance associated with waste management.

Contaminated Amine

Problem: A major oil company had a spill of unused amine. The spilled amine was recovered in drums, but was contaminated by dirt and unsuitable for use in the sweetening unit. The operator initially considered filtering the contaminated amine so it could be used in the sweetening unit, but the cost of filtering was prohibitive. Also, the amine was contaminated by residual surfactant in one of the drums.

Solution:

The operator considered disposal of the amine, but first “brainstormed” to see if a use for the amine could be found. Their corrosion engineer suggested that the contaminated amine could be used as a corrosion inhibitor. Amine is used as an ingredient in corrosion inhibitors and can also be used alone as a corrosion inhibitor. The operator identified several sites where corrosion inhibitors were needed and injected the amine at those locations.

Benefits:

First, the use of the amine as corrosion inhibitor saved the operator the cost of disposal. Also, it negated the need for the purchase of new corrosion inhibitor, making this recycling decision even more cost effective. This case history is simple, but still an excellent example of how wastes that were previously disposed of as a matter of accepted waste management practice can actually be beneficially recycled, resulting in cost savings.

See also **Inventory Control** on page 6-10.

CASE HISTORIES OF SUCCESSFUL WASTE MINIMIZATION TECHNIQUES IN CRUDE OIL AND NATURAL GAS PIPELINE OPERATIONS**Spent Sandblast Media in Compressor Painting Operations**

Problem: The operator was using the typical sandblast procedure to remove paint, rust, and scale in preparation for repainting. The problem with this procedure was the large volume of contaminated sandblast media generated in a typical compressor paint job. Additionally, the old paint on compressors was lead-based. Each operation generated 27 drums of characteristically hazardous waste due to lead toxicity. The total cost to dispose of this hazardous oil and gas waste was \$6,426 (\$238 per drum). Increased regulatory compliance concerns were also a problem. The large quantity of hazardous waste generated by this process required the operator to register the site as a large quantity generator (LQG) and comply with stringent hazardous waste regulations. Also, a hazardous oil and gas waste generation fee of \$2,000 was paid for the site.

Solution: The operator's solution to this problem was to implement a procedural change at subsequent compressor paint jobs. The operator elected to use pneumatic needle scalars instead of sandblasting for paint removal and surface preparation. Paint removal and cleaning with needle scalars was somewhat slower. However, this was offset by a faster, less labor intensive cleanup of generated waste, which consisted only of paint chips.

Benefits: The operator gained impressive benefits by implementing this procedural change. Most impressively, the operator saved about \$8,200 per compressor paint job, primarily due to an 8% reduction in labor costs and reduced waste management

costs. Because only one drum of hazardous paint chips was generated (rather than 27 drums of spent sandblast media), disposal costs were reduced to about \$240.

Also, the operator obtained the benefit of reduced regulatory compliance concerns. The reduced amount of waste generated by use of pneumatic needle scalars resulted in the site being classified as a conditionally exempt small quantity generator (CESQG) site. The CESQG site classification eliminates many of the regulatory compliance requirements and expenses of an LQG site (e.g. no annual generation fee).

Waste Brine From a LPG Salt Cavern Storage Operation

Problem: Two pits had been used to hold brine for use in displacing LPG from an underground storage facility (solution-mined salt cavern). The operator elected to discontinue use of the pits. The RRC required that all salt and brine be removed from the pits prior to their closure. One pit was about an acre in area and contained about a foot and a half of concentrated brine. The other pit was about 7 acres in area and contained about two feet of crystalline salt and silt. The operator was faced with expensive pit closures.

Solution: The operator determined that the concentrated brine and crystalline salt could be used to produce 10 ppg brine for use by drillers operating in an area requiring drilling through salt formations. The contents of the 1-acre pit were moved to the 7-acre pit, allowing closure of the 1-acre pit. Fresh water was then added to the 7-acre pit to generate 10 ppg brine, which was made available to interested drilling operations. This approach to managing the salt waste in the pits was agreed to by the RRC. In just the first year, about 1,200 truck loads of 10 ppg brine water had been hauled from the pit and had resulted in the removal of about 8,000 tons of salt. An additional year of 10 ppg brine removal was estimated for complete removal of the salt from the pit.

Benefits: The recycling of the salt in the pit as 10 ppg brine enabled operators to obtain free brine water for drilling through salt formations. Once the salt waste has been removed from the pit by solution, the operator will be able to close the pit at a greatly reduced expense. This recycling project was a win-win situation. The operator will reduce his pit closure costs and potential liability; and other companies reduced their drilling costs.

Reuse of Waste Lubricating Oil During Salt Cavern Leaching

Problem: An underground natural gas storage operator was leaching a new salt cavern and required protection of the cavern roof during the process. At the same time the operator recognized the costs associated with managing the waste lubricating oil from its operation (sent to a burnable fuels program).

Solution: The operator determined that their operation's waste lubricating oil exhibits no hazardous waste characteristics and is suitable for reuse in their operations. The waste lubricating oil is mixed with diesel to produce a mixture suitable for protection of salt cavern roofs during the leaching process. The diesel/lube oil mixture is returned to the surface at the end of the leaching process. The recovered mixture is then sold to a distillate fuels recycling facility.

Benefits: The management of the waste lube oil and the associated costs were eliminated, while the waste lube oil was reused in the leaching process. In addition, the recovered diesel/lubricating mixture is sold to the recycling facility for about \$0.25 per gallon. The operator did not have to make a capital investment, but only incurred a minor vacuum trucking cost for mixing the diesel and lube oil. Therefore, this project was profitable for the operator.

Inventory Control

See **Inventory Control** below.

A CASE HISTORY OF A SUCCESSFUL WASTE MINIMIZATION TECHNIQUE THAT CAN BE APPLIED IN ALL OIL AND GAS OPERATIONS

Inventory Control

Problem: The staff of an area of operation (which included drilling, gas production and compression) of a major oil and gas company determined that its inventory of chemicals was excessive and that much of the generation of chemical waste was unnecessary. The company was also concerned about the generation of hazardous wastes resulting from its chemical inventory management.

Solution: The company addressed the problem by designing and implementing an inventory control system. The inventory control system is based on a complete inventory of all chemicals in the area of operation. To minimize chemical waste the

company identified suitable (e.g., less toxic) substitute chemicals, eliminated the use of all halogenated and nonhalogenated organic solvents, determined instances where a specific chemical could be used for multiple purposes, and eliminated the use of 55-gallon drums, where possible. An important part of the system is the evaluation of a chemical prior to its purchase using material safety data sheets (MSDSs) and other manufacturer's information. The purchase of a new chemical is approved only after it is determined that the chemical complies with the inventory control system guidelines. Finally, all purchased chemicals are closely tracked to ensure efficient usage.

Benefits: The company eliminated about 32 unnecessary chemicals and products within 6 months of the program's initiation, which resulted in reduced regulatory compliance concerns (e.g., hazardous waste regulations) and savings in operating costs. Waste management concerns and costs were reduced due to the reduction in the number of 55-gallon drums on inventory. Also, the company's chemical suppliers were aware of the inventory control system and worked to supply chemicals which would be approved by the company's system.

APPENDIX A

***REGULATORY DETERMINATION FOR OIL
AND GAS AND GEOTHERMAL EXPLORATION,
DEVELOPMENT AND PRODUCTION WASTES***

53 Federal Register 25446-25459 (July 6, 1988)

Important Note

This Federal Register notice is taken from the U.S. EPA web site. It is accessible from the following URL:

<http://www.epa.gov/epaoswer/other/oil/index.htm>.

The file may be opened as an ASCII text file, or a WordPerfect file.

The notice in this appendix has been reformatted to aid readability. Footnotes are provided at the end of the notice (page A-29).

You should refer to the original Federal Register notice to assure accuracy.

Federal Register / VOL. 53, No. 129 / Wednesday, July 6, 1988 / Rules and Regulations
(Pages 25446 - 25459)

40 CFR Part 261

[FRL-3403-9]

Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes

AGENCY: Environmental Protection Agency (EPA).

ACTION: Regulatory determination.

SUMMARY: Section 3001(b)(2)(B) of the Resource Conservation and Recovery Act (RCRA) requires the Administrator to determine whether to promulgate regulations under RCRA Subtitle C for wastes from the exploration, development, and production of crude oil, natural gas, and geothermal energy. The Administrator must make this determination no later than six months after completing a Report to Congress on these wastes and after providing an opportunity for public comment. The Agency has completed these activities and has decided that regulation under RCRA Subtitle C is not warranted. Rather, EPA will implement a three-pronged strategy to address the diverse environmental and programmatic issues posed by these wastes by: (1) Improving Federal programs under existing authorities in Subtitle D of RCRA, the Clean Water Act, and Safe Drinking Water Act; (2) working with States to encourage changes in their regulations and enforcement to improve some programs; and (3) working with Congress to develop any additional statutory authorities that may be required.

FOR FURTHER INFORMATION CONTACT: For further information on the regulatory determination, contact the RCRA/Superfund hotline at (800) 424-9346 (toll free) or (202) 382-3000.

SUPPLEMENTARY INFORMATION:

Preamble Outline

I. Summary

II. Background

- A. Technical Summary of Report to Congress
- B. Legal Authority
- C. Conclusions of the Report to Congress and Response to Comments
- D. Determination of the Scope of the Temporary RCRA Exemption

III. Factors Considered in Regulatory Determination

IV. Regulatory Determination for Crude Oil and Natural Gas Wastes

- A. Hazard Assessment
- B. Economic Impact Analysis
- C. Adequacy of State and Federal Regulatory Programs
- D. Conclusions

- V. Efforts to Improve State and Federal Programs
 - A. Federal Program Improvements Within Existing Authorities
 - B. Additional Federal Authorities
 - C. Improvements in State Programs

- VI. Regulatory Determination for Geothermal Energy Wastes
 - A. Hazard Assessment
 - B. Adequacy of State and Federal Regulations
 - C. Conclusions

- VII. Research, Development, and Demonstration Plan

- VIII. EPA RCRA Docket

I. Summary

This action presents the Agency's regulatory determination required by section 3001(b)(2)(B) of the Resource Conservation and Recovery Act (RCRA) for drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy. RCRA requires the Administrator to determine either to promulgate regulations under Subtitle C for wastes from oil, gas, and geothermal exploration, development, and production, or that such regulations are unwarranted. In making this determination, the Administrator is required to utilize information developed and accumulated by the Agency pursuant to a study required under RCRA section 8002(m). The Agency completed this study and published its results in December, 1987 in a Report to Congress entitled "Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy."

In completing the Report to Congress and this determination, EPA gathered and evaluated information on all of the issues raised in section 8002(m), including three key factors pertaining to wastes from the exploration, development, and production of oil, gas, and geothermal energy: (1) The characteristics, management practices, and resulting impacts of these wastes on human health and the environment; (2) the adequacy of existing State and Federal regulatory programs; and (3) the economic impacts of any additional regulatory controls on industry.

In considering the first factor, EPA found that a wide variety of management practices are utilized for these wastes, and that many alternatives to these current practices are not feasible or applicable at individual sites. EPA found that oil, gas, and geothermal wastes originate in very diverse ecologic settings and contain a wide variety of hazardous constituents. EPA documented 62 damage cases resulting from the management of these wastes, but found that many of these were in violation of existing State and Federal requirements.

As to the second factor, EPA found that existing State and Federal regulations are generally adequate to control the management of oil and gas wastes. Certain regulatory gaps do exist, however, and enforcement of existing regulations in some States is inadequate. For example, some States have insufficient controls on the use of landfarming, roadspreading, pit construction and surface water discharge practices. Some States lack sufficient controls for central disposal and treatment facilities and for associated wastes.¹ The existing Federal standards under Subtitle D of RCRA provide general environmental performance standards for disposal of solid wastes, including oil, gas, and geothermal wastes, but these standards do not fully address the specific concerns posed by oil and gas wastes. Nevertheless, EPA has authority under Subtitle D to promulgate more tailored criteria. In addition, the authorities

available under the Clean Water Act (CWA) or Safe Drinking Water Act (SDWA) can be more broadly utilized, and efforts are already underway to fill gaps under these programs.

EPA's review of the third factor found that imposition of Subtitle C regulations for all oil and gas wastes could subject billions of barrels of waste to regulation under Subtitle C as hazardous wastes and would cause a severe economic impact on the industry and on oil and gas production in the U.S. Additionally, because a large part of these wastes is managed in off-site commercial facilities, removal of the exemption could cause severe short-term strains on the capacity of Subtitle C Treatment, Storage, and Disposal Facilities (TSDFs), and a significant increase in the Subtitle C permitting burden for State and Federal hazardous waste programs.

As explained in more detail in Section IV of this notice, EPA found that regulation under Subtitle C presents several serious problems. First, Subtitle C contains an unusually large number of highly detailed statutory requirements. It offers little flexibility to take into account the varying geological, climatological, geographic, and other differences characteristic of oil and gas drilling and production sites across the country. At the same time, it does not provide the Agency with the flexibility to consider costs when applying these requirements to oil and gas wastes. Consequently, EPA would not be able to craft a regulatory program to reduce or eliminate the serious economic impacts that it has predicted. Furthermore, since existing State and Federal programs already control oil and gas wastes in many waste management scenarios, EPA needs to impose only a limited number of additional controls targeted to fill the gaps in the existing programs. Subtitle C, with its comprehensive "cradle to grave" management requirement, is not well suited to this type of gap-filling regulation. EPA concluded that it would be more efficient and appropriate to fill the gaps by strengthening under the Clean Water Act and UIC programs and promulgating the remaining rules needed under RCRA under the less prescriptive statutory authorities set out in Subtitle D. This narrower approach would also reduce disruption of existing State and Federal control programs.

Thus, the Agency has decided not to promulgate regulations under Subtitle C for wastes generated by the exploration, development, and production of crude oil, natural gas, and geothermal energy for the following reasons:

- (1) Subtitle C does not provide sufficient flexibility to consider costs and avoid the serious economic impacts that regulation would create for the industry's exploration and production operations;
- (2) Existing State and Federal regulatory programs are generally adequate for controlling oil, gas, and geothermal wastes. Regulatory gaps in the Clean Water Act and UIC program are already being addressed, and the remaining gaps in State and Federal regulatory programs can be effectively addressed by formulating requirements under Subtitle D of RCRA and by working with the States;
- (3) Permitting delays would hinder new facilities, disrupting the search for new oil and gas deposits;
- (4) Subtitle C regulation of these wastes could severely strain existing Subtitle C facility capacity;
- (5) It is impractical and inefficient to implement Subtitle C for all or some of these wastes because of the disruption and, in some cases, duplication of State authorities that administer programs through organizational structures tailored to the oil and gas industry; and

(6) It is impractical and inefficient to implement Subtitle C for all or some of these wastes because of the permitting burden that the regulatory agencies would incur if even a small percentage of these sites were considered Treatment, Storage and Disposal Facilities (TSDFs).

The Agency plans a three-pronged approach toward filling the gaps in existing State and Federal regulatory programs by:

(1) Improving Federal programs under existing authorities in Subtitle D of RCRA, the Clean Water Act, and Safe Drinking Water Act;

(2) Working with States to encourage changes in their regulations and enforcement to improve some programs; and

(3) Working with the Congress to develop any additional statutory authority that may be required.

EPA plans to revise its existing standards under Subtitle D of RCRA, tailoring these standards to address the special problems posed by oil, gas, and geothermal wastes and filling the regulatory gaps. Also, the Agency is moving ahead with improvements in its NPDES and UIC programs under the Clean Water Act and the Safe Drinking Water Act. EPA also plans to work with Congress to obtain any additional authorities that may be required. For example, Subtitle D of RCRA currently does not provide EPA with the authority to address treatment or transportation of wastes. Throughout the process of improving the Federal regulatory program, EPA will work closely with States to encourage improvements in their regulatory programs.

II. Background

Section 3001(b)(2)(A) of the Solid Waste Disposal Act of 1980 (Pub. L. 96-480), which amended the Resource Conservation and Recovery Act of 1976 (RCRA), prohibits EPA from regulating under RCRA Subtitle C "drilling fluids, produced waters, and other wastes associated with exploration, development, or production of crude oil or natural gas or geothermal energy" until at least 6 months after the Agency completes and submits to Congress a comprehensive study required by section 8002(m) (also added by the 1980 amendments). Section 8002(m) directs EPA to conduct

[A] detailed and comprehensive study and submit a report on the adverse effects, if any, of drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas or geothermal energy on human health and the environment, including, but not limited to, the effects of such wastes on humans, water, air, health, welfare, and natural resources and on the adequacy of means and measures currently employed by the oil and gas and geothermal energy drilling and production industry, Government agencies, and others to dispose of and utilize such wastes to prevent or substantially mitigate such adverse effects.

The study way to include an analysis of:

1. The sources and volumes of discarded material generated per year from such wastes;
2. Present disposal practices;
3. Potential danger to human health and the environment from surface runoff or leachate;

4. Documented cases that prove or have caused danger to human health and the environment from surface runoff or leachate;
5. Alternatives to current disposal methods;
6. The cost of such alternatives; and
7. The impact of those alternatives on the exploration for, and development and production of, crude oil and natural gas or geothermal energy.

The 1980 amendments also added section 3001(b)(2)(B), which requires the Administrator to make a "regulatory determination" regarding the waste excluded from RCRA Subtitle C regulation. Specifically, within 6 months after submitting the Report to Congress, and after the opportunity for public hearings and public comment on the report, the Administrator must "determine to promulgate regulations" under RCRA Subtitle C for oil, gas, and geothermal energy waste, "or that such regulations are unwarranted." Section 3001(b)(2)(C) also specifies that any new regulations under RCRA Subtitle C for the crude oil, natural gas, or geothermal energy industry would not take effect until authorized by an Act of Congress.

EPA was required to complete the study and submit it to Congress by October 1982. In August 1985, the Alaska Center for the Environment sued the Agency for its failure to complete the study by the statutory deadline. EPA entered into a consent order obligating it to submit the final Report to Congress on or before August 31, 1987, and to make its regulatory determination by February 29, 1988. In April 1987, the court-ordered schedule was modified, extending the deadline or submittal of the final Report to Congress to December 31, 1987, and requiring the regulatory determination to be made by June 30, 1988. In accordance with this schedule, EPA completed the technical report on methodology in October 1986, the technical report on the waste sampling and analysis in January 1987, the interim report in April 1987, the draft report in August 1987, and the final report in December 1987.

EPA's Report to Congress, "Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy," was transmitted to Congress on December 28, 1987. A notice announcing the availability of the report, as well as the dates and locations of public hearings, was published on January 4, 1988 (53 FR 82). EPA held public hearings on the report in Washington, DC on February 23, 1988; Denver, Colorado, on February 25, 1988; San Francisco, California, on March 1, 1988; Anchorage, Alaska, on March 3, 1988; and Dallas, Texas, on March 8, 1988. The comment period on the report closed on March 15, 1988.

EPA's Report to Congress provides information on all of the study areas mandated by RCRA section 8002(m). The Agency received approximately 150 written comments on the report and heard testimony at the hearings from 105 individuals. All individual comments and transcripts from the public hearings are available for public inspection in the docket. The docket also contains a summary of all the comments presented at the hearings or submitted in writing, along with EPA's response to these comments.

A. Technical Summary of Report to Congress

1. Definition of Exempt Wastes

Section 3001(b)(2)(A) exempts produced water, drilling fluids, and "other wastes associated" with the exploration, development, and production activities. These are general terms that do not identify all of the specific waste streams to be exempted and studied. For study purposes,

EPA broadly defined the scope of the exemption for oil, gas, and geothermal energy wastes to include not only produced waters and drilling fluids, but also related wastes (referred to herein as "associated wastes"), generated during the exploration, development, and production of crude oil, natural gas, and geothermal energy resources. The Agency excluded from its study those wastes not uniquely associated with exploration, development, and production of crude oil and natural gas which are not exempt from Subtitle C regulation (e.g., used batteries and waste solvents).

For geothermal energy, the definition of drilling-related wastes was identical to that of crude oil and natural gas wastes. Exempt wastes unique to geothermal energy production operations included: Waste streams produced from materials passing through the turbine in dry-steam power generation; waste streams resulting from a geothermal energy fluid or gas that passed through the turbine in flashed-stream and binary power plants; waste streams resulting from the geothermal energy products passing through only the heat exchanger in binary operations or through the flash separator in the flash process; and most direct use waste streams. A more detailed description of the scope of the exemption and study appears in section IV.D. below.

2. Waste Quantities and Characterization

In the Report to Congress, EPA estimated that 361 million barrels of drilling waste were generated in 1985 from about 70,000 crude oil and natural gas wells, and that over 800,000 active production sites generated 20.9 billion barrels (including produced water injected for enhanced oil recovery (EOR)) of produced water during that year. Associated waste, such as workover fluids and tank bottoms, are produced at the rate of 11 million barrels per year. For geothermal energy wastes, EPA estimated that approximately 111,000 barrels of geothermal energy-related drilling wastes were generated in 1985, along with 56 billion gallons of liquid wastes (geothermal fluid and condensed steam) from both binary and flash process plants, and 8 billion gallons of liquid waste from direct use of geothermal energy.

For crude oil and natural gas wastes, EPA sampled liquids and sludges from several locations. Drilling fluids were sampled at drilling operations while produced water and tank bottoms were sampled at production operations. Samples from central treatment and disposal facilities and central pits contained mixtures of all wastes including associated wastes. The Agency found that organic pollutants at levels of potential concern (levels that exceed 100 times EPA's health-based standards) included the hydrocarbons benzene and phenanthrene. Inorganic constituents at levels of potential concern included lead, arsenic, barium, antimony, fluoride, and uranium.

Tank bottoms, an associated waste sampled and analyzed by the Agency, contained significant levels of contaminants of concern, with some levels exceeding the reference doses (RfDs) for noncarcinogens or the risk-specific doses (RSDs) for carcinogens (health-based standards) for these contaminants.²

Analysis of the constituents of several geothermal energy waste streams indicated that some of the production wastes exhibited the corrosivity characteristic and extraction procedure (EP) toxicity for certain metals. Factors such as management practices, dilution and attenuation of the contaminant, and hydrogeological characteristics, affect the risk to human health and the environment presented by these chemicals.

3. Current and Alternative Management Practices

A wide range of management practices are employed for crude oil and natural gas wastes. The technological diversity is the result of widely varying geological, climatological, ecological,

topographic, economic, geographic, and age differences among drilling and production sites across the country and partially account for varying State regulatory requirements. There are, however, variations from State to State in the stringency of management practices which are not wholly attributable to the varying physical settings of the operations.

Current practices include the use of reserve pits for drilling wastes; landspreading of reserve pit contents; disposal of produced waters through Class II underground injection wells; disposal of produced water in unlined pits; discharge of produced water to surface waters; roadspreading; use of commercial facilities for treatment and disposal of drilling wastes and produced water; and some practices unique to the Alaska North Slope, such as the use of semipermanent production-related reserve pits, and discharges to the tundra. Less frequently used current practices discussed in the report are closed-cycle drilling mud systems, annular disposal of produced water and drilling fluid, and trenching of reserve pits to dispose of reserve pit fluids.

These practices vary substantially in the protection they provide to the environment. While changes in State regulatory requirements over the years have led generally to the use of more environmentally protective technologies and management practices, there is a need for increased movement to more protective approaches for discharge to ephemeral streams, surface water discharges in estuaries in the Gulf Coast region, road applications of reserve pit contents and discharge to tundra in the Arctic, and annular disposal of produced waters.

For the major waste streams, EPA was unable to identify any new technologies in the research and development stage that offer promise for wide application in the near term. More widespread use of the best existing technologies, however, would provide substantial additional protection for the environment in many areas.

Waste management practices unique to geothermal power generation wastes include closed-cycle ponding, reinjection into the producing zone or a nonproducing zone, and consumptive secondary use. In California, production wastes are tested for hazardousness, using the California tests for hazardousness, before disposal to determine the appropriate disposal method. After direct use of geothermal energy fluid for heating purposes, these fluids can be discharged to surface waters, injected into the producing zone or a nonproducing zone, and consumed by secondary uses.

4. Evidence of Damages

To determine the types and severity of damages caused by crude oil and natural gas wastes, EPA assembled information on a substantial number of damage cases, 62 of which were fully documented and passed EPA's "tests of proof." These cases were based on recent information gathered from the States of Alaska, Arkansas, California, Kansas, Kentucky, Louisiana, Michigan, New Mexico, Ohio, Oklahoma, Pennsylvania, Texas, West Virginia, and Wyoming. These damage cases were extensively reviewed by the States, industry, and third parties. On the basis of all available information, the study found that wastes from crude oil and natural gas operations have endangered human health and caused environmental damage when managed in violation of State and Federal requirements. In some instances damage occurred where wastes are managed in accordance with currently applicable State and Federal requirements.

The major categories of wastes responsible for damages include reserve pit wastes, fracturing and acidizing fluids, stimulation chemicals, waste crude oil, produced water, and other miscellaneous wastes generated by the exploration, development, and production of crude oil and natural gas. The various categories of damages to, or endangerment of, human health and the environment contained in the Report to Congress include:

- Damage to agricultural land, crops, ephemeral streams, livestock, and threats to endangered species, fish, and other aquatic life in estuaries and bays from produced water and drilling fluids;
- Degradation of soil and ground water from runoff and leachate from central treatment and disposal facilities, reserve pits, and unlined disposal pits;
- Potential contamination of aquatic and bird life in estuaries and bays by metals and polycyclic aromatic hydrocarbons resulting from the discharge of drilling fluids and produced waters;
- Potential for endangerment of human health from consumption of contaminated fish and shellfish and from ground water contaminated by seepage from storage and disposal pits;
- Potential damage to tundra on the Alaska North Slope from roadspreading and seepage and discharges from reserve pits;
- Damage to ground water, agricultural land, and domestic and irrigation water caused by seepage of native brines from improperly plugged and unplugged abandoned wells; and
- Ground-water degradation from improper functioning of injection wells.

5. Risk Modeling

EPA used quantitative modeling and a review of the scientific literature to evaluate the health and environmental risks associated with management of oil, gas, and geothermal energy wastes in order to evaluate risks to human health and the environment under a variety of conditions. The Agency characterized selected major risk-influencing factors associated with current operations: Estimated the management of drilling waste in reserve pits, the underground injection of produced water, and the surface water discharge of produced water from stripper wells. The risk analysis did not consider annular disposal, storage of produced water in surface impoundments, migration of produced water contaminants through fractures, unplugged or improperly plugged and abandoned wells, landspreading, roadspreading, or disposal of associated wastes.

For the selected practices, EPA estimated distributions of these risk-influencing factors across the population of crude oil and natural gas facilities; evaluated these factors in terms of their relative effect on risks; and developed initial quantitative estimates of the possible range of baseline health and environmental risks for the variety of conditions found. Risks were analyzed under assumptions that were broadly consistent with baseline requirements of existing Federal and State programs.

For the specific subset of current practices, EPA modeled the potential effects of arsenic, benzene, boron, sodium, chloride, cadmium, chromium, and total mobile ions at concentrations observed in sampled produced water and drilling waste. The study focused heavily on ground water and indicated that, for the vast majority of the scenarios modeled, risks from the disposal of drilling waste in onsite reserve pits and the disposal of produced water by underground injection were small. Only a few chemicals from either source appear to be of major concern relative to health or environmental risk. The actual human health and environmental threats posed by any of these releases is largely dependent upon site-specific factors, including geophysical conditions and a site's proximity to human populations or sensitive ecosystems. Estimated impacts on human health varied widely, and there were typically a few combinations of environmental settings and high sample toxic constituent

concentrations where moderate risks were projected. Quantitative risk modeling indicates the potential in some situations for carcinogenic risks in excess of 1 in 10,000 and sodium levels in drinking water in excess of recommended levels for public drinking water supplies. Modeling of resource damages to ground and surface water generally did not show significant risks at low release rates typical of individual stripper wells although multiple strippers discharging into common water courses were not modeled.

6. Costs and Economic Impacts

EPA developed three estimates of the compliance costs and economic impacts of implementing alternative waste management practices for the large-volume drilling wastes and produced waters in the crude oil and natural gas industries: (1) a "baseline" scenario reflecting current waste management practices; (2) an "intermediate" scenario, in which somewhat stricter controls on waste disposal practices are assumed; and (3) a "Subtitle C" scenario, in which virtually full RCRA hazardous waste requirements would be met. EPA estimated total annual costs for each scenario and then evaluated the projected economic impacts of these costs on the oil industry as a whole.

Assuming produced waters reinjected for enhanced production would not be regulated, total annual costs for additional management requirements ranged from approximately \$50 million to over \$6.7 billion, depending on the scenario and on assumptions regarding the fraction of wastes (10 to 70 percent) that would be handled as RCRA-hazardous under each scenario. Estimated costs for the Subtitle C scenario ranged between \$1 billion and \$6.5 billion without including land-ban and corrective action costs.

Production declines related to these increased waste management costs could range up to 12 percent in the year 2000. Other impacts also varied greatly under different scenario assumptions. Net impacts on oil prices per barrel could range up to \$0.76 per barrel, with projected maximum costs to consumers of \$4.5 billion per year, and increases in the U.S. balance of payments deficit of up to \$11 billion.

A significant part of any overall economic impact of new requirements would be their effects on stripper wells. Stripper operations (generally, wells producing 10 or fewer barrels of oil per day during the declining phase of their production cycle) cumulatively contribute about 14 percent of total domestic oil production. Generation of production wastes by strippers is more significant than would be expected, however, because many strippers produce very high ratios of water to oil. Many stripper operations are economically marginal and are thus highly sensitive to small fluctuations in market prices and cannot easily absorb additional costs for waste management. Stripper operations, therefore, constitute a special subcategory of the crude oil and natural gas industry and should be given special consideration when developing recommendations for improvements in the management of crude oil and natural gas wastes. At the same time, any additional regulations must recognize the great diversity that exists within the stripper industry. The nature of stripper operations is dependent on the volume of crude oil, natural gas and wastes generated, the age of the well, the technology in use, geological, environmental, and economic considerations, and types of ownership. For example, a family-owned stripper well in a century-old field in Appalachia bears little resemblance to a field of stripper wells owned by a single large petrochemical company in California. Regulations governing wastes generated by stripper wells must be tailored to meet this great diversity.

B. Legal Authority

Section 3001(b)(2)(B) of RCRA requires EPA to determine either to promulgate regulations under Subtitle C for oil, gas, and geothermal energy wastes, or that such regulations are

"unwarranted." This section thus gives EPA broad discretion both to identify what factors to consider and to determine what balance of factors permit the conclusion that Subtitle C regulations are unwarranted.

EPA has concluded that its decision whether to regulate oil, gas and geothermal energy waste under Subtitle C should be based not just on whether that waste is hazardous (as currently defined by EPA regulations) but also on a consideration of the other factors section 8002(m) required EPA to study. The basis of this conclusion is the language of section 3001(b)(2)(B), which states that in making the regulatory determination " the Administrator shall utilize the information developed or accumulated pursuant to the study required under section 8002(m)." Clearly, Congress envisioned that the determination would be based on all the considerations stated in section 8002(m).

In reviewing sections 3001(b) and 8002(m), together with the legislative history of these provisions, EPA has concluded that Congress believed certain considerations to be particularly important to the regulatory determination. First, Congress instructed EPA to study the potential dangers to human health and the environment from oil, gas and geothermal energy waste, indicating that any decision to regulate under Subtitle C must be based on a finding of such danger. Second, section 8002(m) required EPA to study "the adequacy of means and measures currently employed by * * * Government agencies * * * to dispose of and utilize such wastes and to prevent or substantially mitigate such adverse effects." The section also permits EPA to review the actions of other Federal agencies, "with a view toward avoiding duplication of effort," and requires the Agency to include in its report of the study "recommendations for Federal and non-Federal actions concerning" the effects of oil, gas and geothermal energy wastes on health and environment. Thus, Congress was concerned that regulations under Subtitle C should not be promulgated "until further information is developed to determine whether a sufficient degree of hazard exists to warrant additional regulations and whether existing State or Federal programs adequately control such hazards." S. Rep. No. 172, 96th Cong., 1st Sess. (1979), at 6. Congress apparently believed that EPA should not impose Subtitle C regulation unless other programs could not adequately control any hazards identified.

In addition, Congress instructed EPA to analyze fully the disposal practices of the industry, including present practices, alternatives, the cost of alternatives, and the impact of alternatives on the exploration for, and development and production of, crude oil and natural gas and geothermal energy. Thus, EPA was required to consider the impact of Subtitle C regulations on existing hazardous waste facilities, and both the cost and impact of such regulations on the oil, gas and geothermal industries. Clearly, Congress believed that Subtitle C regulation would be unwarranted if it had severe impacts on the nation's future energy production capabilities.

C. Conclusions of the Report to Congress and Response to Comments

Based on the study done by EPA, the Report to Congress developed a number of initial general conclusions. Extensive comments were received on these conclusions. A summary of the comments and EPA's response follows each conclusion (underlined statements) below.

1. *Available waste management practices vary in their environmental performance.* Some individuals argued that since crude oil and natural gas operations vary significantly across the country, Federal regulations could not be effectively enforced or applied, and would therefore not be beneficial. Other commenters focused on local issues and regional environmental problems, calling for increased Federal regulations to solve them. Still others observed that the crude oil and natural gas industry does not manage its "hazardous" wastes in the same manner as other industries manage similar hazardous wastes.

The Agency acknowledges that there are valid reasons for differences in practices among areas. This points to a need for individual, tailored regulations at the State and local level for the management of these wastes, rather than a RCRA Subtitle C program. The Agency also agrees, however, that there may be a need for minimum Federal standards covering basic waste management practices. The Agency agrees that because of the large volumes of these wastes, along with the other factors discussed in the report, some crude oil and natural gas wastes require different disposal methods than may be used for management of wastes generated by other industries.

2. Any program to improve management of oil and gas wastes in the near term will be based largely on technologies and practices in current use. Commenters agreeing with this conclusion asserted that existing technologies are adequate and that new technologies would be economically infeasible and would serve no valid purpose. Others, especially those concerned with issues in Alaska, believe that many new technologies are available but seldom used and called for their increased use. A few State regulatory agencies called for increased technical assistance and guidance from EPA.

The Agency continues to believe that there are very few techniques that are not in use under some conditions. There is, however, a need to disseminate knowledge and encourage or perhaps require adoption of improved methods nationwide. States and the industry should continue to develop, refine, and encourage the implementation of new and improved waste management techniques.

3. Increased segregation of waste may help improve management of oil and gas wastes. Many commenters strongly opposed the proposal for segregation of wastes and believed that the scope of the exemption in RCRA section 3001 should be construed to include, and should be maintained for, all associated wastes in addition to the currently exempt large-volume wastes. Many commenters asserted that mixing various wastes with produced water prior to injection is environmentally safe and economically beneficial. Other commenters argued that each waste stream generated by the crude oil and natural gas industry should be tested separately to determine its RCRA characteristics and that wastes determined to be hazardous according to RCRA definitions should remain segregated and be disposed of according to RCRA regulations. Some individuals claimed that many hazardous wastes generated by the crude oil and natural gas industry are commingled with nonhazardous wastes prior to landspreading or injection, causing significant environmental damage.

The Agency believes that under certain circumstances waste segregation is technically and economically feasible and environmentally desirable.

4. Stripper operations constitute a special subcategory of the oil and gas industry. Many commenters strongly agreed with this conclusion, stating that new or additional Federal regulations would be financially harmful to already economically ailing stripper well operators. Other commenters were of the opinion that some stripper wells can cause significant environmental damage, which must ultimately be paid for through general taxes. Some commenters urged that stripper operations should be treated in the same manner as the rest of the crude oil and natural gas industry.

As previously described, the agency recognizes that many, though not all, stripper operations are economically vulnerable to any new regulatory burdens. Stripper wells in many parts of the country are also associated with smaller, independent oil and gas companies that do not have flexibility in pricing and may suffer disproportionate economic impacts from any additional regulation. The Agency is required under the Regulatory Flexibility Act to evaluate impacts of any new regulations on small business enterprises.

5. *Documented damage cases and quantitative modeling results indicate that, when managed in accordance with State and Federal requirements, exempt oil and gas wastes rarely pose significant threats to human health and the environment.* Opinion on this conclusion was sharply divided. Some commenters strongly agreed, saying that State regulations are fully adequate to control crude oil and natural gas operations and challenged the validity of a few selected damage cases. Others strongly opposed this conclusion, saying that State and Federal regulations are inadequate and seldom enforced. A number of commenters stated that many documented damage cases were omitted from the final Report to Congress. Some commenters provided studies and analytical data alleging environmental damage from crude oil and natural gas wastes; others claimed that the risk modeling conducted for the Report underestimated damage to the environment and did not adequately characterize the significance of human health risks from crude oil and natural gas wastes.

A number of comments were received on the quantitative risk modeling on which this conclusion is partly based. Criticisms included:

- The quantitative risk modeling should not have been performed at all because of the severe lack of suitable data.
- The risk analysis is fatally flawed because it used nonconservative assumptions.
- Values for input parameters used in the liner location model (LLM) have been developed on the basis of limited data, worst-case assumptions, or modeling limitations.
- The study underestimates toxicity because too much of the sampling was performed on diluted and weathered crude oil and natural gas wastes.
- Very few of the contaminants at the waste sites were analyzed.
- EPA made no effort to correlate its quantitative risk model with the actual damage cases.
- The health-based standards incorporated in the model are insufficiently documented.
- TCLP extractions used in risk modeling for reserve pits misrepresent conditions at pits.
- Risk is overestimated in the risk analysis.

The Agency believes the damage cases in the Report to Congress demonstrate that violations of existing State and Federal requirements lead to most observed damages, although some damages have been shown to result from practices currently allowable in some States. The risk assessment also showed little risk at most locations from the management practices that were analyzed. The Agency believes from the available evidence that State regulations are generally but not entirely adequate for management of crude oil and natural gas wastes. Additionally, enforcement of and compliance with State regulations vary widely from State to State.

With respect to the specific criticisms of the risk modeling, the Agency disagrees that the modeling should not have been performed because of a severe lack of suitable data. Extensive data were gathered from a variety of sources, including EPA field investigation and waste sampling study, numerous Federal and State agencies, an industry survey conducted by API, comments submitted on interim reports and given during peer review meetings, over

300 topographic maps, automated data bases, and a general literature review. The Agency believes these data are the best available and that they adequately support a risk assessment.

As with any detailed modeling study, a number of assumptions in the risk assessment had to be made, sometimes with respect to values used for model inputs. The Agency rejects the notion, however, that the assumptions made were generally worst-case, significantly nonconservative, or driven only by modeling limitations. For most variables, several realistic representative values were selected to evaluate a variety of circumstances. Whenever assumptions were made, best available data and professional judgment were used and proposed approaches were subjected to peer review, and often outside public review. As noted in the above comments, some of the assumptions tended to result in either overestimates or underestimates of risk. While over- and underestimates are inevitable in any predictive modeling, the Agency believes their impacts on this study have been minimized by (1) analyzing risks under a wide range of conditions across the industry as a whole, in an attempt to even out over- and underestimates of risk for any single scenario; and (2) fully documenting each assumption and its likely effect on risk estimates.

The Agency disagrees that the waste characterization used in the risk assessment was inappropriate. Many of EPA's samples of drilling waste were taken from open reserve pits where the waste could have been "weathered", but these samples were not purposefully diluted and are believed to be representative of drilling waste as it exists in a reserve pit. Contrary to the above comment, all of the contaminants detected in drilling pit waste and produced water were reviewed and considered as candidates for the risk assessment. The eight constituents selected for quantitative modeling were the constituents judged most likely to contribute most significantly to risk to health or the environment. The selection of contaminants for quantitative modeling was based on their frequency of detection, concentration, inherent toxicity, and mobility and persistence in the environment. Finally, the Agency used TCLP extraction results only to model leachate from closed reserve pits (not from operating pits). While uncertainties concerning the applicability of TCLP tests to leachability of reserve pit wastes are acknowledged, the Agency believes the TCLP results were the best data available for modeling this leachate.

The Agency did not attempt to correlate the risk modeling with the damage cases because the risk assessment was intended to complement the damage cases by focusing on different issues. Specifically, the risk assessment analyzed potential current and future effects assuming compliance with a limited subset of typical existing regulations, whereas the damage cases covered past and current effects, many of which were for incidents involving regulatory violations. The risk assessment also focused on more subtle or very long-term impacts, some of which possibly would not be evidenced in the contemporary damage case file. In addition, several of the damage cases represented situations (e.g., releases through abandoned boreholes) that could not be modeled adequately given existing data and modeling techniques. Other scenarios not modeled include annular deposits, storage of produced water in surface impoundments, migration of produced water contaminants through fractures, and landspreading. (Use of impoundments for produced waters and landspreading are both still frequently practiced.)

The Agency believes that the health-based standards incorporated in the risk model incorporated the best available scientific knowledge at the time of the study. These standards and the studies that support them were summarized only briefly in the Report to Congress; readers are referred to the two-volume technical background report on risk assessment for more detail.³

6. Damages may occur in some instances even where wastes are managed in accordance with currently applicable State and Federal requirements. No comments specifically addressed this conclusion, but comments on the previous conclusion relate in part to the substance of this one.

The quantitative risk modeling showed that for the specific management practices and scenarios modeled, a few crude oil and natural gas sites (less than five percent) could pose significant risks even if drilling waste and produced water were managed in accordance with existing regulations. In addition, the damage case results indicate that some waste management practices permitted in some States can have undesirable environmental impacts. These practices include landspreading of high chloride drilling mud, annular disposal of produced water, discharge of produced water and drilling fluids to tidally affected wetlands, discharge of produced water to live streams, and discharge of reserve pit contents to tundra.

7. Unplugged and improperly plugged abandoned wells can pose significant environmental problems. Opinion on this conclusion was divided. Many of the commenters asserted that there is no evidence to support this conclusion, and that State regulations adequately address the potential problems associated with unplugged and improperly plugged and abandoned wells. Others felt that it is economically infeasible to plug or re-plug abandoned wells properly. Conversely, commenters agreeing with this conclusion mentioned specific instances in which unplugged wells have caused significant contamination of ground-water supplies. Some State regulatory agencies commented that inadequate funds are available to properly plug all abandoned wells.

The Agency believes there is adequate evidence to indicate a potential threat to ground water from unplugged and improperly plugged abandoned wells based on the large number of unplugged or improperly plugged abandoned wells, the difficulty in observing plugging of abandoned wells, and the difficulty in enforcing State regulations on plugging of abandoned wells. The damage cases collected and the information presented to the Agency support this conclusion. The Agency recognizes that the full extent of the problem is not well defined. The Agency also recognizes that high costs could be incurred if all unplugged or improperly plugged abandoned wells were required to be plugged, and that such a requirement may not be necessary, as not all unplugged or improperly plugged abandoned wells pose a problem.

8. Discharges of drilling muds and produced waters to surface waters have caused locally significant environmental damage where discharges are not in compliance with State and Federal statutes and regulations or where NPDES permits have not been issued. Comments were divided on this issue even among those who were critical of similar conclusions; some agreed, while others stated that there is no evidence that drilling muds or produced water cause environmental damage. Some stated that both drilling muds and produced water are relatively nonhazardous and nontoxic. Several comments specific to Alaska stated that the Clean Water Act adequately regulates the management of large-volume wastes in Alaska.

Those agreeing with this conclusion often argued that current State and Federal regulations are not adequate or are not enforced properly. They also asserted that drilling muds and produced waters contain RCRA hazardous constituents and have caused significant environmental damage.

Documented damage cases indicate that disposal of drilling muds and produced waters in violation of State regulations and where NPDES permits have not been issued, has clearly caused damages to the environment and endangered human health, particularly in Alaska, the Gulf Coast and the Appalachian States. Also, discharges of produced water from stripper well to

surface waters were estimated to cause cancer risks greater than one in one hundred thousand in roughly 17 percent of the conservative cases studied in the quantitative risk modeling for 90th percentile produced water constituent concentrations.

9. *For the nation as a whole, regulation of all oil and gas field wastes under unmodified Subtitle C of RCRA would have a substantial impact on the U.S. economy.* Those agreeing with this conclusion did so strongly, stating that RCRA regulations applied to the crude oil and natural gas industry would cause the loss of a significant number of jobs. Some said that RCRA regulation would increase oil imports and pose a threat to national security. Others claimed that the potential costs to industry have been underestimated.

Those in favor of regulating wastes determined to be RCRA-hazardous generally recognized the potential economic impacts of regulation, but nevertheless believed that such wastes should be disposed of consistent with RCRA Subtitle C requirements.

In specific comments on the methodologies used to analyze these issues, some commenters believed that the lower 48 State model masks or understates costs and impacts in some regions, and that data limitations and exclusions of some costs lead to understated economic impacts in all scenarios. Some commenters stated that the number of economically marginal wells that would be forced to shut down if RCRA Subtitle C regulations were imposed has been underestimated, and that certain assumptions in the model are unrealistic. Some commented that the analysis ignores impacts on undiscovered energy reserves and gas production.

Taking the opposite point of view, other commenters argued that the cost analysis ignores public health costs associated with continued improper disposal of crude oil and natural gas wastes, and that the report does not take into account the financial consequences of contamination of ground water and other natural resources. Some claimed that long-term financial burdens to taxpayers to mitigate environmental damage, to provide health care, and to sustain financial burden from lost productivity, will be greater than the cost to the crude oil and natural gas industry to prevent that damage.

The Agency believes that its estimates of impacts to the industry of full regulation under RCRA Subtitle C are reasonable and that such impacts would be substantial. The Agency acknowledges that costs related to public health effects and contamination of ground water and other natural resources because of improper disposal of crude oil and natural gas wastes have not been determined.

10. *Regulation of all exempt wastes under full, unmodified RCRA Subtitle C appears unnecessary and impractical at this time.* Opinion was divided on this conclusion. Those agreeing did so strongly, while those opposed generally stated that if a waste is RCRA hazardous, it should be treated under RCRA regulations regardless of its origin. Many of those in disagreement with this conclusion argued that the crude oil and natural gas industry can afford the financial burden of RCRA regulation.

For reasons described in Section IV of this regulatory determination, the Agency continues to believe that regulation of all crude oil and natural gas wastes under RCRA Subtitle C is unnecessary and impractical. The Agency believes that these wastes can be managed in a manner so as to protect human health and the environment without regulating them under RCRA Subtitle C.

11. *States have adopted variable approaches to waste management.* Most commenters agreed with this conclusion, but there was considerable disagreement over whether current State regulations are adequately designed and enforced.

Variable approaches to waste management are partly the result of varying environmental conditions, geology, and economics among the producing States. EPA believes, however, that there are many cases where more stringent requirements are both feasible and desirable, and that many States have recognized this in changes made to their regulations in the last few years. Some States have taken significant leadership roles in the development of more environmentally protective requirements.

12. Implementation of existing State and Federal requirements is a central issue in formulating recommendations in response to section 8002(m). Opinion was divided on this conclusion. Some commenters urged that existing State and Federal regulations are adequate and that additional State or Federal regulations are unnecessary and impractical. Others argued that existing State and Federal regulations have not been adequately enforced and that additional Federal regulations are necessary.

The Agency believes that the design, enforcement, and implementation of existing State and Federal regulations can clearly be improved.

Public comments on the Geothermal Energy Portion of Report to Congress: Only two comments specifically addressed geothermal energy wastes.

One commenter presented additional information relating to damages resulting from the offsite disposal of geothermal energy production wastes (such as hydrogen sulfide abatement wastes which test nonhazardous by California standards) in commercial facilities. The information alleged potential damages and/or risk by contamination of surface and ground water from the disposal of hydrogen sulfide abatement wastes in centralized or commercial disposal facilities in California. These facilities are designated strictly for the disposal of geothermal energy production wastes determined to be nonhazardous by California standards.

The other commenter specifically addressing geothermal energy, fully supported the conclusions of the report and stated that the California statutes regarding the management of geothermal energy wastes are comprehensive and effective.

The Agency continues to believe that geothermal energy wastes are generally well regulated under existing State and Federal programs. However, the Agency acknowledges that at least one significant undesirable disposal practice is occurring and has taken this into consideration in making this final regulatory determination.

D. Determination of the Scope of the Temporary RCRA Exemption

Based on the language of RCRA section 3001(b)(2)(A) of the 1980 amendments to RCRA, review of the statute, and supporting legislative history, the Agency believes that the following wastes were included in the temporary exemption set forth in the statute.

- Produced water;
- Drilling fluids;
- Drill cuttings;
- Rigwash;
- Drilling fluids and cuttings from offshore operations disposed of onshore;

- Geothermal production fluids; and
- Hydrogen sulfide abatement wastes from geothermal energy production.
- Well completion, treatment, and stimulation fluids;
- Basic sediment and water and other tank bottoms from storage facilities that hold product and exempt waste;
 - Accumulated materials such as hydrocarbons, solids, sand, and emulsion from production separators, fluid treating vessels, and production impoundments;
 - Pit sludges and contaminated bottoms from storage or disposal of exempt wastes;
 - Workover wastes;
 - Gas plant dehydration wastes, including glycol-based compounds, glycol filters, filter media, backwash, and molecular sieves;
 - Gas plant sweetening wastes for sulfur removal, including amines, amine filters, amine filter media, backwash, precipitated amine sludge, iron sponge, and hydrogen sulfide scrubber liquid and sludge;
 - Cooling tower blowdown;
 - Spent filters, filter media, and backwash (assuming the filter itself is not hazardous and the residue in it is from an exempt waste stream);
 - Packing fluids;
 - Produced sand;
 - Pipe scale, hydrocarbon solids, hydrates, and other deposits removed from piping and equipment prior to transportation;
 - Hydrocarbon-bearing soil;
 - Pigging wastes from gathering lines;
 - Wastes from subsurface gas storage and retrieval, except for the nonexempt wastes listed below;
 - Constituents removed from produced water before it is injected or otherwise disposed of;
 - Liquid hydrocarbons removed from the production stream but not from oil refining;
 - Gases from the production stream, such as hydrogen sulfide and carbon dioxide, and volatilized hydrocarbons;
 - Materials ejected from a producing well during the process known as blowdown;
 - Waste crude oil from primary field operations and production; and

- Light organics volatilized from exempt wastes in reserve pits or impoundments or production equipment.

The Agency believes that the following wastes were not included in the original exemption:

- Unused fracturing fluids or acids;
- Gas plant cooling tower cleaning wastes;
- Painting wastes;
- Oil and gas service company wastes, such as empty drums, drum rinsate, vacuum truck rinsate, sandblast media, painting wastes, spent solvents, spilled chemicals, and waste acids;
- Vacuum truck and drum rinsate from trucks and drums transporting or containing non-exempt waste;
- Refinery wastes;
- Liquid and solid wastes generated by crude oil and tank bottom reclaimers;
- Used equipment lubrication oils;
- Waste compressor oil, filters, and blowdown;
- Used hydraulic fluids;
- Waste solvents;
- Waste in transportation pipeline-related pits;
- Caustic or acid cleaners;
- Boiler cleaning wastes;
- Boiler refractory bricks;
- Boiler scrubber fluids, sludges, and ash;
- Incinerator ash;
- Laboratory wastes;
- Sanitary wastes;
- Pesticide wastes;
- Radioactive tracer wastes;
- Drums, insulation, and miscellaneous solids.

In order to determine the scope of the exemption, the Agency reviewed the statute and legislative history. The Agency interprets the term "other wastes associated" to include rigwash, drill cuttings, and wastes created by agents used in facilitating the extraction, development and production of the resource, and wastes produced by removing contaminants prior to the transportation or refining of the resource. Drill cuttings and rigwash are generally co-mingled with drilling muds, and the Agency therefore has grouped them with large-volume wastes for purposes of discussion in this determination. The remaining wastes on the above list of exempt wastes are considered "associated wastes" for purposes of this determination.

The Agency has determined that produced water injected for enhanced recovery is not a waste for purposes of RCRA regulation and therefore is not subject to control under RCRA Subtitle C or RCRA Subtitle D. Produced water used in enhanced recovery is beneficially recycled and is an integral part of some crude oil and natural gas production processes. Produced water injected in this manner is already regulated by the Underground Injection Control program under the Safe Drinking Water Act. The Agency notes, however, that if the produced water is stored in surface impoundments prior to injection, it may be subject to RCRA Subtitle D regulations.

III. Factors Considered in Regulatory Determination

Section 3001(b)(2)(B) of RCRA states that in making the regulatory determination, the Agency must "utilize the information developed or accumulated pursuant to the study required under section 8002(m)." Clearly, Congress envisioned that the determination would be based on all factors specifically enumerated in section 8002(m), as well as general issues raised by the text of section 8002(m) as a whole. Therefore, in making today's determination, EPA considered not just the impact of these wastes on human health and the environment, but also the other factors that RCRA section 8002(m) required EPA to study.

Specifically, EPA considered three major factors in developing this determination: (1) The characteristics, management practices, and impacts of oil, gas, and geothermal wastes on human health and the environment; (2) the adequacy of existing State and Federal regulatory programs for controlling these wastes; and (3) the economic impacts of any additional regulations on the exploration for, and development and production of, crude oil, natural gas, and geothermal energy. Section 8002(m) required EPA to study each of these factors.

IV. Regulatory Determination for Crude Oil and Natural Gas Wastes

The following discussion summarizes information on the three major factors (discussed above) used in making this regulatory determination and then presents EPA's conclusions and rationale for the regulatory determination for crude oil and natural gas wastes. The information summarized here incorporates information received during the public comment period and additional refinement of the data presented in EPA's December 1987 Report to Congress.

A. Hazard Assessment

For the Report to Congress, EPA conducted a limited analysis which modeled the potential effects of disposal of drilling waste in reserve pits and the disposal of produced water by underground injection and found that the potential risks to human health and the environment were small. Only a few constituents appeared to be of major concern when these wastes are managed in accordance with existing State and Federal regulations. The actual threats posed were largely dependent upon site-specific factors such as populations or sensitive ecosystems.

Other management practices such as storage of produced water in unlined pits were not modeled and may pose higher risks.

Analysis of field data collected by EPA and presented in the January 1987 technical report shows that a portion of oil and gas wastes contain constituents of concern above EPA health- or environmental-based standards. For example, wastes at 7 percent of the sites generating drilling fluids and 23 percent of the statistically weighted sample sites generating produced water contain one or more of the toxic constituents of concern at levels greater than 100 times the health-based standards. The constituents typically exceeding the standards in drilling fluids are fluoride, lead, cadmium, and chromium. The constituents exceeding the standards in produced water are benzene, arsenic, barium, and boron. In addition, wastes at 78 percent of the sample sites generating drilling fluids, and 75 percent of the sample sites generating produced water, contain chlorides at levels greater than 1,000 times the EPA secondary maximum contaminant level for chloride. Like large-volume wastes, associated wastes contain a wide variety of hazardous constituents. Many associated wastes contain constituents that are similar in chemical composition and/or toxicity to other wastes currently regulated under RCRA Subtitle C.

The presence of constituents in concentrations exceeding health- or environmental-based standards does not necessarily mean that these wastes pose significant risks to human health and the environment. In evaluating the risks to human health and the environment, several factors beyond the toxicity of the waste should be considered. These factors include the rate of release of contaminants from different management practices, the fate and transport of these contaminants in the environment, and the potential for human health or ecological exposure to the contaminants.

On the basis of available data, EPA can only roughly estimate how much currently exempt oil and gas waste would be considered hazardous under current or proposed RCRA Subtitle C standards. It is clear that some portions of both the large-volume and associated waste would have to be treated as hazardous if the Subtitle C exemption were lifted. EPA estimates that approximately 10 to 70 percent of large-volume wastes and 40 to 60 percent of associated wastes could potentially exhibit RCRA hazardous waste characteristics under EPA's regulatory tests.

EPA has documented 62 damage cases caused by crude oil and natural gas wastes. Because large-volume wastes and associated wastes are often managed and disposed of together, it is often difficult to isolate the specific waste stream that contributed greatest to the damage. However, available data does not indicate that significant damage can occur from mismanagement of both large-volume wastes and associated wastes. EPA believes that most of these damages could have been prevented if the wastes had been managed in accordance with existing State and Federal requirements. However, because of certain regulatory gaps, damages have occurred even where wastes are managed in compliance with existing requirements.

B. Economic Impact Analysis

Application of RCRA Subtitle C to exploration, development, and production wastes could be extremely costly if large portions of these wastes were hazardous. The Agency estimates that implementation of RCRA Subtitle C on 10 to 70 percent of the large-volume drilling waste and non-EOR produced water would cost the industry and consumers \$1 billion to \$6.7 billion per year in compliance costs (not including costs for land ban or corrective action regulations mandated by Congress). This would reduce domestic production by as much as 12 percent.

In response to questions raised subsequent to the Report of Congress, the Agency also conducted a preliminary evaluation of the likely range of potential compliance costs and industry impacts that could result from removal of the RCRA Subtitle C exemption for associated wastes. The Agency's preliminary estimate is that the cost to the crude oil and natural gas industry of RCRA Subtitle C management for associated wastes would range between \$200 million and \$550 million per year. These cost estimates are based on American Petroleum Institute survey estimates on the quantities of associated wastes produced and their current management practices, together with the Agency assumption that 40 to 60 percent of these wastes might require management under RCRA Subtitle C, and Agency estimates of the probable range of unit costs for managing these various waste types.

However, it is important to note that these estimates do not include the cost of corrective action. The application of corrective action requirements to facilities that manage associated wastes on-site would impose substantial costs on the units managing the associated wastes as well as any other solid waste management units that exist within the facility boundaries to the extent that the wastes continue to be managed on-site. Since nearly half of the associated wastes are currently managed on-site, this could result in significant costs to the industry. The cost estimates also assume that "land-ban" treatment of hazardous solids and sludges consists of recycling and resource recovery. It is likely that some fraction of these wastes would need to be incinerated in compliance with the treatment standards established by the "land-ban," implying higher costs of regulating the associated wastes under Subtitle C.

C. Adequacy of State and Federal Regulatory Programs

EPA evaluated State regulations pertaining to large-volume wastes and associated wastes. Often, some of these wastes are co-mingled and disposed of together. Consequently, they are usually managed together under one regulatory program at the State level.

With regard to large-volume wastes, EPA found most existing State regulations are generally adequate for protecting human health and the environment. Most States have requirements specifically controlling the management of drilling muds and produced waters. However, certain gaps do exist in State regulations for large-volume wastes. For example, some States do not have adequate requirements controlling roadspreading or landspreading of large-volume wastes, design or maintenance rules for reserve pits, or have insufficient management specifications for centralized and commercial disposal facilities. As noted previously, EPA also found damages which occurred due to surface discharges not prohibited by State regulation.

Another regulatory gap for some States are controls for associated wastes. Most State regulations do not include specific controls for the management of these wastes. General standards are often difficult to enforce unless a specific pollution incident is discovered and can be attributed to a particular waste disposal event. However, a few States such as Texas do specifically address associated wastes and other States have general standards that provide partial control of these wastes.

The Agency has examined changes in State regulatory programs over the past two years. Some States have improved their regulations, while other States have relaxed specific waste management requirements. For example, while reserve pit management has been strengthened in some States, other States have relaxed controls pertaining to land application of large-volume wastes. Problems also remain regarding adequate State implementation and enforcement of existing regulations.

The Agency also evaluated the Federal Underground Injection Control (UIC) program under the Safe Drinking Water Act and regulatory programs under the Clean Water Act. The UIC program

effectively controls underground injection from the point of the wellhead, while the NPDES program addresses point source discharges to surface water bodies. These programs are particularly important in controlling management of large-volume wastes. However, EPA has identified certain gaps in these programs. For example, UIC regulations currently allow the practice of annular disposal and lack uniform mechanical integrity testing standards. The Clean Water Act regulatory program gaps include the lack of national effluent limitations at the Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) levels. These national limitations are needed to more effectively deal with discharges from facilities in the onshore and coastal subcategories of the industry. EPA also found that improvements are needed regarding implementation and enforcement of existing regulations. The Agency has already undertaken steps to address these deficiencies; these are discussed in Section V of today's notice.

Finally, EPA evaluated the existing Federal criteria under Subtitle D of RCRA. These criteria (40 CFR Part 257) include general environmental performance standards applicable to the disposal of any solid waste, including oil, gas, and geothermal wastes. These criteria include among other things, standards related to surface water discharges, ground-water contamination, and endangered species. Because the programs' criteria are aimed principally at municipal solid waste, EPA believes they do not now fully address oil and gas waste concerns. In addition, many of these criteria, such as control of disease vectors and aviation hazards, are not appropriate for oil and gas waste. Nevertheless, EPA has authority under Subtitle D to tailor requirements appropriate for the disposal of oil and gas wastes.

D. Conclusions

The Agency has decided not to promulgate regulations under Subtitle C for large-volume and associated wastes generated by the exploration, development and production of crude oil and natural gas. The Agency decision is based on the following reasons:

(1) Subtitle C contains an unusually large number of highly detailed statutory requirements, some of which are not only extremely costly, but also are unnecessary for the safe management of oil and gas wastes. Subtitle C does not, however, allow the Agency to consider costs where applying these requirements to oil and gas wastes. Consequently, EPA would not be able to craft a regulatory program to reduce or eliminate the serious economic impacts that it has predicted. Thus, in light of Congress' concern for the protection of the nation's future energy supply, Subtitle C regulations must be considered unwarranted. A tailored Subtitle D program, by contrast, will enable the Agency to apply all necessary requirements to the management of these wastes, while ensuring that economic impacts are minimized.

(2) As discussed in Section II. B., Congress has indicated that Subtitle C regulations are unwarranted where existing programs can be employed to protect human health and the environment from the problems created by oil and gas wastes. EPA has concluded that, in fact, existing State and Federal programs are generally adequate, and that remaining gaps can be filled by modifying these programs. Subtitle C regulation is, therefore, unwarranted. Moreover, Subtitle C, with its comprehensive "cradle to grave" management requirement, simply is not well suited to this type of gap-filling regulation. It is thus both more efficient and appropriate to fill the gaps by strengthening regulations under the Clean Water Act and UIC program and promulgating the remaining rules needed under RCRA under the less prescriptive statutory authorities set out in Subtitle D.

(3) Since the States and EPA have consistently required long periods of time to process Subtitle C permits, regulation under Subtitle C could delay the start of operations at new facilities.

These delays would be particularly disruptive to the exploration phase of oil and gas development.

(4) Subtitle C regulation of these wastes would subject them to all of the land disposal restriction requirements, including BDAT, and thus could severely strain existing Subtitle C facility capacity.

(5) The Agency believes that it is impractical and inefficient to implement Subtitle C for all or some of these wastes because of the disruption and, in some cases, duplication of State authorities that administer programs through organizational structures tailored to the oil and gas industry.

(6) It is impractical and inefficient to implement Subtitle C for all or some of these wastes because of the permitting burden that the regulatory agencies would incur if even a small percentage of these sites were considered Treatment, Storage and Disposal Facilities (TSDFs).

V. Efforts to Improve State and Federal Programs

The Agency plans a three-pronged approach toward filling the gaps in existing State and Federal programs that regulate the management of wastes from the crude oil, and natural gas, industries. This effort will include:

1. Improving Federal programs using existing authorities under Subtitle D of RCRA and the Clean Water and Safe Drinking Water Acts;
2. Working with the States to encourage changes in their regulations and enforcement programs to achieve more uniformity in the administration of their programs; and
3. Working with Congress to develop any additional statutory authority that may be required.

A. Federal Program Improvements Within Existing Authorities

1. Clean Water and Safe Drinking Water Act Programs

The Agency believes certain improvements in the Safe Drinking Water and Clean Water Acts are desirable with respect to their application to crude oil and natural gas wastes. In the case of the UIC program, the Agency had previously determined that a critical examination of the overall program was in order. The program has now been in effect for approximately 5 years or more, depending on when a State program was approved or a Federal program was promulgated in a State. This examination, currently underway, includes a review of the adequacy of the regulations and policies governing the program and of the way in which States and EPA Regions are implementing and enforcing the program. The review of the adequacy of State implementation is complex because approval of State programs was, by statute, governed by a determination of their effectiveness in protecting underground sources of drinking water, rather than by their conformity with minimum Federal regulations.

Implementation of the UIC program by the EPA Regions is undergoing a peer review process, which will be completed by the fall of 1988. Implementation of the State programs is reviewed routinely by the EPA Regions. In addition, the EPA's Office of Drinking Water has undertaken a cycle of in-depth reviews of the UIC program. The California, Texas, and Kansas programs were reviewed in 1987. A review of Wyoming and at least one other State, not yet selected, will be conducted in 1988. The States have also undertaken a peer review project directed by the Underground Injection Practices Council.

The Agency has formed a workgroup, which will include participation by the States and other Federal agencies, to review issues pertinent to the UIC regulations. The strategy for this review is available in the RCRA docket. A final report and the recommendations of the workgroup are expected to be available in the winter of 1988-89.

In conjunction with the Clean Water Act, the Agency is currently developing national discharge regulations for the offshore crude oil and natural gas industry and is planning for the development of national discharge regulations for the coastal oil and gas industry. The coastal segment generally includes exploration, development and production facilities that are located in or adjacent to tidal wetlands. These regulations will cover the discharges of produced water, drilling fluids, drill cuttings and various low-income waste streams to surface waters of the U.S. The regulations will address the best available technology (BAT), best conventional technology (BCT) and new source performance standards (NSPS) levels of control. These regulations may result in a prohibition on the discharge of a significant portion of high volume drilling wastes (drilling fluids and cuttings) into U.S. offshore waters. As such, these wastes will be transported to shore by the offshore operators for land disposal. These wastes would then be subject to regulation under RCRA Subtitle D.

The Agency is also planning to begin development of national effluent regulations for onshore stripper oil and gas production. The onshore stripper well regulations will cover the discharges of produced water and well treatment wastes to surface waters of the U.S. These regulations will be established at increasing levels of stringency compared to the best practicable technology (BPT) level of control. Non-stripper wells located onshore are already subject to a "zero-discharge" requirement under NPDES.

22. RCRA Subtitle D Approach

(a) General Approach. EPA believes it can design and implement a program specific to crude oil and natural gas wastes under Subtitle D of RCRA that effectively addresses the risks associated with these wastes. EPA is already in the process of developing revised Subtitle D criteria for facilities that may receive hazardous household waste or small quantity generator hazardous wastes as well as for mining waste disposal facilities. The Agency intends to augment the Subtitle D program by developing appropriate standards and taking other actions as appropriate for crude oil and natural gas wastes.

In developing these tailored Subtitle D standards for crude oil and natural gas wastes, EPA will focus on gaps in existing State and Federal regulations and develop appropriate standards that are protective of human health and the environment. Gaps in existing programs include adequate controls specific to associated wastes and certain management practices and facilities for large-volume wastes, including roadspreading, landspreading, and impoundments. EPA is particularly concerned about centralized and commercial facilities that treat, store, or dispose of oil field wastes in concentrated form. Pits or impoundments at these facilities often contain hazardous constituents in high concentrations. In addition, centralized facilities are responsible for some of the most significant damages the Agency documented.

To ensure proper control over oil and gas disposal facilities and practices, EPA will consider requirements under Subtitle D such as: (1) Engineering and operating practices, including run-off controls, to minimize releases to surface water and groundwater; (2) proper procedures for closing facilities; (3) monitoring that accommodates site-specific variability; and (4) clean-up provisions. EPA will tailor these standards to the special problems posed by oil and gas waste disposal facilities, as well as incorporate appropriate flexibility to address site-specific variability.

In developing a tailored Subtitle D program for oil and gas wastes, EPA will use its RCRA section 3007 authority to collect any additional information needed on the characteristics and management practices of oil and gas wastes. EPA believes this authority does not limit information collection to "hazardous" waste identified under Subtitle C, but also authorizes the collection of information on any solid waste that the Agency reasonably believes may pose a hazard when improperly managed. (EPA may also use this authority in preparing enforcement actions.)

In specifying the appropriate standards, EPA also will further analyze existing Federal and State authorities and programs and determine future plans for administering their oil and gas waste programs. Additionally, EPA will perform analyses of costs, impacts, and benefits and will comply fully with Executive Orders 12291 and 12498, the Regulatory Flexibility Act, and the Paperwork Reduction Act.

The Agency will specifically consider the impact of future regulations on small business operations in the process of regulatory development under the Agency guidelines with respect to the Regulatory Flexibility Act. The Agency believes that the tailored RCRA Subtitle D regulations can provide the flexibility necessary to reflect the marginal economic nature of certain segments of the industry, while at the same time affording improved environmental protection. For example, the Agency recognizes that many stripper operations are, by their nature, more vulnerable to regulatory burdens imposed by any new controls over crude oil and natural gas wastes, and that many stripper wells are associated with small, non-integrated producers. This is particularly significant in certain producing regions such as Appalachia.

(b) Alaska's North Slope. Tailored standards under Subtitle D will specifically address controls necessary to protect fragile or sensitive environments; one such sensitive environment is the Arctic North Slope. EPA is particularly concerned about the management of crude oil and natural gas wastes in this area, where oil extraction is performed on a very large scale, accounting for roughly 20 percent of total U.S. production. There also exists the likelihood for future development of potentially significant crude oil and natural gas reserves on the North Slope in areas surrounding Prudhoe Bay and areas in the Arctic National Wildlife Refuge.

The Arctic North Slope is particularly sensitive and fragile, with unique geographic and climatic conditions that make its environment fundamentally different from the lower 48 States. The area is primarily an arctic desert, frozen for about 9 months out of the year and underlain by up to 2,000 feet of permafrost. During the summer months, surface water exists in the form of interconnected tundra ponds, which exhibit little or no flow during the summer season. This, in addition to the severity of the climate and the shortness of the growing season, makes the area particularly vulnerable to ecological impacts, or impacts from less than rigorous waste management practices.

There is a lack of long-term historical data on impacts of crude oil and natural gas industry activities on the North Slope. Based on preliminary studies, current waste management practices used on the North Slope pose the potential for environmental degradation. As stated in the Report to Congress, a 1983 U.S. Fish and Wildlife Service study found chromium, arsenic, cadmium, nickel, and barium to be present in tundra ponds adjacent to reserve pits at levels significantly greater than in control ponds. Levels of chromium in adjacent ponds were also found to exceed EPA chronic toxicity criteria, and affected distant ponds were found to contain chromium levels significantly higher than background levels. The authors of this study caution, however, that these findings cannot be extrapolated to present-day oil field practices on the North Slope because some industry practices have changed and the State's regulations have become increasingly more stringent since 1983.

Historically, enforcement of environmental controls on the North Slope has been inadequate. EPA believes this inadequacy has contributed to the use of undesirable waste management practices in some cases. For example, as discussed in the Report to Congress, an incident developed involving an oil field service company that was disposing of drums and waste chemicals in an inappropriate manner. The Agency believes that a greater enforcement presence in addition to improved regulations could prevent such incidents from recurring.

Recently, the State of Alaska has improved waste management regulations pertaining to the North Slope. In addition, some operators plan to implement more desirable waste management practices, including the possibility of phasing out reserve pits through the use of closed drilling systems and injection for waste drilling muds and cuttings. If implemented, these changes would be major improvements in waste management practices on the North Slope.

B. Additional Federal Authorities

EPA is concerned over the lack of Federal authority under Subtitle D of RCRA to address treatment and transportation of oil and gas wastes. The Administrator therefore will work with Congress to develop any additional legislative authorities that may be needed to address these issues. In the interim, EPA will use section 7003 of RCRA and sections 104 and 106 of CERCLA to seek relief in those cases where wastes from oil and gas sites pose substantial threats or imminent hazards to human health and the environment. Oil and gas waste problems can also be addressed under RCRA section 7002 which authorizes citizen lawsuits for violations of Subtitle D requirements in 40 CFR Part 257.

C. Improvement in State Programs

While in the process of completing improvements in the Federal programs, EPA plans to work with the States to improve the content, implementation, and enforcement of existing State regulations. This will be a cooperative effort with voluntary State participation. For example, the Interstate Oil Compact Commission has already begun work in this area and has expressed an interest in cooperating with EPA in this regard. Specifically, the Agency plans to encourage States to take steps to fill the following gaps (where present) in their existing regulatory programs:

- (1) Controls for roadspreading and landspreading;
- (2) Surface impoundment (i.e., pit) location, design, and maintenance;
- (3) Controls for associated wastes; and
- (4) Plugging abandoned oil and gas wells.

According to State officials, many States have tens of thousands of unplugged or improperly plugged abandoned wells. EPA's December 1987 Report to Congress documented ground-water contamination with chlorides from unplugged or improperly plugged abandoned crude oil and natural gas wells and indicated that State requirements for plugging and abandoning crude oil and natural gas wells vary, with inadequacies apparent in some State programs. For example, many States do not require a plugging bond from operators who drill crude oil and natural gas wells. Where bonding is required, the amount is often not adequate to provide for proper plugging once a well is abandoned.

EPA encourages States to develop programs to address abandoned wells. However, the Agency recognizes that locating and identifying these wells is difficult, and sometimes impossible,

because of poor record keeping or the absence of records. Because many unplugged wells are several decades old, the owner or operator often cannot be identified. Some States have plugging funds to use in such circumstances, some do not.

The Agency will also work with States to improve implementation and enforcement of existing State regulations. EPA believes that improvements in enforcement of existing regulations will significantly increase protection of human health and the environment.

EPA will also work closely with the State of Alaska on addressing problems associated with management of crude oil and natural gas wastes on the Arctic North Slope. Because of the remoteness and severe climatic conditions, enforcement is particularly difficult in this area. The Agency will explore with the State of Alaska and the Department of the Interior ways to improve enforcement in this area. The Agency believes operators should continue research into impacts on the environment of their waste management practices. The Agency will develop a list of recommended areas for research in the research, demonstration, and development plan required by RCRA section 8002(m)(2).

VI. Regulatory Determination for Geothermal Energy Wastes

A. Hazard Assessment

There is only a limited record of damages or danger to human health or the environment resulting from the exploration, development, and production of geothermal energy. Based on the limited information available, the Agency has determined that the risk to human health and the environment resulting from the exploration, development, and production of geothermal energy is relatively low. The geothermal energy industry is comparatively small, with a total of 395 wildcat, production, and injection wells drilled between 1981 and 1985. Most geothermal energy production is in California (321 out of 395 wells) and Nevada. It is unlikely that there will be further large-scale development of geothermal energy resources outside of the State of California because the occurrence of accessible geothermal energy is extremely limited.

B. Adequacy of State and Federal Regulations

As indicated in the Report to Congress, the Agency believes that existing State and Federal regulations are generally adequate for controlling wastes from geothermal energy production. However, one public comment on the Report to Congress suggests a possible gap in California's regulatory program addressing these wastes. The commenter documented potential endangerment of human health and damage to the environment because of the disposal of geothermal energy hydrogen sulfide abatement wastes in commercial facilities in California.

C. Conclusions

EPA has decided not to regulate wastes generated by the exploration and development of geothermal energy resources under RCRA Subtitle C. EPA believes that Subtitle C control for these wastes is unwarranted because of the relatively low risk of these wastes and the presence of generally effective State and Federal regulatory programs. Because these wastes are largely confined to California and Nevada, EPA will work closely with these States to address any gaps in their regulatory programs for the management of hydrogen sulfide abatement wastes.

VII. Research, Development, and Demonstration Plan

The Agency will develop a research, development, and demonstration plan based on the findings of the Report to Congress and subsequent public comments on the report. This plan will outline various topics that the Federal and State governments and/or industry could pursue. This plan will include the following topics:

- Alternative waste management technologies;
- Waste minimization techniques;
- Materials substitution;
- Recycling and reuse;
- Reserve pit construction (percolation, leaching, and erosion control issues);
- Plugging and abandonment of crude oil and natural gas wells;
- Better characterization of produced waters and associated wastes generated by stripper crude oil and natural gas wells; and
- Field monitoring to evaluate the adequacy of waste containment practices.

VIII. EPA RCRA Docket

The EPA RCRA docket is located at:

United States Environmental Protection Agency, EPA RCRA Docket (Sub-basement), 401 M Street, SW., Washington, DC 20460.

The docket is open from 9:30 a.m. to 3:30 p.m., Monday through Friday, except for Federal holidays. The public must make an appointment to review docket materials. Call the docket clerk at (202) 475-9327 for appointments.

The following documents related to this regulatory determination are available for inspection in the docket:

- Report to Congress on Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy;
- All supporting documentation for the regulatory determination, including public comments on the Report to Congress and EPA response to comments; and
- Transcripts from the public hearings on the Report to Congress.

Dated: June 29, 1988.

A. James Barnes,
Acting Administrator.

[FR Doc. 88-15097 Filed 7-5-88; 8:45 am]
BILLING CODE

Footnotes:

¹ Associated wastes are those wastes other than produced water, drilling muds and cutting, and rigwash that are intrinsic to exploration, development and production of crude oil and natural gas. See Section II D below.

² It is the Agency's policy to consider Maximum Contaminant levels (MCLs) (established by the Office of Drinking Water) when available. Where an MCL has not been developed, RfDs for noncarcinogens and RSDs for carcinogens will be used to set health-based limits. These terms are defined as follows:

- Maximum Contaminant Level (MCL) is the enforceable drinking water standard, based on health and technical feasibility, attained at the tap. This measure is used when ground water is the main exposure pathway.

- Reference Dose (RfD) is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime." [Integrated Risk Information System (IRIS) Vol. 1, Supplementary Documentation Appendix A, EPA/600/8-86/032A.]

- Risk-Specific Dose (RSD) is the daily dose of a carcinogen received over a lifetime that will result in an incidence of cancer equal to the specific risk level. The risk level of A and B carcinogens is $10E^{-6}$ (1 in 1 million) and for C carcinogens it is $10E^{-5}$ (1 in 100,000). [51 FR 21667, June 13, 1986.] The classes of carcinogens are: Class A = human carcinogen, Class B = probable human carcinogen, Class C = possible human carcinogen. [Both RfDs and RSDs are converted into medium specific concentrations using intake assumptions for selected routes of exposure. They are expressed in mg/kg/day. Surface and ground water (ingestion): 2 liters/day for a 70-kg adult for a 70-year exposure. Air (inhalation): 20 cubic meters air/day for a 70-kg adult for a 70-year exposure.]

³ U.S. EPA, December 1987. Office of Solid Waste. Onshore Oil and Gas Exploration, Development and Production: Human Health and Environmental Risk Assessment.

NOTES

APPENDIX B

CLARIFICATION OF THE REGULATORY DETERMINATION FOR WASTES FROM THE EXPLORATION, DEVELOPMENT AND PRODUCTION OF CRUDE OIL, NATURAL GAS AND GEOTHERMAL ENERGY

58 Federal Register 15284-15287 (March 22, 1993)

Important Note

This Federal Register notice is taken from the U.S. EPA web site. It is accessible from the following URL:

<http://www.epa.gov/epaoswer/other/oil/index.htm>.

The file may be opened as an ASCII text file, or a WordPerfect file.

The notice in this appendix has been reformatted to aid readability.

You should refer to the original Federal Register notice to assure accuracy.

Federal Register / VOL. 58, No. 53 / Monday March 22, 1993 / Rules and Regulations
(Pages 15284 - 15287)

40 CFR Part 261

[FRL-4606-6]

Clarification of the Regulatory Determination for Wastes From the Exploration, Development and Production of Crude Oil, Natural Gas and Geothermal Energy

AGENCY: Environmental Protection Agency (EPA).

ACTION: Clarification.

SUMMARY: This document provides additional clarification of the Resource Conservation and Recovery Act (RCRA) Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes dated June 29, 1988 (53 FR 25446; July 6, 1988). This document clarifies the regulatory status of wastes generated by the crude oil reclamation industry, service companies, gas plants and feeder pipelines, and crude oil pipelines. Since this document only further clarifies the status of these wastes under the RCRA Subtitle C hazardous waste exemption discussed in EPA's 1988 Regulatory Determination, and does not alter the scope of the current exemption in any way, comments are not being solicited by the Agency on this notice.

FOR FURTHER INFORMATION CONTACT: For general information on the scope of the RCRA Subtitle C exemption for wastes from the exploration, development and production of crude oil, natural gas and geothermal energy, contact the RCRA/Superfund hotline at (800) 424-9346 (toll free) or (703) 412-9810. For technical information, contact Mike Fitzpatrick, U.S. Environmental Protection Agency OS-323W, 401 M Street, SW., Washington, DC 20460; phone (703) 308-8411.

SUPPLEMENTARY INFORMATION:

Table of Contents

- I. Introduction
- II. Clarification of the Scope of the Oil and Gas Exemption
 - A. Crude Oil Reclamation Industry
 - B. Service Companies
 - C. Crude Oil Pipelines
 - D. Gas Plants and Feeder Pipelines
- III. Administrative Procedures Act Requirements
- IV. EPA RCRA Docket

I. Introduction

In the Solid Waste Disposal Act Amendments of 1980 (Pub. L. 94-580), Congress amended the Resource Conservation and Recovery Act (RCRA) to add sections 3001 (b)(2)(A), and 8002(m). Section 3001(b)(2)(A) exempted drilling fluids, produced waters, and other wastes associated with exploration, development, and production of crude oil, natural gas and geothermal energy

from regulation as hazardous wastes. Section 8002(m) required the Administrator to complete a Report to Congress on these wastes and provide an opportunity for public comment. The Administrator was also required by section 3001 (b)(2)(A) to make a determination no later than six months after completing the Report to Congress as to whether hazardous waste regulations under RCRA Subtitle C were warranted for these wastes.

EPA's Report to Congress was transmitted to Congress on December 28, 1987. In the process of preparing the Report to Congress, the Agency found it necessary to define the scope of the exemption for the purpose of determining which wastes were considered "wastes from the exploration, development or production of crude oil, natural gas or geothermal energy." Based upon statutory language and legislative history, the Report to Congress identified several criteria used in making such a determination. In particular, for a waste to be exempt from regulation as hazardous waste under RCRA Subtitle C, it must be associated with operations to locate or remove oil or gas from the ground or to remove impurities from such substances and it must be intrinsic to and uniquely associated with oil and gas exploration, development or production operations (commonly referred to simply as exploration and production or E&P); the waste must not be generated by transportation or manufacturing operations.

Transportation of oil and gas can be for short or long distances. For crude oil, "transportation" is defined in the Report to Congress and the subsequent Regulatory Determination as beginning after transfer of legal custody of the oil from the producer to a carrier (i.e., pipeline or trucking concern) for transport to a refinery or, in the absence of custody transfer, after the initial separation of the oil and water at the primary field site. For natural gas, "transportation" is defined as beginning after dehydration and purification at a gas plant, but prior to transport to market. To accurately determine the scope of the exemption, the reader is referred to the December 28, 1987, Report to Congress, Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy (NTIS # PB88-146212) for the specific application of the criteria.

The Agency's Regulatory Determination was published in the Federal Register on July 6, 1988 (53 FR 25446). The Regulatory Determination included a list of example wastes that generally are exempt and a list of example wastes that generally are not exempt. Neither of these lists was intended to be a complete itemization of all possible exempt or non-exempt wastes. Also, because definitions of the terms used in these lists vary, the criteria identified in the Report to Congress remain the authoritative source for determining the scope of the exemption. The reader is referred to the July 6, 1988, notice for detailed background on all aspects of the Regulatory Determination.

Since 1987, the terms uniquely associated and intrinsic have been used as interchangeable synonyms in various documents in reference to oil and gas wastes qualifying for the exemption from Subtitle C regulation. (For simplicity's sake, when referring to exempt wastes, this notice combines the use of these two terms into the single term uniquely associated.) A simple rule of thumb for determining the scope of the exemption is whether the waste in question has come from down-hole (i.e., brought to the surface during oil and gas E&P operations) or has otherwise been generated by contact with the oil and gas production stream during the removal of produced water or other contaminants from the product (e.g., waste demulsifiers, spent iron sponge). If the answer to either question is yes, the waste is most likely considered exempt.

Since the Agency's Regulatory Determination, numerous requests have been received for determination, on a site-specific basis, of the regulatory status of wastes not itemized in the Regulatory Determination's list of examples. Many of these requests have dealt with broad categories of similar wastes (e.g., crude oil reclaimer wastes, service company wastes, pipeline wastes). Today's notice responds to the many requests for clarification of the scope of the exemption.

II. Clarification of the Scope of the Oil and Gas Exemption

A. Crude Oil Reclamation Industry

The crude oil reclamation industry recovers marketable crude oil and other hydrocarbons from produced water, crude oil tank bottoms and other oily wastes that are generated by the production of crude oil and natural gas. In general, the marketable crude oil is recovered from the waste materials by simple thermal and/or physical processes (e.g., heat and gravity separation). Occasionally, demulsifiers may be added to produced waters from which crude oil cannot be separated with heat and settling time alone. The typical residual materials left after removal of the crude oil by the reclaimers are also produced water and tank bottom solids. These residuals will often exhibit the same characteristics as the parent waste, although the concentrations of some constituents may vary from those in the parent.

In September 1990, the crude oil reclamation industry requested that the Agency provide an interpretation of the language in the 1988 Regulatory Determination pertaining to RCRA Subtitle C coverage of wastes from crude oil and tank bottom reclaimers. (The list of "non-exempt" wastes in the Regulatory Determination included "liquid and solid wastes generated by crude oil and tank bottom reclaimers.") In particular, they requested that EPA clarify whether any wastes generated by crude oil reclaimers are included within the oil and gas exemption, particularly those originating from the crude oil itself, such as produced water and the other extraneous materials in crude oil, otherwise known as basic sediment and water (BS&W).

In April 1991, the Agency responded to the request with a letter that included broad guidance on the status of wastes from the crude oil reclamation industry. (A copy of the letter is included in the docket to this notice.) EPA explained that the inclusion of "liquid and solid wastes" from crude oil reclamation on the list of non-exempt wastes contained in the Regulatory Determination was intended to refer only to those non-E&P wastes generated by reclaimers (e.g., waste solvents from cleaning reclaimers' equipment) and was not intended to refer to wastes remaining from the treatment of exempt wastes originally generated by the exploration, development or production of crude oil or natural gas.

EPA's basis for this position is several-fold. First, the Agency has consistently taken the position that wastes derived from the treatment of an exempt waste, including any recovery of product from an exempt waste, generally remain exempt from the requirements of RCRA Subtitle C. Treatment of, or product recovery from, E&P exempt wastes prior to disposal does not negate the exemption. [The same principle applies to exempt mining and mineral processing wastes. See, 54 FR at 36621 (Sept. 1, 1989).] For example, waste residuals (e.g., BS&W) from the on-site or off-site process of recovering crude oil from tank bottoms obtained from crude oil storage facilities at primary field operations (i.e., operations at or near the wellhead) are exempt from RCRA Subtitle C because the crude oil storage tank bottoms at primary field operations are exempt. In effect, reclaimers are conducting a specialized form of waste treatment in which valuable product is recovered and removed from waste uniquely associated with E&P operations. In addition, in many cases, product recovery or treatment reduces the volume and overall toxicity of the waste and thereby contributes to the Agency's policy and goals for waste minimization and treatment of waste prior to disposal.

EPA further notes that the off-site transport of exempt waste from a primary field site for treatment, reclamation, or disposal does not negate the exemption. The change of custody criterion (which is discussed in the Report to Congress) for the purpose of defining transportation refers to the transport of product (crude oil, natural gas) and does not apply to exempt wastes moving off-site for treatment or disposal since these wastes were generated by the exploration, development or production operations and not by the transportation process.

Thus, the off-site transport and/or sale of exempt oil-field wastes to crude oil reclaimers for treatment does not terminate the exempt status either of the wastes or the residuals from a reclamation process applied to these wastes.

However, there are solid and liquid wastes from reclamation operations that are not exempt from RCRA Subtitle C. These are wastes which the Agency intended to refer to in its example within the 1988 Regulatory Determination. Generally, these reclaimer wastes are derived from non-exempt oilfield wastes or otherwise contain materials that are not uniquely associated with exploration, development or production operations. An example would be waste solvents generated from the solvent cleaning of tank trucks that are used to transport oilfield tank bottoms. Such wastes would not be exempt from Subtitle C because the use of cleaning solvents is not uniquely associated with the production of crude oil.

Generally, crude oil reclaimer wastes that are derived from exempt oilfield wastes (e.g., produced water, BS&W) are not subject to the Subtitle C waste management requirements of RCRA. Such wastes, however, remain subject to any applicable state solid waste management requirements. Moreover, this exemption from RCRA Subtitle C requirements may not apply if the crude oil reclaimer wastes are combined with other wastes that are subject to RCRA Subtitle C requirements.

B. Service Companies

Oil and gas service companies are those companies hired by the principal operating company to, among other things, supply materials for use at a drilling or production site or provide a service to be performed. Some of the activities of service companies take place on-site while others may take place off-site. Examples of the types of activities that may take place off-site are product formulation, transport of materials, laboratory analysis, and waste handling and disposal.

The 1988 Regulatory Determination stated that "oil and gas service company wastes, such as empty drums, drum rinsate, vacuum truck rinsate, sandblast media, painting wastes, spent solvents, spilled chemicals, and waste acids" are not covered by the oil and gas E&P exemption. The Agency intended this statement to identify those wastes, including unused and discarded product materials, generated by service companies that are not uniquely associated with primary field operations. (Primary field operations occur at or near the wellhead or gas plant and include only those operations necessary to locate and recover oil and gas from the ground and to remove impurities.) Similar to the reference to crude oil reclamation wastes, the Agency did not intend to imply that under no circumstances will a service company ever generate a RCRA Subtitle C-exempt waste. For example, if a service company generates spent acid returns from a well work-over, the waste is exempt since the waste acid in this case came from down-hole and was part of primary field operations.

EPA is aware that some confusion exists in various segments of the industry with regard to the scope of the exemption from RCRA Subtitle C for solid wastes not uniquely associated with oil and gas exploration and production. One common belief is that any wastes generated by, in support of, or intended for use by the oil and gas E&P industry (including most service company wastes) are exempt. This is not the case; in fact, only wastes generated by activities uniquely associated with the exploration, development or production of crude oil or natural gas at primary field operations (i.e., wastes from down-hole or wastes that have otherwise been generated by contact with the production stream during the removal of produced water or other contaminants from the product) are exempt from regulation under RCRA Subtitle C regardless of whether they are generated on-site by a service company or by the principal operator. In other words, wastes generated by a service company (e.g., unused frac or stimulation fluids

and waste products) that do not meet the basic criteria listed in the Report to Congress (i.e., are not uniquely associated with oil and gas E&P operations) are not exempt from Subtitle C under the oil and gas exemption, just as wastes generated by a principal operator that do not meet these criteria are not exempt from coverage by RCRA Subtitle C.

The 1988 Regulatory Determination also stated that "vacuum truck and drum rinsate from trucks and drums transporting or containing non-exempt waste" is not included within the exemption (emphasis added). The unstated corollary to this is that vacuum truck and drum rinsate from trucks and drums transporting or containing exempt wastes is exempt, provided that the trucks or drums only contain E&P-related exempt wastes and that the water or fluid used in the rinsing is not subject to RCRA Subtitle C (i.e., is itself non-hazardous). This is consistent with the general policy principle that certain wastes derived exclusively from RCRA Subtitle C-exempt wastes remain exempt from RCRA Subtitle C.

C. Crude Oil Pipelines

Crude oil is produced from the ground through a system of one or more wells in an oilfield. The oil and any related produced water typically is directed to a series of tanks known as a tank battery where the water and oil separate naturally due to gravity; sometimes, separation is enhanced by the use of heat. Most water is separated from the oil at the tank battery. The volume of oil produced is then metered prior to a change in custody or ownership of the oil and/or its transportation off-site.

In the case of crude oil, all production-related activities occur as part of primary field operations at or near the wellhead. Wastes generated as part of the process of transporting products away from primary field operations are not exempt. Generally, for crude oil production, a custody transfer of the oil (i.e., the product) or, in the absence of custody transfer, the end point of initial product separation of the oil and water, will define the end point of primary field operations and the beginning of transportation. Only wastes generated before the end point of primary field operations are exempt. In this context, the term end point of initial product separation means the point at which crude oil leaves the last vessel, including the stock tank, in the tank battery associated with the well or wells. The purpose of the tank battery is to separate the crude oil from the produced water and/or gas. The movement of crude oil by pipeline or other means after the point of custody transfer or initial product separation is not part of primary field operations.

Therefore, any waste generated by the transportation or handling of the crude oil (product) after custody transfer or, in the absence of custody transfer, after the end point of initial product separation of the oil and water, is not within the scope of the exemption. Examples of non-exempt wastes resulting from transportation include transportation pipeline pigging wastes, contaminated water and snow resulting from spills from transportation pipelines or other forms of transport of the product, and soils contaminated from such spills. It should be noted that the hydrocarbon-bearing soils identified in the 1987 Report to Congress and listed in the 1988 Regulatory Determination as being exempt are limited to those hydrocarbon-bearing soils that occur at oil or gas E&P sites or result from spills of exempt waste. As discussed above, the exempt status of wastes generated by primary field operations and transported off-site for treatment or disposal is not affected by custody transfer.

D. Gas Plants and Feeder Pipelines

Natural gas is produced from the ground through a system of one or more wells in a gas field. Some water may be separated from the gas at the wellhead, but due to economy of scale, the gas from several wells is generally commingled and sent to a central gas plant where additional

water and other impurities are removed. The ownership, or custody, of the natural gas commonly changes hands between the wellhead and the gas plant, yet the removal of impurities from the gas at a gas plant is still a necessary part of the production process for natural gas.

For natural gas, primary field operations (as defined in the 1987 Report to Congress) include those production-related activities at or near the wellhead and at the gas plant (regardless of whether or not the gas plant is at or near the wellhead) but prior to transport of the natural gas from the gas plant to market. Because the movement of the natural gas between the wellhead and the gas plant is considered a necessary part of the production operation, uniquely associated wastes derived from the production stream along the gas plant feeder pipelines (e.g., produced water, gas condensate) are considered exempt wastes, even if a change of custody of the natural gas has occurred between the wellhead and the gas plant. Some wastes generated at this production stage may not be uniquely associated with the natural gas production stream and are, therefore, not exempt (e.g., pump lube oil, waste mercury from meters and gauges). Similarly, soils contaminated by spills of wastes that are not uniquely associated with production operations, such as soils contaminated by mercury from gauges, are not exempt wastes.

Wastes generated at compressor stations and facilities located along the transportation and distribution network downstream from the gas plant or at the market end of the transportation system are not covered by the E&P exemption. These wastes are not uniquely associated with oil or gas exploration and production and are not exempt.

In addition, wastes generated by non-production related activities (i.e., manufacturing) that may occur at a gas plant are not exempt. These non-exempt manufacturing activities include operations that go beyond the removal of impurities from the raw gas and the physical separation of the gas into its component fractions. Manufacturing activities would be those that are similar to petrochemical plant operations, such as the cracking and reforming of the molecular structures of the various gas fractions and the addition of odorants or other substances. The end point of the scope of the exemption for natural gas is in the gas plant once manufacturing begins or, if no manufacturing occurs, at the point at which the natural gas leaves the gas plant for transportation to market.

It should be noted that the production of elemental sulfur from hydrogen sulfide gas at a gas plant is considered treatment of an exempt waste (i.e., the hydrogen sulfide gas is a uniquely associated waste). This waste treatment process reduces the volume and/or toxicity of the exempt waste and produces a saleable product. As such, this process is similar to crude oil reclamation and any residual waste derived from the hydrogen sulfide remains exempt.

Finally, wastes uniquely associated with operations to recover natural gas from underground gas storage fields are covered by the exemption just as if the gas were being produced for the first time. This is because operations to store and retrieve natural gas from natural underground formations, as well as the types of wastes generated, are virtually identical to those involved with the production of natural gas for the first time, although the volume of wastes generated by natural gas storage and retrieval is typically smaller than the volume generated by the initial production. In effect, in the context of the E&P exemption, the storage of natural gas in natural underground formations returns the gas to the beginning point of the production process.

III. Administrative Procedure Act Requirements

Today's notice is issued without request for public comment since it does not revise, amend, repeal, change, or otherwise alter any EPA regulation, nor constitute a change to EPA's

1988 Regulatory Determination regarding oil and gas exploration and production wastes. This notice merely provides further clarification of EPA's statements regarding the scope of the exemption for oil and gas wastes. Thus, EPA does not believe that today's notice constitutes an action for which notice and comment is required under the Administrative Procedure Act (APA).

To the extent today's notice is covered by APA requirements, EPA believes that it is merely interpreting the scope of the existing RCRA statutory exclusion for oil and gas wastes, for which notice and comment is not ordinarily required. Alternatively, EPA believes it has good cause under Section 553(b) of the APA to publish this notice without opportunity for comment. EPA has already received substantial comment regarding the scope of the oil and gas exemption in response to its 1987 Report to Congress, and further comment on the issue is unnecessary, particularly since EPA is not altering its position from that which the Agency announced in the 1988 Regulatory Determination.

IV. EPA RCRA Docket

The EPA RCRA docket is located at: United States Environmental Protection Agency, RCRA Information Center, room M2427, 401 M Street, SW., Washington, DC 20460.

The RCRA Information Center is open from 9:00 to 4:00 Monday through Friday, except for federal holidays. The public must make an appointment to review docket materials. Call the docket at (202) 260-9327 for appointments. Copies cost \$.15 per page.

The following documents related to the July 6, 1988 regulatory determination are available for inspection in docket number F-88-OGRA-FFFFF.

- Report to Congress on Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy;
- All supporting documentation for the regulatory determination, including public comments on the Report to Congress and EPA response to comments, and
- Transcripts from the public hearings on the Report to Congress.

All supporting documentation for this Federal Register Notice are available for inspection in docket number F-93-OGRC-FFFFF.

Dated: March 11, 1993.

Richard J. Guimond,
Assistant Surgeon General, USPHS. Acting Assistant Administrator.

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NOTES

APPENDIX C

***LIST OF E&P WASTES:
EXEMPT AND NONEXEMPT***

NOTES

LIST OF E&P WASTES: EXEMPT AND NON EXEMPT

The lists below are not complete lists of exempt wastes and non exempt wastes. Additional wastes may be discovered during your day-to-day E&P operations. It is important to remember that a material that is unique to E&P operations must be used in primary field operations to gain exemption as a waste. Chapter 3 of this manual and the references cited in Chapter 3 can provide guidance in determining the waste's regulatory status. Please note, however, the Commission or the EPA should be contacted for guidance in the event the regulatory status of a waste is in doubt.

EXEMPT WASTES

Activated charcoal filter media

Basic sediment and water (BS&W) - see
Tank bottoms

Caustics, if used as drilling fluid
additives or for gas treatment

Condensate

Cooling tower blowdown

Debris, crude oil soaked

Debris, crude oil stained

Deposits removed from piping and
equipment prior to transportation (i.e.,
pipe scale, hydrocarbon solids,
hydrates, and other deposits)

Drilling cuttings/solids

Drilling fluids

Drilling fluids and cuttings from offshore
operations disposed of onshore

Gas dehydration wastes:

- a. Glycol-based compounds
- b. Glycol filters (see process filters),
filter media, and backwash
- c. Molecular sieves

Gas plant sweetening wastes for sulfur
removal:

- a. Amines (including amine reclaimer
bottoms)
- b. Amine filters (see process filters),
amine filter media and backwash
- c. Amine sludge, precipitated
- d. Iron sponge (and iron sulfide scale)
- e. Hydrogen sulfide scrubber liquid and
sludge

Gases removed from the production
stream (i.e., H₂S, CO₂, and VOCs)

Liquid hydrocarbons removed from the
production stream but not from oil
refining

Liquid and solid wastes generated by
crude oil and tank bottom reclaimers

Oil, weathered

Paraffin

Pigging wastes from producer operated
gathering lines

Pit sludges and contaminated bottoms
from storage or disposal of exempt
wastes

Process filters

EXEMPT WASTES (Continued)

Produced sand	Tank bottoms and basic sediment and water (BS&W) from: storage facilities that hold product and exempt waste (including accumulated materials such as hydrocarbons, solids, sand, and emulsion from production separators, fluid treating vessels, and production impoundments).
Produced water	
Produced water constituents removed before disposal (injection or other disposal)	
Produced water filters (see Process filters)	VOCs from exempt wastes in reserve pits or impoundments or production equipment
Rigwash	
Slop oil (waste crude oil from primary field operations and production)	Well completion, treatment, and stimulation, and packing fluids
Soils, crude oil-contaminated	Workover wastes (i.e., blowdown, swabbing and bailing wastes)
Sulfacheck/Chemsweet waste	

NONEXEMPT WASTES

Although the wastes listed below are not exempt from RCRA Subtitle C, they are not necessarily hazardous or necessarily subject to hazardous waste regulation. Use process knowledge or testing to determine the waste characteristics prior to management.

Batteries: lead acid	Methanol, unused
Batteries: nickel-cadmium	Oil, equipment lubricating (used)
Boiler cleaning wastes	Paint and paint wastes
Boiler refractory bricks	Pesticide and herbicide wastes
Caustic or acid cleaners	Pipe dope, unused
Chemicals, surplus	Radioactive tracer wastes
Chemicals, unusable (including waste acids)	Refinery wastes (e.g., unused frac fluids or acids)
Compressor oil, filters, and blowdown waste	Sandblast media
Debris, lube oil contaminated	Scrap metal
Drilling fluids, unused	Soil, chemical-contaminated (including spilled chemicals)
Drums/containers, containing chemicals	Soil, lube oil-contaminated
Drums/containers, containing lubricating oil	Soil, mercury-contaminated
Drums, empty (and drum rinsate)	Solvents, spent (including waste solvents)
Filters, lubrication oil (used)	Thread protectors, pipe dope-contaminated
Gas plant cooling tower cleaning wastes	Vacuum truck rinsate (from tanks containing nonexempt waste)
Hydraulic fluids, used	Waste in transportation pipeline related pits
Incinerator ash	Well completion, treatment and stimulation fluids, unused
Laboratory wastes	
Mercury	

QUESTIONABLE STATUS WASTES

These wastes were not specifically listed by EPA as exempt; however, they do appear to be exempt based on the Regulatory Determination⁶ and Clarification⁷ provided by EPA.

Cement slurry returns from the well and cement cuttings (unused cement slurries would be nonexempt)

Gas plant sweetening unit catalyst

Natural gas gathering line hydrotest water

Produced-water-contaminated soil

Sulfur recovery unit wastes

SPECIAL CATEGORY WASTES

Special category wastes are subject to waste specific regulations.

Naturally occurring radioactive materials (NORM):

The possession, use, transfer, transport, and/or storage of NORM or the recycling of certain NORM-contaminated materials is regulated by the Texas Department of Health (TDH). Disposal of oil and gas NORM waste and operations incidental to disposal are regulated by the Railroad Commission. Disposal of all other NORM is regulated by the TNRCC.

Polychlorinated biphenols (PCBs) and PCB-contaminated soils:

Regulated under the federal Toxic Substances Control Act (TSCA). At the state level, oil and gas wastes contaminated by PCBs are regulated by the Railroad Commission.

Asbestos:

Regulated under the National Emissions Standards for Hazardous Air Pollutants (NESHAP). At the state level, asbestos waste from oil and gas operations is regulated by the Railroad Commission of Texas (regarding oil and gas waste), the Texas Department of Health (regarding NESHAPS), and the Texas Natural Resource Conservation Commission (regarding disposal in landfills).

APPENDIX D

TNRCC REGULATION OF WASTE

NOTES

TNRCC REGULATION OF WASTE

TNRCC WASTE CLASSIFICATIONS

Oil and gas wastes may occasionally be recycled or disposed of at facilities permitted by the Texas Natural Resource Conservation Commission (TNRCC). Guidance for the disposal of oil and gas wastes at municipal landfills permitted by the TNRCC is provided on page D-5 of this appendix. While oil and gas wastes are under Railroad Commission jurisdiction, it is helpful to also understand the TNRCC's waste classifications, which are outlined below.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION WASTE CLASSIFICATIONS (TNRCC "Guidelines for the Classification and Coding of Industrial and Hazardous Wastes," Nov. 1993)

The TNRCC Guideline and the 30 TAC Chapter 335 Subchapter R rules pertain to, among other things, the classification and coding of industrial wastes and hazardous wastes generated within the state of Texas. They do not apply to nonhazardous wastes generated by nonindustrial facilities (e.g., oil and gas facilities regulated by the Railroad Commission).

Industrial wastes are wastes resulting from or incidental to any process of industry, process of industry, process of manufacturing, mining operations (excluding brine mining operations), or agricultural operations.

Hazardous Waste:

Any single industrial waste or combination of industrial wastes listed by EPA as hazardous or determined by EPA to be characteristically hazardous (RCRA Hazardous Waste).

Class 1 Waste:

Any industrial solid waste or mixture of industrial solid wastes, other than a hazardous waste, which, because of its concentration or physical or chemical characteristics, is toxic, corrosive, flammable, a strong sensitizer or irritant, a generator of sudden pressure by decomposition, heat, or other means, and may pose a substantial present or potential danger to human health or the environment when improperly processed, stored, transported, disposed of, or otherwise managed. Class 1 waste is also referred to in 30 TAC Chapter 335 as Class 1 waste.

Class 1 Waste includes, but may not be limited to:

- containers (5 gallons or larger) which
 - ◊ have held a hazardous substance (40 CFR Part 302), a hazardous waste, a TNRCC Class 1 waste, or a material that would be classified as a hazardous or Class 1 waste if disposed; and
 - ◊ still contain any residue of the material or have been rendered unusable.
- waste containing Regulated Asbestos Containing Material.
- waste contaminated by a material which originally contained 50 ppm or greater PCBs.
- waste containing 50 ppm or greater PCBs.
- waste from the production of a "new chemical substance" as defined by the federal Toxic Substances Control Act (TSCA).
- liquid waste with a flash point of less than 150 degrees F.
- solid or semi-solid waste which, under conditions normally incident to storage, transportation, and disposal, is liable to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily, and when ignited burns so vigorously and persistently as to create a serious hazard.
- solid or semi-solid waste which, when mixed with an equivalent weight of distilled water, produces a solution having a pH less than or equal to 2 or greater than or equal to 12.5.
- waste for which a TCLP test indicates characteristically hazardous constituent levels.

Class 2 Waste:

Any individual solid waste or combination of industrial solid waste which cannot be described as Hazardous, Class 1 or Class 3. Class 2 waste is also referred to in 30 TAC Chapter 335 as Class II waste. (Note: Containers (smaller than 5 gallons) which have held a hazardous waste were formerly classified as Class 1 Waste; however, if thoroughly emptied, these containers are Class 2 Waste, regardless of contents per 10 TexReg 1042, 11 February 1994.)

Class 3 Waste:

Inert and essentially insoluble waste, usually including, but not limited to, materials such as rock, brick, glass, dirt, and certain plastics and rubber, that are not readily decomposable. Class 2 waste is also referred to in 30 TAC Chapter 335 as Class III waste.

Waste Generator:

For the purposes of TNRCC waste classification regulations in Texas, a waste generator is defined as any person, by site, who produces industrial waste; any person who possesses industrial waste to be shipped to any other person; or any person whose act first causes the waste to become subject to regulation under this chapter.

For the purpose of this regulation, a person who generates or possesses Class 3 Industrial Waste only shall not be considered a generator.

NOTES

TONY GARZA, Chairman
CHARLES R. MATTHEWS, Commissioner
MICHAEL L. WILLIAMS, Commissioner

Ronald L. Kitchens
Acting Director
Leslie Savage
Assistant Director for Environmental Services

Railroad Commission of Texas

Oil and Gas Division

DISPOSAL OF OIL AND GAS WASTES AT MUNICIPAL LANDFILLS PERMITTED BY THE TEXAS NATURAL RESOURCE CONSERVATION COMMISSION July 1999

The Railroad Commission of Texas has adopted several measures that will provide some relief to an oil and gas industry hit by low oil and gas prices. One of these measures is to no longer require an oil and gas operator to obtain a minor permit issued by the Commission under Statewide Rule 8(d)(6)(G) to dispose of oil and gas waste at a landfill permitted by the Texas Natural Resource Conservation Commission or TNRCC. The disposal of oil and gas waste at a landfill permitted by the Texas Natural Resource Conservation Commission will be authorized if the waste generator submits to the Railroad Commission district office in the district in which the waste was generated documentation regarding the shipment of waste to such facility within 30 days after shipment. The oil and gas operator must obtain permission for the disposal from the landfill operator and the Texas Natural Resource Conservation Commission.

Attached is a guide to disposal of oil and gas waste at a landfill permitted by the TNRCC. This guide is the result of coordination between the Railroad Commission and the Special Waste Branch of the Texas Natural Resource Conservation Commission to make landfill operators and oil and gas operators aware of the requirements for and restrictions on disposal of oil and gas waste in a landfill. The guide lists oil and gas wastes commonly taken to a landfill for disposal, and, for each waste, indicates whether or not the waste is exempt from federal hazardous waste regulations under RCRA, what treatment or testing is required for the waste, and whether or not written approval is required from the Texas Natural Resource Conservation Commission.

Recycling should be considered before disposing of an oil and gas waste at a landfill. Please contact Bart Sims at (512) 463-5405 with the Railroad Commission's Source Reduction and Recycling Program for information on recycling. Or you may call the Texas Natural Resource Conservation Commission's toll-free number to call for information on recycling of all types of wastes (1-800-64TEXAS).

The attached guide is subject to revision. We would welcome your comments on the guide concerning any suggested additions or revisions. We hope this is helpful. **If you have any questions about this guide, call (512) 463-6818.**

DESCRIPTION OF WASTE ITEMS	RCRA EXEMPT STATUS	TREATMENT OR TESTING REQUIRED	WRITTEN APPROVAL OF TNRCC FOR LANDFILL DISPOSAL (at TNRCC sites)
glycol filters	YES	Drain, air dry 48 hrs, TPH**, TCLP benzene*	YES
dehydration filter media	YES	Drain, air dry 48 hrs, TPH**, TCLP benzene*	YES
gas condensate filters	YES	Drain, air dry 48 hrs, TPH**, TCLP benzene*	YES
molecular sieves	YES	Cool in nonhydrocarbon, inert atmosphere, hydrate in ambient air 24 hrs, TPH**, TCLP benzene*	YES
amine filters	YES	Drain, air dry 48 hrs, TPH**, TCLP benzene*	YES
iron sponge	YES	Allow to oxidize completely to prevent threat of combustion.	YES
saltwater filters	YES	Drain, air dry 48 hrs, pH, total chlorides**, TPH**	YES
cooling tower filters	YES	Drain, air dry 48 hrs, TCLP chromium*	YES
ferrous sulfur, elemental sulfur & soil contaminated with sulfur	YES	If uncontaminated, recover & sell as raw material. If contaminated, requires case-by-case approval.	YES
water treatment backwash solids, and filters	YES	TCLP metals*, NORM	YES
tower packing	YES	Recycle, TCLP chromium	YES
produced sand	YES	TPH**, TCLP benzene*, NORM	YES
pipe scale & other deposits removed from piping & equipment	YES	TPH**, TOX**, TCLP metals*, NORM	YES
hydrocarbon bearing soils (crude oil)	YES	TPH**, TCLP benzene*, see TNRCC policy on contaminated soils	YES
hydrocarbon bearing soils (lube oil)	NO	TCLP cadmium, chromium, lead; TPH**, TCLP benzene*, PCB**	YES
pigging waste from gathering lines	YES	TPH**, TCLP benzene*, NORM, MSDS sheets for corrosion inhibitors, TCLP arsenic	YES
pigging waste from transmission lines	NO	TPH**, TCLP benzene*, TCLP arsenic, NORM, MSDS sheets for corrosion inhibitors	YES

DESCRIPTION OF WASTE ITEMS	RCRA EXEMPT STATUS	TREATMENT OR TESTING REQUIRED	WRITTEN APPROVAL OF TNRCC FOR LANDFILL DISPOSAL (at TNRCC sites)
Waste oil filters (1) entire unit is inside metal container (2) replaceable inside units (paper/fiber)	NO NO	(1) Separate & recycle oil & metal parts. (2) Recycle, waste-to-energy drain for at least 24 hours, TCLP lead & benzene*	(1) subject to 31 TAC 330.136(e) (2) YES
plastic pit liners	YES	Determine type of contamination, clean well.	NO
unused pipe dope	NO	MSDS sheets – may contain lead, reuse if possible.	YES
drilling muds	YES	TCLP barium*, TPH, BTEX*, treatment to reduce hydrocarbons may be required	YES
drill cuttings	YES	Only cuttings, no fluids. MSDS sheets for additives, chlorides**	YES
unused mud additives	NO	(Barium), MSDS, approval only for small quantities.	YES
sacks of unused drilling mud	NO	Return to vendor or use at other site if usable. If unusable, MSDS sheets	YES
sorbent pads (crude oil & other exempt wastes)	YES	TPH**, TCLP benzene* (TPH usually too high, treat for recovery/reuse)	YES TPH usually too high for LFs, treatment needed
sorbent pads (lube oil & other non exempt wastes)	NO	TPH**, TCLP benzene*	YES TPH usually too high for LFs, treatment needed
uncontaminated concrete from production facilities	--	None required unless contaminated.	NO if uncontaminated
contaminated concrete from gas plants, compressor stations & other oil & gas facilities	NO	Testing determined on case-by-case basis.	YES
asbestos asbestos - contaminated waste material	YES (see TSCA)	Comply with federal and state regulations for asbestos materials, remove asbestos from metal, recycle metal	YES for sites approved to take asbestos (only)

DESCRIPTION OF WASTE ITEMS	RCRA EXEMPT STATUS	TREATMENT OR TESTING REQUIRED	WRITTEN APPROVAL OF TNRCC FOR LANDFILL DISPOSAL (at TNRCC sites)
paper, paper bags	NO	Bags must be empty.	NO
soiled rags/gloves	NO	None.	NO
wooden pallets	NO	None unless contaminated	NO
detergent buckets	NO	Must be empty--recycle if possible	NO
grease buckets	NO	Must be empty--recycle if possible (scrap metal)	NO
empty containers	NO	Must be empty--recycle if possible (scrap metal)	NO
barrels/drums 5-gallon buckets	NO	Recycle if possible	NO
metal plate, metal pipe, metal cable	NO	Recycle as scrap metal	NO
junked pumps, valves, etc.	NO	NORM, recycle	NO
uncontaminated brush & vegetation from clearing land	--	None, compost	NO
rubber tank seals	NO	Drain, recycle, (tire recycling facility)	YES
fiberglass tanks and pipe	NO	Must be empty, cut up or shredded.	NO

EXPLANATION OF ABBREVIATIONS:

MSDS Material Safety Data Sheet(s)
 NORM Naturally Occurring Radioactive Materials
 PCB Polychlorinated biphenyls [or polybrominated biphenyls]

TSCA Toxic Substances Control Act
 TCLP Toxicity characteristic leaching procedure
 TOX Total organic halides (X = fluorine, chlorine, bromine, or iodine)
 TPH Total petroleum hydrocarbons (EPA Method 418.1 with known standard)

* If a total analysis (i.e. Total Lead, Total Benzene, etc.) exceeds the limits listed below, then TCLP must be performed and the TCLP results must not exceed the stated limits:

** Results of the following analyses must be within the limits stated for disposal in a municipal solid waste landfill:

<u>Analyte</u>	<u>Total Limit</u>	<u>TCLP Limit</u>
Benzene	10 mg/Kg	0.5 mg/L
Arsenic	36 mg/Kg	1.8 mg/L
Barium	2000 mg/Kg	100 mg/L
Cadmium	10 mg/Kg	0.5 mg/L
Chromium	100 mg/Kg	5.0 mg/L
Lead	30 mg/Kg	1.5 mg/L
Mercury	4 mg/Kg	0.2 mg/L
Selenium	20 mg/Kg	1.0 mg/L
Silver	100 mg/Kg	5.0 mg/L

<u>ANALYTE</u>	<u>LIMIT</u>
TPH	1500 mg/Kg (for most facilities)
TOX	50 mg/Kg
PCB's	< 50 mg/Kg
Chlorides	case-by-case review
NORM	below regulatory limit

NOTE:

State law mandates waste recycling rate of 40% by 1994 for municipal wastes (Senate bill 1340 72nd Legislature). State policy considers landfill disposal as the least desirable method of disposal. All metal items must be recycled whenever possible. Other wastes not listed above will be handled on a case-by-case basis. Wastes requiring testing should be segregated from those wastes not requiring testing. TNRCC Watts Line for Information on Recycling: 1-800-64TEXAS

NOTES

APPENDIX E
SARA TITLE III LISTED CHEMICALS

NOTES

LIST OF SARA TITLE III CHEMICALS

The American Petroleum Institute (API) and Independent Petroleum Association of America (IPAA) have developed a generic report approach for oil and gas operators' use in complying with the requirements of Title III of SARA (Superfund Amendments and Reauthorization Act), also known as the Emergency Planning and Community Right-to-Know Act of 1986. API/IPAA developed two generic reports to assist an E&P operator in complying with the reporting requirements. The following Generic List of Hazardous Chemical Categories is provided as Exhibit A in the API/IPAA document of November, 1988, titled:

Superfund Amendments and Reauthorization Act of 1986
Emergency Planning and Community Right-to-Know Act
Sections 311 and 312

Generic Hazardous Chemical Category List and Inventory
for the Oil and Gas Exploration and Production Industry

NOTES

SARA TITLE III §311
GENERIC LIST OF HAZARDOUS* CHEMICAL CATEGORIES
FOR THE OIL AND GAS EXPLORATION AND PRODUCTION INDUSTRY

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Acids, Inorganic Hydrochloric acid (<30%) (CAS#7647-01-0)	Reactivity, Immediate (Acute)
Acids, Inorganic - Hydrofluoric Acid Hydrofluoric acid (<12%) (CAS#7664-39-3)	Immediate (Acute)
Acids, Inorganic - Sulfuric Acid Sulfuric Acid (CAS#7664-93-9)	Reactivity, Immediate (Acute)
Acids, Organic Acetic acid (CAS#64-19-7) Acetic anhydride (CAS#108-24-7) Benzoic acid (CAS#65-85-0) Citric acid (CAS#5949-29-1) Formic acid (CAS#64-18-6)	Fire, Reactivity, Immediate (Acute)
Acrylamide Monomer (CAS#79-06-1)	Immediate (Acute), Delayed (Chronic)
Alkalinity and pH Control Materials Calcium hydroxide (CAS#1305-62-0) Potassium hydroxide (CAS#1310-58-3) Soda ash (CAS#497-19-8) Sodium bicarbonate (CAS#144-55-8) Sodium carbonate (CAS#497-19-8) Sodium hydroxide (CAS#1310-73-2)	Reactivity, Immediate (Acute)
Biocides Amines Glutaraldehyde (CAS#111-30-8) Isopropanol (CAS#67-63-0) Thiozolin	Fire, Immediate (Acute), Delayed (Chronic)
Biocides - Acrolein Acrolein (CAS#107-02-8)	Fire, Sudden Release of Pressure, Reactivity, Immediate (Acute)
Biocides - Anhydrous Ammonia Anhydrous ammonia	Sudden Release of Pressure, Immediate (Acute)

- Note: The list refers to the chemicals as "hazardous;" however, for the purposes of SARA Title III, "hazardous" indicates any chemical required to have a material data safety sheet (MSDS). All chemicals listed in this appendix are not necessarily hazardous as defined by RCRA.

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Biocides - Formaldehyde Formaldehyde	Fire, Immediate (Acute), Delayed (Chronic)
Breakers, Emulsion/Gel Ammonium persulfate (CAS#7727-54-0) Benzoic acid (CAS#65-85-0) Enzyme Sodium acetate (CAS#127-09-3) Sodium persulfate (CAS#7772-27-1)	Fire, Immediate (Acute)
Buffers, pH Sodium acetate (CAS#127-09-3) Sodium bicarbonate (CAS#144-55-8) Sodium carbonate (CAS#497-19-8) Sodium diacetate	Immediate (Acute)
Calcium Compounds Calcium bromite (CAS#71626-99-8) Calcium hypochlorite (CAS#17778-54-3) Calcium oxide (CAS#1305-78-8) Gypsum (CAS#10101-41-4) Lime (CAS#1305-78-8)	Immediate (Acute)
Cement (CAS#65997-15-1)	Immediate (Acute)
Cement Additives - Accelerators Calcium chloride (CAS#10035-04-8) Gypsum (CAS#10101-41-4) Potassium chloride (CAS#7337-40-7) Sodium chloride (CAS#7647-14-5) Sodium metasilicate	Immediate (Acute)
Cement Additives - Fluid Loss Cellulose polymer Latex	Immediate (Acute)
Cement Additives - Miscellaneous Cellulose flakes (CAS#9004-34-6) Coated aluminum Gilsonite (CAS#12002-43-6) Lime (CAS#1305-78-8) Long chain alcohols	Immediate (Acute)
Cement Additives - Retarders Cellulose polymer Lignosulfonates	Immediate (Acute)

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

Hazardous Chemical Category
 (With Examples of Representative Chemicals)

Physical and Health Hazards

Cement Additives - Weight Modification

Immediate (Acute)

Barite (CAS#7727-43-7)
 Bentonite
 Diatomaceous earth (CAS#68855-54-9)
 Fly ash
 Glass beads
 Hematite (CAS#1317-60-8)
 Ilmenite
 Pozzolans

Chlorine GasSudden Release of Pressure, Reactivity,
Immediate (Acute), Delayed (Chronic)**Corrosion Inhibitors**

Fire, Immediate (Acute), Delayed (Chronic)

2-Butoxyethanol
 4-4' Methylene dianiline (CAS#101-77-9)
 Acetylenic alcohols
 Amine formulations
 Ammonium bisulfite (CAS#10192-30-0)
 Gelatin
 Ironite sponge (CAS#1309-37-1)
 Sodium chromate (CAS#7775-11-3)
 Sodium dichromate (CAS#10588-01-9)
 Sodium polyacrylate
 Zinc carbonate (CAS#3486-35-9)
 Zinc lignosulfonate
 Zinc oxide (CAS#1314-13-2)

Crosslinkers (Polymer Linking)

Fire, Immediate (Acute), Delayed (Chronic)

Boron compounds
 Organo-metallic complexes

Defoaming Agents

Immediate (Acute)

Aluminum stearate
 Fatty acid salt formation
 Mixed alcohols
 Silicones
 Tributylphosphate (CAS#126-73-8)

Deflocculants

Immediate (Acute)

Acrylic polymer
 Calcium lignosulfonate
 Chrome-free lignosulfonate
 Chromium lignosulfonate
 Iron lignosulfonate
 Quebracho
 Sodium acid pyrophosphate (SAPP)
 Sodium hexametaphosphate (CAS#10124-56-8)
 Sodium phosphate (oilfos)
 Sodium tetraphosphate
 Sodium tripolyphosphate (STP)
 Styrene, maleic anhydride co-polymer salt
 Sulfo-methylated tannin

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Detergents/Foamers Amphoteric surfactant formulation Detergents Ethoxylated phenol	Fire, Immediate (Acute)
Explosives Charged well jet perforating gun, Class C explosives Detonators, Class A explosives Explosive power device, Class B	Sudden Release of Pressure
Filtration Control Agents/Flocculants Acrylamide AMPS copolymer Aniline formaldehyde copolymer hydrochlorite Anionic polyacrylamide Causticized leonardite Leonardite Partially hydrolyzed polyacrylamide Polyaklanolamine ester Polyamine acrylate Polyanionic cellulose Potassium lignite Preserved starch Sodium carboxymethyl cellulose (CAS#9004-32-4) Starch (CAS#9905-25-8) Sulfomethylated phenol formaldehyde Vinylsulfonate copolymer	Immediate (Acute)
Fluoride Generating Compounds Ammonium bifluoride (CAS#1341-49-7) Ammonium fluoride (CAS#12125-01-8)	Immediate (Acute)
Friction Reducers Acrylamide methacrylate copolymers Sulfonates	Immediate (Acute)
Fuels Acetylene gas (CAS#74-86-2) Diesel (CAS#68476-34-6) Fuel oil Gasoline (CAS#8006-61-9) Kerosene (CAS#8008-20-6) Propane (CAS#74-98-6)	Fire, Sudden Release of Pressure, Immediate (Acute), Delayed (Chronic)
Gelling Agents Cellulose and guar derivatives	Immediate (Acute)
Gel Stabilizers Sulfites Thiosulfates	Immediate (Acute)
Heat Transfer Fluids Ethylene glycol (CAS#107-21-1) Freon	Immediate (Acute), Delayed (Chronic)

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Herbicides	Immediate (Acute)
Hydraulic Fluids	Fire, Immediate (Acute)
Hydrogen Sulfide (CAS#7783-0604)	Fire, Immediate (Acute)
Inert Gases Carbonate dioxide (CAS#124-38-9) Nitrogen (CAS#7727-37-9)	Sudden Release of Pressure, Immediate (Acute)
Lost Circulation Materials	Immediate (Acute)
Cane Fibers Cedar fibers Cellophane fibers Corn cob Cottonseed hulls Mica (CAS#12001-26-2) Nut Shells Paper Rock wool Sawdust	
Lubricants, Drilling Mud Additives	Immediate (Acute)
Graphite (CAS#7782-42-5) Mineral oil formulations Organo-fatty acid salt Vegetable oil formulations Walnut shells	
Lubricants, Engine	Immediate (Acute)
Grease Motor oil	
Miscellaneous Drilling Additives	Immediate (Acute), Delayed (Chronic)
Diatomaceous earth (CAS#68855-54-9) Oxalic acid (CAS#144-62-7) Potassium acetate (CAS#127-08-2) Zinc bromide (CAS#7699-45-8)	
Odorants	Fire, Immediate (Acute)
Mercaptans, aliphatic	
Oil-Based Mud Additives	Fire, Immediate (Acute), Delayed (Chronic)
Amid polymer formulations Amine treated lignite Asphalt Diesel (CAS#68476-34-6) Gilsonite (CAS#12002-43-6) Mineral Oil Organophilic clay Organophilic hectorite Petroleum distillate (CAS#8030-30-6) Polyethylene powder Polymerized organic acids Sulfonate surfactant	

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Paint and Paint Thinner	Fire, Delayed (Chronic)
Pipe Joint Compound	Delayed (Chronic)
Preservatives Dithiocarbamates Isothiazions Paraformaldehyde (CAS#30525-89-4)	Immediate (Acute), Delayed (Chronic)
Produced Hydrocarbons Condensate Crude oil (CAS#8002-05-9) Natural gas	Fire, Sudden Release of Pressure, Immediate (Acute), Delayed (Chronic)
Proppants Bauxite (CAS#1318-16-7) Resin coated sand Zirconium proppant	Immediate (Acute)
Resin and Resin Solutions Melamine resins Phenolic resins Polyglycol resins	Fire, Immediate (Acute)
Salt Solutions Aluminum chloride (CAS#7446-70-0) Ammonium chloride (CAS#12125-02-9) Calcium bromide (CAS#71626-99-8) Calcium chloride (CAS#10035-04-8) Calcium sulfate (CAS#778-18-9) Ferrous sulfate (CAS#7782-63-0) Potassium chloride (CAS#7447-40-7) Sodium chloride (CAS#7647-14-5) Sodium sulfate (CAS#7757-82-6) Zinc bromide (CAS#7699-45-8) Zinc chloride (CAS#7646-85-7) Zinc sulfate	Immediate (Acute)
Scale Inhibitors Ethylenediaminetetraacetic acid (EDTA) (CAS#60-00-4) Inorganic phosphates Nitrilotriacetic acid (NTA) (CAS#139-13-9) Organic phosphates Phosphonates Polyacrylate Polyphosphates	Fire, Immediate (Acute), Delayed (Chronic)
Shale Control Additives Hydrolyzed polyacrylamide polymer Organo-aluminum complex Polyacrylate polymer Sulfonated asphaltic residuum	Immediate (Acute)

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

Hazardous Chemical Category
 (With Examples of Representative Chemicals)

Physical and Health Hazards

Silica	Immediate (Acute), Delayed (Chronic)
Solvents	Fire, Immediate (Acute), Delayed (Chronic)
1,1,1 - Trichloroethane (CAS#71-55-6)	
Acetone (CAS#67-64-1)	
Aliphatic hydrocarbons	
t-Butyl alcohol (CAS#75-65-0)	
Carbon tetrachloride (CAS#56-23-5)	
Chloroform (CAS#67-6-3)	
Diacetone alcohol (CAS#123-42-2)	
Ethylene glycol monobutyl ether (CAS#111-76-2)	
Kerosene (CAS#8008-20-6)	
Isopropanol (CAS#67-63-0)	
Methyl ethyl ketone (MEK)(CAS#78-93-3)	
Methyl isobutyl ketone (MIBK) (CAS#108-10-1)	
Methylene chloride (CAS#75-09-2)	
Methanol (CAS#67-56-1)	
Naphtha (CAS#8032-32-4)	
Toluene (CAS#108-88-3)	
Turpentine (CAS#8006-64-2)	
Xylene (CAS#1330-20-7)	
Spotting Fluids	Fire, Immediate (Acute), Delayed (Chronic)
Non-oil base spotting fluid	
Oil base spotting fluid (diesel oil base)	
Oil base spotting fluid (mineral oil base)	
Sulfonated vegetable ester	
Sulphur Dioxide (CAS#7446-09-5)	Sudden Release of Pressure, Immediate (Acute), Delayed (Chronic)
Surfactants - Corrosive	Immediate (Acute), Delayed (Chronic)
Alcohol ether sulfates	
Amines	
Quaternary polyamine	
Sulfonic acid	
Surfactants - Ethylene Diamine	Fire, Immediate (Acute)
Ethylene Diamine (CAS#107-15-3)	
Surfactants - Flammable	Fire, Immediate (Acute), Delayed (Chronic)
Amines	
Ammonium salts	
Fatty alcohols	
Isopropanol (CAS#67-63-0)	
Methanol (CAS#67-56-1)	
Oxyalkylated phenols	
Petroleum naphtha (CAS#8030-30-6)	
Sulfonates	
Surfactants - Miscellaneous	Immediate (Acute)
Amine salts	
Glycols	

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

Hazardous Chemical Category Physical and Health Hazards
 (With Examples of Representative Chemicals)

<p>Temporary Blocking Agents Benzoic acid (CAS#65-85-0) Naphthalene (CAS#91-20-3) Petroleum wax polymers Sodium chloride (CAS#7647-14-5)</p>	<p>Immediate (Acute)</p>
<p>Tracers Ammonium nitrate Potassium nitrate</p>	<p>Fire</p>
<p>Viscosifiers Attapulgate Bentonite Guar gum (CAS#9000-30-0) Sepiolite Xanthan gum</p>	<p>Immediate (Acute)</p>
<p>Weight Materials Barite (CAS#7727-43-7) Calcium carbonate (CAS#1317-65-3) Galena Hematite (CAS#1317-60-8) Iron carbonate Siderite</p>	<p>Immediate (Acute)</p>
<p>Welding Materials Solder Welding Rods</p>	<p>Immediate (Acute)</p>

The specific chemicals listed are representative examples in each applicable Hazardous Chemical Category

APPENDIX F
MINIMIZATION OPPORTUNITIES
FOR WASTES GENERATED IN
OIL AND GAS OPERATIONS

NOTES

**RAILROAD COMMISSION OF TEXAS
WASTE MINIMIZATION PROGRAM**

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Absorbent materials	Exempt (if contaminated with exempt waste)	SR: Prevent spills and leaks by practicing preventive maintenance and good housekeeping. R: Recover and contain used absorbent pads for recycling. R: Return used absorbent pads to vendor for recycling.
Acid, spent	Exempt	SR: Micro-meter solutions to minimize unused acid (continuous mix versus batch mix). R: Use to neutralize excess caustics (see 40 CFR 264.1 (g)(6))
Activated charcoal filter media	Exempt	R: Send to recycling facility.
Air emissions Includes: Nitrogen oxides (NO _x), sulphur oxides (SO _x), hydrocarbons, BTEX, carbon monoxide, particulates, halons, mercury, chlorofluorocarbons, refrigerants, VOCs, and fugitive emissions.	Classify depending upon source	SR: Design and operate to minimize air emissions. Use regular preventative maintenance and monitoring procedures. SR: Install and maintain catalytic converters. SR: Use low NO _x burners. SR: Convert engines to lean-burn. Maintain and run all engines to be the most fuel efficient. SR: Install pre-combustion chambers on engines. SR: Install electronic ignition systems on engines. SR: Use natural gas engines instead of engines fueled by diesel or other fuels. SR: Tighten connections and replace packing to minimize leaks and fugitive emissions. SR: Reduce emissions of unburned hydrocarbons in new facility design (e.g., route emissions to flare, route dehydrator still emissions to first stage compression, use electric drivers for compressors, use shorter piping runs with fewer flanges, use welded rather than screwed or bolted fittings. SR: Reduce horsepower demands to reduce emissions. SR: Maintain tank thief hatch seals. SR: Route dehydrator still emissions to reboiler, firebox, first stage compression, or flare. SR: Lower glycol circulation rate - avoid over dehydrating (vapor recovery). SR: Eliminate use of sparge or stripping gas in dehydrators. SR: Buy solvents and liquid chemical in bulk and keep containers covered. SR: Buy less volatile solvents and liquid chemicals. SR: Use dust control techniques at facilities. SR: Eliminate the use of halon fire extinguishing materials. SR: Revise test procedures so halon is not released. R: Use waste heat recovery opportunities where possible. R: Use vented or flared gas as fuel. R: Collect vented or flared gas, compress, and sell as product.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Aerosol cans	Nonexempt	SR: Use non-aerosol containers whenever possible. R: Recycle metal cans at appropriate recycling facility.
Amines, used	Exempt	SR: Use an amine reclaimer in the system to allow reuse of amine and minimization of the volume of waste amine generated. SR: Use an amine filter to extend life of solution and maintain efficiency. SR: Operate and maintain at proper temperatures to avoid hydrocarbon contamination. SR: Maintain a testing program to avoid problems (e.g., corrosion). R: Return to vendor or send to recycler.
Amine sludge, precipitated	Exempt	SR: Maintain sufficient pH to reduce the contribution of heavy metals to the sludge as a result of corrosion. SR: Substitute potassium hydroxide for sodium hydroxide for pH control to reduce sodium content of sludge.
Ammonium hydroxide, spent (copy machine use)	Nonexempt	SR: Convert to copiers which do not require ammonium hydroxide.
Antifreeze	Nonexempt	SR: Use a less toxic substitute for ethylene glycol (e.g., propylene glycol). R: Regenerate on site by filtration (if not thermally degraded). R: Send to a recycler.
Asbestos-containing material	Nonexempt & Regulated by NESHAPS	SR: Purchase asbestos-free products and equipment. SR: Maintain to keep friable (brittle) asbestos from becoming exposed (e.g., encapsulation). Mark materials which contain asbestos.
Batteries, lead acid	Nonexempt	SR: Use other sources of electrical current whenever possible. R: Return to vendor. When batteries are permanently taken out of service, send for recycling as soon as possible.
Batteries Includes nickel-cadmium, lithium alkali, and lead-acid	Nonexempt	SR: Use other sources of electrical current whenever possible. SR: Purchase long-life batteries to decrease the number needed. SR: Use rechargeable batteries. R: Return to vendor or manufacturer. R: When batteries are permanently taken out of service, send to recycler as soon as possible.
Biocides, pesticides, herbicides, insecticides (used for site or facility maintenance)	Nonexempt	SR: Use a commercial application service. SR: Properly store and label containers to prevent degradation and contamination.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Biocides, pesticides, herbicides, insecticides (Continued)		SR: Use all contents/material and then triple rinse the container. Use rinsate as originally intended for the material. SR: Practice good inventory control. Use excess at another facility. R: Return unused chemicals to vendor for recycling. R: Send unusable chemicals to a recycler.
Blasting sand/media	Nonexempt	SR: Use coatings that do not require sandblasting. SR: Use alternative methods to reduce unnecessary sandblasting (e.g., use a paint that does not require sandblast preparation, cathodic protection from corrosion rather than paint, use tanks constructed of materials that do not need to be painted). SR: Brush-blast and paint instead of blasting to base metal. SR: Reduce blasting/painting frequency. SR: Substitute suitable wastes (e.g., copper slag) for virgin blast media. SR: Use dry ice pellets or recyclable media for some applications. SR: Use lead-free paint or paints with lower levels of other metals. SR: Buy in bulk hoppers to minimize sacks and pallets. SR: Insure that purchased sandblast grit does not contain metal or other contaminants. SR: Do not allow contractors to conduct unnecessary sandblasting and painting of their equipment on site. R: If permissible, send to a cement kiln as a substitute for feedstock. R: Separate from blasted paint waste and reuse blast media. R: Use as aggregate in road mix, if permissible. R: If uncontaminated and permissible, use on site as a substitute for virgin fill material.
Blowdown, cooling tower	Exempt	SR: Operate cooling towers efficiently to minimize the generation of blowdown. SR: Cascade water use. SR: Substitute more acceptable biocides such as isothiazoline and amines for biocides such as pentachlorophenols and formaldehyde releasing compounds. SR: Substitute corrosion inhibitors such as sulfite and organic phosphates for inhibitors that contain chromates.
Blow-out preventer test fluids	Exempt	SR: Collect leakage to avoid soil contamination. R: Return test fluids to system if uncontaminated.
Catalyst, spent (e.g., sulphur recovery process)	Exempt	SR: Substitute a less hazardous catalyst. SR: Use catalyst completely before removing from system. SR: Operate the system to prevent contamination. R: Regenerate spent catalyst.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Catalyst, spent (Continued)		R: Certain types of catalysts can be sent to pulp and paper mills for reuse. R: Send to recycler for metals recovery. R: If permissible, send to cement kiln as a substitute feedstock. R: If uncontaminated and permissible, use on site as fill material.
Caustics, used (used for gas treatment or drilling fluids)	Exempt	SR: For gas treatment, consider alternate recyclable products. SR: Plan drilling operation to minimize volume of fluid, thereby reducing caustic requirements. SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused chemicals to other company facilities in lieu of disposal. R: Return unused caustic to vendor. R: Reuse to neutralize excess acids (see 40 CFR 264.1 (g)(6)).
Cement returns	Exempt	SR: Calculate cement needs carefully to excess cement mixture. SR: Use cement in other projects, such as erosion prevention. SR: Require vendors to use nonhazardous cement additives. R: Return unused dry cement to vendor. R: Solid cement may be reclaimed if not contaminated.
Chemicals, surplus or unusable	Nonexempt (May be hazardous)	SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused chemicals to other company facilities in lieu of recycling, treatment or disposal. Label and store chemicals properly (e.g., protect containers from weather and keep covered). SR: Purchase chemicals in bulk with supplier retaining ownership of containers. SR: Calculate chemical needs carefully to avoid surplus. SR: Use all of the product. Transfer for use at other sites or find alternate uses. SR: Use nonhazardous products whenever possible. SR: Minimize the use and variety of similar-use chemicals when one chemical is suitable. R: Return surplus to vendor. R: Donate surplus laboratory chemicals to a high school or college. R: Send to a recycler.
Cleaning wastes	Nonexempt	SR: Minimize drips, leaks and spills by practicing good housekeeping. SR: Wipe with recyclable rags rather than washing with cleanser or chemical. R: Regenerate cleansers or cleaning solvents for reuse. R: Send to a recycler.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Compressor oil, filters, and blowdown waste	Nonexempt	<p>SR: Use stainless steel, reusable filters.</p> <p>SR: Isolate all drained fluids in a resealable container. (See Oil, Lube.)</p> <p>SR: When handling filters, take precautions to prevent oil spilling.</p> <p>SR: Change oil and filters only when necessary. Lab testing of oil and differential pressure gauge will indicate the need for filter replacement. (Note: Many lubricating oil vendors provide a testing service at no charge.)</p> <p>SR: Evaluate applicability of filterless centrifugal oil cleaning.</p> <p>R: Before recycling spent filters, drain all free liquids from the cartridge or filter media into a container. Recycle back into production stream.</p> <p>R: Send used oil to a recycling facility.</p> <p>R: Introduce used oil into production stream.</p>
Completion, workover, and well treatment fluids	Exempt	<p>SR: Plan the job carefully to reduce excess fluids.</p> <p>SR: Use less toxic substitutes for chemicals and products.</p> <p>SR: Use improved acidizing technology and inhibition technology to decrease the frequency of well workovers and formation treatments.</p> <p>SR: Use leftover, excess fluids on other jobs.</p> <p>R: Return all unused treatment fluids to the supplier.</p>
Condensate	Exempt	<p>SR: Prevent releases by complete regular inspection and maintenance of all surface lines and facilities.</p> <p>SR: Treat as a product.</p> <p>R: Condensate should be recycled back into production stream.</p>
Construction/demolition debris Includes: Spoil, vegetation, wood, scrap metal	Nonexempt	<p>SR: Plan site to minimize size.</p> <p>SR: Minimize demolition requirements.</p> <p>SR: Consider portable pads or skid-mounted equipment.</p> <p>SR: Use high-density polyethylene liners rather than concrete.</p> <p>R: Crush uncontaminated concrete for use as aggregate.</p> <p>R: Compost vegetation and use as soil supplement. Chip uncontaminated wood to use as mulch.</p> <p>R: Sell or for reuse.</p> <p>R: Send scrap metals to a recycler.</p>
Copier toner, developer, solutions and cartridges	Nonexempt	<p>SR: Buy recycled cartridges.</p> <p>SR: Buy what you need and use what you buy.</p> <p>R: Return empty containers and used components to the supplier or manufacturer.</p>
Debris and soil, contaminated by used chemicals	Exempt	<p>SR: Use proper containers, keep lids on containers and store properly to prevent overflow or spillage.</p> <p>SR: Install containment to allow for better recovery of spills.</p>

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Debris, crude oil soaked (if contaminated within production system, i.e., before point of sale)	Exempt	SR: Develop operational procedures that prevent contamination with crude oil by keeping areas clear of debris. SR: Use leak-proof storage containers.
Debris, lube oil contaminated	Nonexempt	SR: Develop operational procedures that prevent contamination with lube oil by keeping areas clear of debris. R: Contractors are available to pick up and clean used rags for reuse.
Debris, uncontaminated	Nonexempt	SR: Store in labeled containers/dumpsters. SR: Do not mix with material that is contaminated or may be hazardous. R: Recycle paper, metal, cardboard, aluminum cans whenever possible.
Domestic refuse Includes: Food waste, packaging material, paper, plastic, styrofoam, cooking oils and greases, and other trash	Nonexempt	SR: Reduce packaging; buy in bulk. SR: Purchase and prepare only what is needed; avoid surplus. SR: Purchase higher quality materials with longer use cycles. SR: Use washable mugs, cups, plates, and utensils. SR: Prepare fewer fried foods. SR: Copy on both sides of the paper (duplex copying). SR: Purchase recycled/recyclable materials. SR: Use microbes and enzymes to control grease in traps. R: Obtain agreements to send packaging waste back to the vendor for reuse or recycling. R: Set up recycle bins for wood, paper, newspapers, plastic, glass, cardboard, aluminum, and other metals (i.e., food cans). R: Reuse waste paper or styrofoam as packaging materials and fillers. R: Send used cooking oils, grease and fat to a rendering or reclamation facility for reuse. R: Compost food and other biodegradable waste to use as soil additive.
Domestic and sanitary wastewater	Nonexempt	SR: Use low flow and low water use toilets, showers and faucets. SR: Repair or replace leaking equipment. R: Use treated water as facility washdown water or to water grasses, plants, etc. R: Use digested sewage sludge for agricultural purpose, if permissible.
Drilling fluids and additives, used	Exempt	SR: Use a closed-loop mud system whenever possible to reduce volumes of drilling fluid wastes. SR: Use solids control technology (e.g., chemically enhanced centrifuge) to recover water from drilling mud and reserve pit. SR: Optimize solids control (e.g., hydrocyclones or centrifuges) to minimize need to dilute mud. SR: Use low solids, non-dispersed muds whenever drilling conditions allow it.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Drilling fluids and additives, used (Continued)		<p>SR: Use an inside-diameter wiping tool for drill pipe to minimize loss of drilling fluid (can save approximately 0.4 barrels of drilling fluid per 1,000 feet of drill pipe).</p> <p>SR: Use inventory control and careful planning to avoid unused materials.</p> <p>SR: Use all of the product whenever possible.</p> <p>SR: Transfer unused additives for use at other sites.</p> <p>SR: Use products low in toxicity whenever possible.</p> <p>SR: Carefully screen barite weighting agents for naturally occurring concentrations of heavy metals, particularly mercury and cadmium.</p> <p>SR: Substitute organic additives, polymers, or biodegradable additives for oil-based mud to reduce toxicity.</p> <p>SR: Use lubricants such as lubra beads and gilsonite-based additives for spotting fluids, rather than diesel oil.</p> <p>R: Have a drilling mud recycler pick up waste drilling mud for reconditioning and reuse.</p> <p>R: Condition mud for reuse in drilling your next well.</p> <p>R: Reuse waste drilling mud for upcoming well spudding or plugging operations.</p> <p>R: Return surplus additives to vendor.</p> <p>R: Return oil-based mud to vendor for recycling.</p> <p>R: Reuse water-based mud whenever possible.</p>
Drilling cuttings/solids	Exempt	<p>SR: Minimize hole size (if feasible) when drilling.</p> <p>SR: Drill horizontal holes if feasible to reduce number of wells required.</p> <p>SR: Carefully design and monitor drilling mud programs to minimize caving, etc.</p> <p>SR: Substitute organic additives, polymers, or biodegradable additives for oil-based mud to reduce costs associated with cleanup of oil-based drill cuttings.</p>
Drums/containers, containing unused chemicals or lube oil	Nonexempt	<p>SR: Use the remaining chemical or lube oil for its intended propose whenever possible before disposing of drum. (See Chemicals, surplus.)</p> <p>SR: Switch to purchase of chemicals in bulk containers, reducing the amount of drums requiring handling. Added benefit: less drum handling results in fewer spills and releases requiring cleanup of contaminated soil or debris.</p> <p>R: Return unused chemical, in original drum/container (properly sealed and labeled), to vendor.</p> <p>R: If drum can be properly emptied: triple rinse, and recycle drum (add the rinse water to the chemical stream).</p> <p>R: Recycle empty drums/containers whenever possible.</p>

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Drums/containers, empty	Nonexempt	<p>SR: Switch to purchase of materials and chemicals in bulk containers, reducing the amount of drums requiring handling. Added benefit: less drum handling results in fewer spills and releases requiring cleanup (of contaminated soil).</p> <p>SR: Purchase materials in returnable/recyclable drums and containers.</p> <p>R: Return undamaged drums/containers to vendor or send to a drum reconditioner/recycler.</p> <p>R: Reuse uncontaminated drums for other purposes (e.g., storage and transfer of nonhazardous waste).</p>
Electrical equipment, oil-filled (less than 50 parts per million polychlorinated biphenyl content) and out of service Includes: Capacitors, transformers, switches, heat transfer fluids	Nonexempt	<p>SR: If putting back into service, do not refill or service with oils containing more than 50 ppm PCBs.</p> <p>R: Refurbish and reuse or sell for reuse.</p> <p>R: Recycle oils into production stream.</p> <p>R: Send scrap equipment to a metal recycler.</p> <p>R: Burn oil for energy recovery if permissible (PCB content may prohibit this option; check appropriate regulations).</p>
Filters, lube oil	Nonexempt	<p>SR: When handling filters, take precautions to prevent oil spillage and the contamination of soil, etc.</p> <p>SR: Change filters only when necessary. Use differential pressure as an indicator of needed change.</p> <p>SR: Use stainless steel, reusable filters.</p> <p>SR: Evaluate applicability of filterless centrifugal oil cleaning. (Use "spinners" to replace or lengthen oil filter life.)</p> <p>SR: Install lubricating oil purification equipment to reduce frequency of conventional filter replacement.</p> <p>R: Isolate all drained fluids in a resealable container for recycling. (See Oil, Lube.)</p> <p>R: Before recycling spent filters, drain all free liquids from the cartridge or filter media into a container. Recycle back into production stream.</p> <p>R: Send to a recycling facility.</p>
Filters, process	Exempt	<p>SR: Use or retrofit with stainless steel, reusable filters to reduce the volume of filters requiring recycling or disposal.</p> <p>SR: Change filters only when necessary. Use differential pressure as an indicator of needed change.</p> <p>SR: Evaluate applicability of filterless centrifugal oil cleaning. (Use "spinners" to replace or lengthen oil filter life.)</p> <p>R: Before disposing of spent filters, drain all free liquids from the cartridge or filter media into a container. Recycle back through production stream, on the lease from which the filters are generated.</p>

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Fire fighting agents	Nonexempt	SR: Convert to less toxic alternatives. SR: Eliminate the use of halon extinguishers. SR: Avoid the use of dry agents when water will suffice. R: Contact with vendor to maintain fire fighting equipment and take back all unused fire fighting agents.
Fracturing fluids, unused	Nonexempt	SR: Use "mix-on-the-fly" systems for frac fluids. SR: Recycle unused frac oil back into production stream. SR: Plan frac job carefully to avoid mixing unnecessary fluids.
Glycol	Exempt	SR: Maintain a testing program to avoid problems (e.g., corrosion). SR: Optimize flow rates in the dehydration system. SR: Operate and maintain at proper temperatures to avoid hydrocarbon contamination. R: Regenerate for reuse. R: Send to a recycling facility.
Hydrocarbon liquids	Exempt if from primary operations; otherwise Nonexempt	R: Reclaim and manage as product. R: Blend with product.
Hydrates	Exempt if from primary operations; otherwise Nonexempt	SR: Inject methanol or glycol to inhibit hydrate formation. SR: Melt in place. R: Return to water treating system to recover any contained hydrocarbons.
Hydraulic fluids	Nonexempt	SR: Introduce into production stream at facility where generated. R: Recycle whenever possible.
Hydrotest water from gathering lines (in primary field operations)	Exempt	SR: Conduct tests only when necessary. Use of "smart pigs" or ultrasonic devices to test wall thickness or holidays may enable better targeting of pipeline sections requiring pressure testing or replacement. SR: Efficiently pig and pre-clean pipelines prior to hydrotesting to reduce the toxicity of the hydrotest water. SR: Use produced water for hydrotesting rather than fresh water (reduction in use of water). R: Reuse hydrotest water in other tests.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Iron sponge and iron sulfide scale, spent	Exempt	SR: Consider alternative methods of removing hydrogen sulfide from gas stream. SR: Treat production streams with biocide or scale inhibitor to reduce iron sulfide formation.
Laboratory samples	Dependent upon source of sample and test method	SR: Collect only the amount necessary for analysis. SR: Minimize testing; sample and analyze no more often than required. SR: Use test methods /procedures which generate no or less waste (e.g., colorimetric testing). SR: Use process knowledge instead of testing.
Laboratory waste	Nonexempt	SR: Segregate waste chemicals (i.e., keep hazardous and nonhazardous waste chemicals separate) to reduce the amount of hazardous waste for management. SR: Buy only the amount and size necessary. SR: Use test methods which generate less or no waste. R: Sell excess unused chemicals. R: Send laboratory wastes to a recycler. R: Provide excess laboratory chemicals to schools for their use.
Lubricating oil	Nonexempt	SR: Minimize the volume of lube oil by extending its use. SR: Test oil and extend its use based on wear vs. accumulated operating hours. (Note: Many lubricating oil suppliers offer testing service at no charge.) SR: Install lubricating oil purification equipment on engines to eliminate the need for lubricating oil changes. SR: Practice preventative maintenance to reduce leaks and drips. SR: Contract with service company to purify and regenerate oil for reuse rather than replacing with new lubricating oil. SR: Consider use of synthetic oil. SR: Use oil additives that improve engine and oil performance. R: Recycle back into production stream on facility where generated. (Note: Ensure that no conflict arises with purchaser or refiner.) R: Send to a recycling facility.
Mercury, free	Nonexempt	SR: Replace mercury manometers, level switches, flow meters and gas meters with electronic (digital) instruments. SR: Do not use mercury in operations. R: Send to mercury recycler.
Metal, scrap	Nonexempt	SR: If clean, re-use for structural steel. R: Sell to salvage/scrap dealer (metal recycler).
Methanol, used	Nonexempt	SR: Use all of the product whenever possible. R: Send to a recycling facility.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Molecular sieve, spent	Exempt	<p>SR: Install activated carbon upstream of the unit to remove corrosion inhibitors, amines, absorber oils, glycol, and other contaminants to extend the life of the molecular sieve.</p> <p>SR: Regenerate molecular sieves for reuse.</p> <p>R: Before disposing of spent filters, drain all free liquids from the sieve media into a container. Recycle back through production stream, on the lease from which the sieves are generated.</p>
Naturally Occurring Radioactive Materials (NORM), NORM-containing materials	Subject to other regulation (e.g., Statewide Rule 94)	<p>SR: Periodic monitoring for accumulations of NORM may minimize potential risks and liabilities.</p> <p>SR: Use scale inhibitors where NORM scale accumulates. Circulate inhibitor in well or inject inhibitor into producing formation.</p> <p>SR: Avoid mixing incompatible produced waters which will result in scale formation.</p> <p>SR: Design facility to reduce locations prone to scale formation (e.g., large pressure drops and unnecessary pipe elbows).</p> <p>SR: Do not mix NORM with other materials.</p> <p>SR: Dually complete oil zone and water zone to allow water to be produced simultaneously but separately from oil and to allow control of water coning (research indicates that water production may be reduced by as much as half, thereby reducing exposure to NORM of production equipment carrying the oil stream).</p> <p>SR: Use polymer injection to reduce permeability to water in the production zone, thereby reducing the volume of radionuclide-containing water produced.</p> <p>SR: Use rock plugging with gel slugs to block off water production in completions where there is a discernible separation of the oil and water zones.</p> <p>SR: Carefully design gravel packs and other well screening procedures to reduce the volume of NORM-contaminated formation sand (coated by NORM scale) that is produced.</p> <p>SR: Coat material surfaces with chemicals at critical points in the production system to reduce the availability of nucleation points for NORM-containing scale formation.</p> <p>SR: Reinject NORM-containing produced water (containing scale inhibitors) for enhanced recovery, (preferably into the same zone from which it was produced), as soon as possible after initial production to increase the amount of NORM returned to the subsurface and decreasing the potential for the precipitation of NORM-containing scale in surface equipment.</p> <p>SR: Store NORM-contaminated waste in either tanks or lined pits which will accommodate the eventual recovery and proper disposal of the NORM-contaminated waste. The contamination of soils with NORM may be averted by not storing NORM containing produced water or other waste in earthen pits, thereby decreasing the volume of NORM-contaminated waste.</p> <p>SR: Provide NORM management procedures training for employees involved with the operation and maintenance of affected production facilities.</p>

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Naturally Occurring Radioactive Materials (NORM), NORM-containing materials (Continued)		<p>R: Clean NORM-contaminated scale from pipe and equipment to minimize the volume of NORM-contaminated waste requiring disposal and allow the recycling of the pipe and equipment. However, restrictions on the level of radioactivity of the NORM-contaminated waste may be imposed.</p> <p>R: Use of NORM-contaminated waste (metals) as feedstock at smelters may be a potential method of recycling. However, restrictions on the level of radioactivity of the NORM-contaminated waste may be imposed.</p>
Oil, slop	Exempt	<p>SR: Recycle back into production stream.</p> <p>SR: Install a mechanical stirrer inside slop oil tank to keep sediment in suspension.</p> <p>SR: Implement the use of 'canned submersible pumps' to replace conventional impeller type pumps used for fluid transfer service. Eliminates leaks from impeller pump seals and gear boxes.</p> <p>R: Send slop oil that cannot be recycled into production stream to a state-permitted tank bottoms reclamation facility.</p>
Oil, weathered	Exempt	<p>SR: Pick up free liquids or solids spilled as soon as possible after the spill is contained. Recycle back into production stream.</p> <p>SR: Prevent spills or waste whenever possible.</p>
Paint and paint wastes	Nonexempt	<p>SR: Paint less frequently; only when necessary.</p> <p>SR: Buy in bulk and only the volume needed. Use all of the product before it becomes unusable.</p> <p>SR: Size paint batches systematically to specific jobs.</p> <p>SR: Eliminate the use of lead paint; use waterbase, lead-free paint or high-solids coatings.</p> <p>SR: Purchase less toxic, less volatile paints and solvents. Purchase paints with greater durability.</p> <p>SR: Paint contractor should be responsible for the proper management of unused paint, solvents, and empty containers.</p> <p>SR: Reduce and control overspray. Use a brush for small jobs rather than spraying.</p> <p>SR: Keep containers closed to reduce evaporation.</p> <p>SR: Ensure paint containers are completely emptied and dried.</p> <p>SR: Use separate solvents and/or containers for each paint color. When solvent is spent use it as a thinner for that particular color.</p> <p>R: Regenerate solvents for reuse.</p> <p>R: Send to a recycler.</p>

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Pallets	Nonexempt	SR: Buy materials in skid-mounted bulk hoppers or containers. SR: Purchase recycled plastic pallets which have a longer life than wooden pallets. R: Reuse pallets. R: Return pallets to the vendor. R: Send wooden pallets to a pallet or wood recycler. R: Chip uncontaminated wooden pallets and use as mulch.
Paraffin	Exempt	SR: Collect solidified paraffin in tanks, mix with paraffin solvent, and recycle back into production stream. SR: Investigate the feasibility of installing magnetic fluid conditioner(s) to prevent paraffin formation. SR: Use paraffin inhibitor chemicals. SR: Use hot-oil treatment to dissolve paraffin in well and flow lines; send to production. R: Send mechanically removed paraffin to a recycler (Call RRC @ (512) 463-6874 for current list of permitted crude oil reclamation plants; some recycle paraffin.)
PCB, oil	Subject to additional regulation	SR: Replace any electrical equipment that is determined to be PCB containing with non-PCB containing, electrical equipment. Note: Cleanup of PCB spills and contaminated soils is regulated by both RCRA and TSCA. Special Handling: <i>Contact your Health and Safety Coordinator immediately!</i>
Pesticides and herbicides	Nonexempt	SR: Use rinse water in original application whenever possible. SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused pesticides and herbicides to other company facilities in lieu of disposal. SR: Use a commercial application service. SR: Properly store and label containers to prevent degradation and contamination. SR: Use all contents/material and then triple rinse the container. Use rinsate as originally intended for the material. SR: Practice good inventory control. Use excess at another facility. R: Return unused chemicals to vendor for recycling. R: Send unusable chemicals to a recycler.
Pigging wastes from gathering lines in primary field operations	Exempt	SR: Minimize paraffin accumulation (see paraffin). Add appropriate chemical agents to reduce accumulation of paraffin. SR: Reduce accumulation of hydrates (see hydrates). SR: Reduce accumulation of scale (see scale). R: If possible, reuse pigs and reclaim paraffin whenever possible.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Pigging wastes from transportation pipelines	Nonexempt	SR: Minimize paraffin accumulation (see paraffin). Add appropriate chemical agents to reduce accumulation of paraffin. SR: Reduce accumulation of hydrates (see hydrates). SR: Reduce accumulation of scale (see scale). R: If possible, reuse pigs. R: Recycle paraffin whenever possible. (See paraffin.)
Pipe dope, used	Exempt	SR: Choose biodegradable, lead-free pipe dope. SR: Use all of the product whenever possible. SR: Minimize waste, conserve compound for use at the next job. SR: All drilling, well servicing, pipeline, and other contractors should be responsible for unused and waste pipe dope and containers.
Pit wastes Includes: waste in reserve pits and emergency pits	Exempt	SR: Use rig wash judiciously. Install high-pressure, low-volume spray nozzles with automatic cutoffs. SR: Segregate fresh water, salt water, and oil-based fluids and solids. Use the "reserve pit management system." SR: Remove oil as soon as possible to minimize contamination of pit. SR: Locate and eliminate all sources of water leaks. SR: Grade site and use diversion structures to prevent or minimize stormwater run-on volume. SR: Use a closed-loop drilling fluid system if feasible. SR: Design pit and pit system to minimize waste. For example, use the "V" shaped pit or the "reserve pit management system." SR: Size and construct pits to accommodate only the necessary volumes anticipated plus an adequate freeboard. SR: Use tanks/vacuum trucks rather than earthen pits for workovers. R: Stabilized, uncontaminated solids may be suitable for use as daily cover at landfills. R: Recover and reuse weighting materials and drilling fluids. Waste drilling mud can be reused at other locations for spudding or plugging and abandoning operations. R: Contract a drilling mud recycler to take waste drilling mud.
Plastic liners	Nonexempt	SR: Use reusable steel pits or portable tanks whenever possible. SR: Purchase liners constructed of recycled plastic. R: Send to a plastic recycler.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Produced sand	Exempt	<p>SR: Improved gravel pack design.</p> <p>SR: Optimize production rate to minimize sand production.</p> <p>SR: Design perforations in completion to minimize sand production.</p> <p>R: Use as fill material, if uncontaminated</p> <p>R: Send to cement kiln as a substitute for feedstock, if permissible.</p>
Produced water	Exempt	<p>SR: Assess the feasibility of treating the producing formation with polymers that decrease the permeability of the formation for water, while the permeability of hydrocarbons remains unchanged.</p> <p>SR: Use rock plugging with gel slugs to block off water production in completions where there is a discernible separation of the oil and water zones.</p> <p>SR: Dually complete oil zone and water zone to allow water to be produced simultaneously but separately from oil and to allow control of water coning (research indicates that water production may be reduced by as much as half).</p> <p>SR: Investigate feasibility of dually completing gas/water producing zone and injection (Class II) disposal zone (water phase separates and is not produced at surface).</p> <p>SR: Carefully planned well completions.</p> <p>SR: Reperforate well to reduce water production.</p> <p>SR: Drill wells to minimize water production (e.g., horizontal wells when feasible).</p> <p>SR: Optimize production rate to minimize the influx of water (e.g., coning).</p> <p>R: Create a system that distributes produced water to various waterfloods in area. Results: reduction in volume of produced water requiring disposal and reduction of the amount of make up water purchased. Also, the need for water storage tanks for suction at water injection stations is eliminated by pumping directly from the water separation tanks to provide pressured water to the high pressure injection pumps. This reduces cost associated with operating charge pumps at the water station.</p> <p>R: Use produced water for hydrotesting of pipelines, equipment and tanks.</p> <p>R: Desalinate for use in other E&P operations if water supply is scarce and the process is cost effective.</p>
Rags, oily	Exempt (if soaked with crude oil or other exempt waste)	<p>SR: Maintain equipment and facilities to prevent drips, leaks, and spills which would require cleanup.</p> <p>SR: Use drip pans or other containment devices to collect leaks, drips or accidental spills. Empty containment devices properly.</p> <p>R: Keep separate from other wastes and wash for reuse.</p> <p>R: Send to recycler.</p>

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Rigwash	Exempt	SR: Prudent use of water in rig maintenance. SR: Use high-pressure, low-volume hose nozzles with automatic cutoffs. SR: Set up a regular maintenance program for water systems to reduce leaks and drips. SR: Remove paint solids from water arrestor holding tanks with a centrifuge or cyclone system. SR: Reduce rigwash use by sweeping or other dry cleaning when feasible. SR: Collect rigwash in tanks rather than earthen pits. R: Collect and reuse rigwash for subsequent rig washdowns or for first stage washing of equipment. R: Use as make-up water in drilling and completion operations.
Sandblast media		See Blasting sand, media
Scale, pipe and equipment	Exempt (If generated in primary field operations)	SR: Use scale inhibitors. Circulate inhibitor in well or inject inhibitor into producing formation. SR: Avoid mixing incompatible produced waters which will result in scale formation. SR: Design facility to reduce locations prone to scale formation (e.g., large pressure drops and unnecessary pipe elbows). SR: Dually complete oil zone and water zone to allow water to be produced simultaneously but separately from oil and to allow control of water coning (research indicates that water production may be reduced by as much as half, thereby reducing scale formation in production equipment carrying the oil stream). SR: Use polymer injection to reduce permeability to water in the production zone, thereby reducing the volume of water produced which is the source of scale. SR: Use rock plugging with gel slugs to block off water production in completions where there is a discernible separation of the oil and water zones. SR: Coat material surfaces with chemicals at critical points in the production system to reduce the availability of nucleation points for scale formation. R: Clean scale from pipe and equipment and recycle the pipe and equipment.
Scrubber wastes	Exempt	SR: Convert to natural gas as a fuel to avoid generating SO ₂ and flyash. R: Remove solids through gravity separation, filtration, etc., and send liquids to water softening for steam generation or direct injection for enhanced recovery. R: Use as an oxygen scavenger.
Silver-containing waste	Nonexempt	SR: Minimize the number of film reproductions. SR: Install on-line equipment to remove silver from process liquids. R: Recover silver from the film/developing solution before disposal and recycle. R: Send waste liquids to a recycler. R: Send waste solids and film to a recycler.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Soils, unused-chemical contaminated	Nonexempt	SR: Develop operational procedures that prevent contamination of soils. For example, use containment devices in chemical storage areas to prevent contamination of soils. SR: Install fencing around chemical storage to discourage losses due to vandalism. R: Recover free liquids and recycle.
Soils, crude oil contaminated (in primary field operations)	Exempt	SR: Pick up free liquid or solids spilled as soon as possible after the spill is contained. Recycle back into production stream. SR: Develop operational procedures that prevent contamination of soils. For example, preventative maintenance on flowlines and containment under tank battery load-line connections. SR: Use impervious secondary containment. Use pit liner material around and under production facilities. SR: Consider use of magnetic ion coating technology for stuffing box packing rubbers, valve stems and other friction and wear points that may provide a source of leakage. SR: Prepare and implement Spill Prevention, Control and Countermeasures (SPCC) Plans for each facility. SR: Use cathodic protection or coated pipe to reduce leaks caused by corrosion. SR: Consolidate produced fluid separation and well testing facilities. SR: Use "canned submersible pumps" to replace conventional impeller type pumps use for fluid transfer service. R: Recover free crude oil and return to production stream.
Soils, lube oil contaminated	Nonexempt	SR: Pick up free liquid or solids spilled as soon as possible after the spill is contained and recycle. SR: Develop operational procedures that prevent contamination of soils. For example, preventative maintenance on lubricating oil system and containment under system. SR: Use impervious secondary containment. Use pit liner material around and under lubricating oil systems. R: Recover free lubricating oil and recycle.
Soil, produced water-contaminated	Exempt	SR: Develop operational procedures that prevent contamination of soils. For example, preventative maintenance on flowlines and containment under tank battery load-line connections. SR: Use impervious secondary containment. Use pit liner material around and under production facilities. SR: Consider use of magnetic ion coating technology for stuffing box packing rubbers, valve stems and other friction and wear points that may provide a source of leakage. SR: Use cathodic protection or coated pipe to reduce leaks caused by corrosion. SR: Consolidate produced fluid separation and well testing facilities. SR: Use "canned submersible pumps" to replace conventional impeller type pumps use for fluid transfer service.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Soil, produced water-contaminated (Continued)		SR: Pick up free liquid as soon as possible after the spill is contained. SR: Use smaller injection pumps at each injection well for secondary recovery projects and supply water by gravity drainage (low pressure lines) from a central water storage tank. SR: Prepare and implement Spill Prevention, Control and Countermeasures (SPCC) Plans for each facility.
Solvents (organic solvents used in cleaning and degreasing equipment)	Nonexempt	SR: Use water-based solvents or soap cleaners that are biodegradable whenever possible. SR: Substitute nonhazardous surfactants (soap) for hazardous solvents (mineral spirits) for equipment cleaning. SR: Use up all solvent in container, ensuring no residue remains. SR: Minimize amount of solvent being lost during cleaning or maintenance; for example, use drip pans to collect solvent for reuse. SR: Use high-pressure water, steam or other non-toxic solvents to clean equipment. SR: Keep solvent containers tightly covered when not in use to decrease loss due to vaporization. SR: Use inventory control to minimize volume of unnecessary solvent stored. SR: Use dirty solvent for initial cleaning and clean solvent for final cleaning. R: Send to a recycler. R: Filter/clean or regenerate solvents and reuse. R: Use spent solvent for paraffin removal.
Stormwater	Refer to Mixture Rules	SR: Improve work process and properly maintain equipment and facilities to reduce leaks, spills, etc. SR: Cover facilities to eliminate contamination of stormwater. SR: Segregate stormwater drainage from liquid storage, loading/unloading facilities and, operations areas from un-impacted areas. SR: Clean up spills and leaks promptly to minimize stormwater contamination. R: Use stormwater as make-up water in the process. For example, use contaminated stormwater for first stage washing of equipment, use stormwater as make-up water in drilling/completion operations, and use stormwater for process water and agricultural purposes.
Sulfur recovery unit wastes, including sulfur-contaminated	Exempt	SR: Substitute a less hazardous catalyst in the Scot Tailgas process of a sulfur recovery plant. Nonhazardous spent catalyst waste can result, thereby resulting in disposal cost savings.
Tank bottoms (basic sediment and water)	Exempt	SR: Recycle back through treatment system, with no additional requirements. SR: Keep turbulent flow in tank to prevent sedimentation whenever possible. The use of mechanical stirring devices in oil storage tanks will eliminate build-up of tank bottom sediments and reduce chemical storage. SR: Add appropriate chemical agents to reduce tank bottom accumulation.

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS		
WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Tank bottoms (basic sediment and water) (Continued)		<p>SR: Treat light oil tank bottoms with high temperature in heavy oil dehydration facilities.</p> <p>SR: Recover product by recycling light oil tank bottoms through heavy oil dehydration facilities. Results: added revenue and substantial cost savings through reduction of waste disposal.</p> <p>SR: Use cone bottom stock tanks and run bottoms through heater-treater more frequently than normal.</p> <p>SR: Reduce the number of tanks by consolidating produced fluid storage facilities.</p> <p>SR: Keep a gas blanket on tanks to reduce oxygen and formation of iron oxides. A gas blanket can also reduce risk of explosion and subsequent leakage due to lightning strikes.</p> <p>SR: Identify and minimize the source of solids.</p> <p>R: Send tank bottoms to crude oil reclamation plants. (Call RRC @ (512) 463-6874 for current list of permitted crude oil reclamation plants.)</p> <p>R: Send to a refinery coker.</p> <p>R: Use a centrifuge or filter press to recover oil and water from tank bottoms.</p>
Thread protectors	Nonexempt	<p>SR: Avoid using excess pipe dope.</p> <p>SR: Return to vendor or send to recycler.</p> <p>R: Reuse in operations or sell for re-use.</p> <p>R: Send to a reclamation facility that removes pipe dope and markets for reuse.</p>
Tires	Nonexempt	<p>SR: Rotate tires and align regularly.</p> <p>SR: Maintain proper inflation pressure.</p> <p>SR: Purchase tires with greater road-wear abilities.</p> <p>R: Send to a tire recycler.</p> <p>R: Purchase retreaded tires if feasible.</p>
Vacuum truck rinsate	Nonexempt	<p>SR: Use chemicals and products that are less hazardous or toxic.</p> <p>SR: Avoid mixing nonhazardous and hazardous wastes in vacuum truck.</p>
Well completion, treatment, and stimulation fluids, unused	Nonexempt	<p>SR: Recycle unused frac oil back into production stream.</p> <p>SR: Use all of the product whenever possible; e.g., use excess frac oil, acid, stimulation fluids, and xylene in other wells.</p> <p>SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused chemicals to other company facilities in lieu of disposal.</p> <p>SR: Return unused portion to vendor.</p>
Workover wastes	Exempt	<p>SR: Place into production stream whenever possible.</p> <p>R: Recycle free liquids back into production stream.</p>

NOTES

APPENDIX G

***HAZARDOUS WASTE MANAGEMENT
SYSTEM; IDENTIFICATION AND LISTING OF
HAZARDOUS WASTE; RECYCLED USED OIL
MANAGEMENT STANDARDS***

59 Federal Register 10550-10560 (March 4, 1994)

Important Note

This Federal Register notice is taken from the U.S. EPA web site at the following URL:

<http://www.epa.gov/OSWRCRA/hazwaste/usedoil/fr/fr030494.txt>

The notice has been reformatted to aid in readability. The footnote is provided at the end of the notice (page G-21).

You should refer to the original Federal Register notice to assure accuracy.

Federal Register / VOL. 59, No. 43 / Friday, March 4, 1994 / Rules and Regulations
(Pages 10550 - 10560)

40 CFR Parts 271 and 279

[EPA/530-2-42-011; FRL-4845-2]

Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Recycled Used Oil Management Standards; Final Rule

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: On September 10, 1992, EPA exempted used oil inserted into crude oil pipelines from the part 279 used oil management standards. EPA is today clarifying the existing pipeline exemption and expanding the exemption to other petroleum refinery applications. Today's document clarifies that the exemption from the used oil management standards did not intend to exclude used oil mixed with crude oil or natural gas liquids (hereinafter referred to as "crude oil") in pre-pipeline units (e.g., stock tanks, production separators) prior to being introduced into the crude oil pipeline. In addition, today's rule expands the used oil exemption to include transportation and/or storage of mixtures of small amounts of used oil (i.e., less than 1%) and crude oil that are destined for insertion into a petroleum refining facility process at a point prior to crude distillation or catalytic cracking.

Today's rule exempts from the part 279 standards, used oil that is inserted into the petroleum refining facility process after distillation or catalytic cracking operations provided that the used oil meets the used oil specification prior to insertion.

Today's rule also exempts from the part 279 standards used oil that incidentally enters and is recovered from a refinery's hydrocarbon recovery system or wastewater treatment system (i.e., process sewer, storm sewer, or wastewater treatment units), if the recovered used oil is subsequently inserted into the petroleum refinery process.

In addition, today's rule expands the definition of transfer facility to allow used oil to be held more than 24 hours but less than 35 days prior to specified activities.

Finally, EPA is today amending the used oil processor standards to clarify that a specific set of on-site maintenance, filtering, and separation activities were not intended to be covered under the used oil processor standards. EPA is also correcting errors in regulations that appeared in the May 3, 1993, Federal Register.

EFFECTIVE DATE: April 4, 1994.

ADDRESSES: The regulatory docket for this rulemaking is available for public inspection at room 2427, U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460 from 9 a.m. to 4 p.m., Monday through Friday, except for Federal holidays. The docket number is F-94-UOTA-FFFFF. The public must make an appointment to review docket materials by calling (202) 260-9327. The public may copy a maximum of 100 pages from any regulatory document at no cost. Additional copies cost \$.20 per page.

FOR FURTHER INFORMATION CONTACT: For general information contact the RCRA Hotline, Office of Solid Waste, U.S. Environmental Protection Agency, 401 M Street SW., Washington,

DC 20460; Telephone (800) 424-9346 (toll free) or, in the Washington DC, metropolitan area at (703) 920-9810.

For information on specific aspects of this rule, contact Ms. Eydie Pines, telephone (202) 260-3509, U.S. EPA, 401 M Street SW., Washington, DC 20460.

SUPPLEMENTARY INFORMATION: The contents of today's preamble are listed in the following outline:

I. Authority.

II. Background.

A. Summary of Recent Regulatory Actions Pertaining to Used Oil.

1. Summary of May 20, 1992, Federal Register Notice.
2. Summary of September 10, 1992, Federal Register Notice.
3. May 3, 1993, and June 17, 1993 Correction Notices.

B. Summary of the 1985 Comments.

C. Summary of 1991 Comments.

III. Analysis of New Part 279 Provisions.

A. Summary of Comments from Interested Parties.

B. Definition of petroleum refining facility, used oil re-refining facility.

C. Used Oil Introduced into Crude Oil Pipelines or Petroleum Refineries.

1. Used Oil Introduced into Crude Oil Pipelines.

2. Storage and Transportation of Mixtures of Used Oil and Crude Oil.

3. Used Oil Inserted into the Petroleum Refining Process without Prior Mixing and Mixtures of Greater Than One Percent Used Oil.

4. Used Oil Inserted Into the Petroleum Refining Process after Crude Distillation or Catalytic Cracking.

5. Used Oil Captured by the Refinery's Hydrocarbon Recovery System or Wastewater Treatment System and Inserted into Petroleum Refining Process.

6. Stock Tank Bottoms.

D. Used Oil Transportation. Definition of Transfer Facility.

E. Used Oil Processing by Generators and Transfer Facilities.

1. Definition of Used Oil Processor.

(A) Reconditioning used oil before returning it for reuse by the generator.

(B) Separating used oil from wastewater to make wastewater acceptable for discharge or reuse.

(C) Using oil mist collectors to remove droplets of used oil from in-plant air to make plant air suitable for continued recirculation.

(D) Removing used oil from materials containing or otherwise contaminated with used oil in order to remove excessive oil.

(E) Filtering, separating, or otherwise reconditioning used oil before burning it in a space heater.

F. Restrictions on transporters who are not also processors or re-refiners and changes to the definition of transfer facility.

G. Tracking.

H. Correction to the Regulatory Language.

1. Requirements for enforcement authority.

2. Rebuttable Presumption.

3. Characteristic Hazardous Waste.

I. Correction to the Preamble Language.

IV. State Authorization.

V. Executive Order 12866.

VI. Paperwork Reduction Act.

VII. Regulatory Flexibility Act.

VIII. Administrative Procedure Act.

Authority

The regulations promulgated today are issued under the authority of sections 1004, 1006, 2002(a), 3014, and 7004 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and as amended by the Used Oil recycling Act, as amended, 42 U.S.C. 6903, 6905, 6912(a), 6935, and 6974.

II. Background

A. Summary of Recent Regulatory Actions Pertaining to Used Oil

1. Summary of May 20, 1992, Federal Register Notice

On May 20, 1992, EPA published a final listing determination for used oils that are destined for disposal (see 57 FR 21524). The Agency determined that used oils destined for disposal did not have to be listed as a hazardous waste because used oils do not typically and frequently meet the technical criteria for listing a waste as hazardous. EPA gave considerable attention, in reaching its determination, to the current Federal regulations that govern the management of used oils that are disposed, including the requirement for used oil that exhibits a characteristic of hazardous waste under subtitle C of RCRA.

The May 20, 1992, Federal Register notice also included a categorical exemption from the definition of hazardous waste in Sec. 261.4 for non-terne-plated used oil filters that have been hot-drained to remove used oil. EPA based this exemption on data submitted to the Agency indicating that these filters do not typically and frequently exhibit the toxicity characteristic.

2. Summary of September 10, 1992, Federal Register Notice

On September 10, 1992, EPA promulgated a final listing decision for used oils that are recycled and simultaneously promulgated management standards for used oil, codified at 40 CFR part 279 (see 57 FR 41566). EPA determined that used oil destined for recycling did not have to be listed as a hazardous waste because the used oil did not meet the technical criteria for listing a waste as hazardous, particularly in light of the new management standards and other federal requirements which control the risks posed by improper management of used oil. The standards cover used oil generators, transporters, processors, re-refiners, off-specification burners and marketers. The standards included an exemption from the management standards for used oil placed directly in a crude oil pipeline.

3. May 3, 1993, and June 17, 1993 Correction Notices

On May 3, 1993, EPA published technical amendments and corrections to the May 20, 1992 and September 10, 1992, Federal Register Notices (see 58 FR 26421). On June 17, 1993, EPA corrected several errors in the May 3, 1993, notice (see 58 FR 33341).

B. Summary of the 1985 Comments Regarding Used Oil Mixed With Crude Oil Destined for Refineries

On November 29, 1985, EPA proposed to list all used oil as a hazardous waste (50 FR 49248). Commenters responded that used oil mixed with crude oil be exempt from such regulation because the small quantities of used oil mixed with crude oil posed no threat to the environment when refined with crude oil.

C. Summary of 1991 Comments

On September 23, 1991, EPA proposed that the two exemptions from subtitle C requirements promulgated in 1985 (see 40 CFR 261.6(a)(3) (v)-(viii)) for oil-bearing hazardous waste and fuels derived from these wastes, also apply to used oils. (56 FR 48026, 48042) EPA proposed exemptions from the used oil management requirements (whether or not EPA ultimately listed used oil as a hazardous waste) for: (1) Used oils that are reinserted as feedstocks at primary petroleum refineries; and (2) fuels derived from those used oils.

Commenters (mainly the primary petroleum refining industry) stated that if EPA chose to list used oil as hazardous waste, the Agency should exempt used oil that is reintroduced into the refinery process from hazardous waste or used oil management standards requirements. Commenters further stated that if EPA did not adopt this exemption, the entire refinery process could be subject to hazardous waste management requirements, including permits. Commenters stated that this would be unwarranted because the reintroduction of used oil into the refining process contributes only insignificant concentrations of metals to the crude oil or finished petroleum product. Other commenters stated that refiners that handle used oil should be subject to the same requirements for used oil management as are used oil re-refiners.

Commenters from the primary petroleum refining industry also stated that EPA should not limit the exemption to those instances where used oil is inserted before fluid catalytic cracking or distillation, since other conversion and distillation processes in the refinery would also remove, alter or immobilize impurities in the oil. They asserted that limiting the point of insertion could foreclose the future development of used oil recycling activities. These commenters also stated that limiting the insertion point could preclude refineries from accepting DIY oil. Commenters asserted that DIY oil might have to undergo certain pre-processing at refineries prior to its insertion into the refining process. They also asserted that under the proposed exemption, this pre-processing would not be exempt and would be a hazardous waste activity. Commenters stated that these activities are part of the refining process.

Commenters from the primary petroleum industry further stated that EPA should extend the exemption to apply to used oil inserted into the pipeline at marketing, E&P and pipeline facilities for use in the refinery process. They asserted that used oil recovered from oil and gas exploration and production is placed in pipelines and trucks and returned to the refinery from other petroleum facilities. Commenters stated that the recovered oils are useful, valuable raw materials that are reintroduced into the crude stream for their economic value.

III. Analysis of New Part 279 Provisions

On September 10, 1992, EPA promulgated a final listing decision for used oils that are recycled and simultaneously promulgated standards in 40 CFR part 279 for the management of used oil under RCRA section 3014. Under Sec. 279.10(g) of part 279, EPA granted an exemption for used oils introduced directly into crude oil pipelines from part 279 standards at the point at which they are introduced. EPA did not address the proposed exemptions for used oil inserted into the petroleum refining facility process either prior to or after crude distillation or catalytic cracking.

The American Petroleum Institute filed a petition for review of the September 10, 1992, rule, on December 8, 1992, raising the issue that EPA had not addressed the proposed exemptions for petroleum refining, production, and transportation in the September 10, 1992, final rule. Today's rule responds to comments and addresses outstanding issues related to used oil and petroleum refining facility processes.

A. Summary of Comments From Interested Parties

Today's rule was distributed in draft form for comment to the litigants and intervenors concerning the 1992 rule, and other concerned members of the regulated community, States, and environmental groups. The primary substantive comments received on the draft and EPA's responses to those comments are summarized below.

EPA received several comments from the petroleum industry on the exemption from part 279 for storage and transportation of mixtures of used oil and crude oil that contain less than 1% used oil and are destined for insertion into petroleum refining process. These commenters objected primarily to provisions in the draft final rule limiting the exemption to mixtures that contain less than 1% used oil. The commenters also objected to limiting the amount of used oil that can be directly inserted into the petroleum refining process to 1% of the crude oil process unit throughput at any given time. EPA has retained the 1% limit in both cases in today's final rule for reasons discussed in section III.B.2 of this preamble.

EPA received comments from used oil re-refiners (i.e., "secondary" petroleum industry--a type of used oil processor) regarding the regulatory status of petroleum refineries that receive used oil from off-site and store the used oil on-site before mixing it with crude oil. The draft rule proposed to regulate petroleum refining facilities as used oil transfer facilities in these circumstances. Commenters stated, however, that petroleum refineries that receive used oil from off-site pose the same potential concerns from receipt of adulterated used oil and improper storage of used oil as re-refiners and should therefore be subject to the requirements for used oil processor/re-refiners prior to mixing. EPA agrees and has revised the draft rule accordingly. These changes are discussed in greater detail below.

EPA also received numerous comments on provisions clarifying what constitutes a used oil processor. Provisions contained in the draft document would have prohibited both on- and off-site burning of used oil generated from specified activities that EPA is today clarifying are not subject to the used oil processor standards. Commenters stated that the used oil generated from these activities would be suitable for burning in accordance with the part 279, subpart G standards and that burning should not be further restricted. In response to these comments, EPA has decided to allow on-site burning of the used oil generated from these activities but has retained the prohibition against off-site burning. The basis for this decision is discussed in section III.C of today's preamble.

B. Section 279.1--Definition of Petroleum Refining Facility

Today's rule establishes a regulatory definition for "petroleum refining facility." EPA believes it is necessary to define this term in order to provide a clear distinction between what the Agency considers to be and regulates as primary petroleum refining facilities and facilities that EPA considers to be used oil re-refiners for regulatory purposes. Under today's rule, "petroleum refining facility" is defined as follows:

"Petroleum refining facility" means an establishment primarily engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, and lubricants, through fractionation, straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking or other processes (i.e., facilities classified as SIC 2911).

A used oil re-refiner, in contrast, is a facility that processes used oil to produce lube base stocks and greases, industrial fuels, asphalt extenders, diesel like fuels, and other products.

EPA is aware that petroleum refiners and used oil re-refiners employ similar production processes and produce similar products. Consequently, the Agency has avoided defining these facilities in terms of the process steps employed to produce a finished product or the type of products produced. As defined by today's rule, petroleum refining facilities and used oil re-refining facilities differ primarily in the material that constitutes the primary initial feed to the process. In order for a facility to be considered a petroleum refining facility, the material fed to the front end of the refining process must be comprised primarily of crude oil. In order to be considered a used oil re-refiner, the material entering the front end of the process must be comprised primarily of used oil.

C. Section 279.10(g)--Used Oil Introduced Into Crude Oil Pipelines or Petroleum Refining Facilities

1. Section 279.10(g)(1)--Used Oil Introduced Into Crude Oil Pipelines

The September 10, 1992, final used oil regulations provided an exemption at Sec. 279.10(g) from management standards for used oil that is placed directly into a crude oil pipeline (see 57 FR 41613). Today's rule replaces Sec. 279.10(g) with Sec. 279.10(g)(1) which clarifies the original intent of the pipeline exemption. Section 279.10(g) of the September 10, 1992, final rule provided that "Used oil that is placed directly into a crude oil, oil or natural gas pipeline is subject to the management standards of [part 279] only prior to the point of introduction into the pipeline. Once the used oil is introduced to the pipeline, the material is exempt from the requirements of [part 279]."

EPA is concerned that the phrase, "placed directly into a crude oil or natural gas pipeline," can be literally interpreted to apply more narrowly than the Agency had intended. EPA understands that it is standard practice to first mix small amounts of used oil, typically less than 1%, with crude oil in stock tanks, production separators or other tank units that are connected via pipeline to the petroleum refining facility (i.e., pre-pipeline units). It was not EPA's intent to exclude used oil that is mixed with crude oil in these pre-pipeline units from the Sec. 279.10(g) pipeline exemption. Rather, EPA intended to include this practice within the meaning of "direct insertion." Because used oil is typically inserted into the petroleum pipeline through these pre-pipeline units, to exclude these units from the pipeline exemption would effectively render the exemption meaningless. Clearly this was not EPA's intent. Today's rule revises the language of the exemption to clarify that used oil may be inserted into the pipeline via pre-pipeline units (which contain crude oil) exempt from the requirements of part 279. It should be noted here that the Sec. 279.10(g)(1) pipeline exemption established by today's rule is limited to pipelines that convey crude oil from off-site locations to the petroleum refining facility. The exemption does not apply to pipelines that convey crude oil from one on-site location within a petroleum refinery to another. If such on-site piping contains used oil, it is exempt only if it qualifies under Secs. 279.10(g)(2)-(5) discussed below. Also, if processing of the used oil is performed prior to mixing with crude oil in these pre-pipeline units, such processing remains subject to the part 279, subpart F standards for used oil processors and re-refiners. Used oil that is generated and stored at the pipeline is subject to the used oil generator standards prior to mixing with crude oil. Used oil that is transported to the pipeline and immediately mixed with crude oil or stored for less than 24 hours prior to such mixing is subject to all Subpart E transporter standards except for Sec. 279.45 which applies to transfer facilities. Used oil that is transported to and subsequently stored at the pipeline for more than 24 hours and less than 35 days prior to mixing with crude oil is subject to all the part 279, subpart E transporter/transfer facility requirements.

2. Section 279.10(g)(2)--Storage and Transportation of Mixtures of Used Oil and Crude Oil

Section 279.10(g)(2) of today's rule expands the used oil management standard exemption to include: (1) Mixtures of used oil and crude oil containing less than 1% used oil that are being stored at the petroleum refining facility or in discrete units remotely located from the pipeline, as long as the mixture is destined for the refinery and inserted prior to crude distillation or catalytic cracking; and (2) mixtures of used oil and crude oil containing less than 1% used oil that are being transported (via truck, rail, or vessel) to the petroleum refinery or the pipeline for insertion into the petroleum refining process prior to crude distillation or catalytic cracking. The former exemption provided at Sec. 279.10(g) did not apply either to mixtures of used oil and crude oil that are stored at the petroleum refinery or in remotely located units, or to the transportation of mixtures of used oil and crude oil. The previous, more narrow exemption was based on the assumption that used oil was placed directly into the pipeline (or into units directly connected to the pipeline as previously discussed). EPA assumed that the mixing of used oil and crude oil occurred at the point at which used oil was inserted into the pipeline. EPA has since learned, however, that mixing frequently occurs at exploration and production sites that are remotely located from the pipeline or the petroleum refinery.

For example, used oil generated during on- and off-shore drilling activities (e.g. from compressors, trucks and other heavy equipment) is routinely mixed with crude oil in units (e.g. production separators, seagoing vessels, stock tanks, etc.) located at the exploration and production site and then transported, as a mixture, to the pipeline or petroleum refining facility. Depending on the location of the drilling activities, the mixture of used oil and crude oil may need to be transported (by vessel, truck, rail, etc.) to a separate location for introduction into the pipeline or the petroleum refining facility. In the case of off-shore drilling sites for example, conveyance of the mixture may involve multiple modes of transportation (i.e., from the off-shore platform to land by vessel or pipeline and then to the crude oil pipeline by land-based transport). Today's exemption covers all modes of transportation of mixtures of used oil and crude or natural gas liquids, as long as the mixture contains less than 1% used oil and is destined for insertion into a petroleum refining facility process at a point prior to crude distillation or catalytic cracking. In addition, today's exemption covers storage of mixtures of used oil and crude oil, provided that the mixture contains less than 1% used oil and is inserted into a petroleum refining facility process prior to crude distillation or catalytic cracking.

Used oil that is generated at exploration and production sites continues to be subject to used oil generator standards prior to being mixed with crude oil such that it is exempt under today's rule. Used oil that is generated off-site and transported to or stored at an exploration and production site is subject to the transporter and transfer facility standards, as applicable, up until the point at which the used oil is mixed with crude oil such that it is exempt under Sec. 279.10(g)(2).

EPA is exempting mixtures of used oil and crude oil held in discrete units at a refinery or at remote locations because the Agency understands that the amount of used oil contained in these mixtures is extremely small relative to the large quantities of crude oil. In developing today's rule, EPA held numerous discussions with petroleum refinery industry representatives regarding the maximum amount of used oil contained in mixtures of used oil and crude oil that are destined for insertion into a petroleum refining process prior to crude distillation or catalytic cracking. Industry representatives repeatedly informed the Agency that used oil constitutes less than 1% of these mixtures. In gathering information for today's rule, EPA held conference calls with representatives from a number of petroleum refining companies (e.g., Mobil Oil Corporation and Phillips Petroleum Inc.). The Agency also conducted several site visits, including visits to an Amoco refinery in Whiting, Indiana and a Mobil Oil Corporation refinery in Paulsboro, New Jersey. In each case, EPA was informed that used oil does not currently, and will not comprise greater than 1% of the crude oil/used oil mixture because of the sheer volumes of crude oil that are continuously being produced and processed

relative to the amount of used oil that is generated at production sites or refineries. This recent information is consistent with comments submitted in response to the 1985 Used Oil Proposed Rule in which Exxon Company, USA stated that the average percentage of used oil in refinery feed stock streams is less than 0.02% and Texaco, Inc., indicated that used oil would constitute no more than 0.01% of the refinery input.

EPA does not believe it is necessary to apply the used oil management standards to the less than 1% fraction of used oil that is being held temporarily in discrete units or transported from those units to the pipeline or the petroleum refinery for recycling as part of a mixture that is composed overwhelmingly of crude oil. In essence, because of the high ratio of crude oil to used oil, EPA considers the mixture to be equivalent to crude oil for regulatory purposes. EPA's part 279 standards were designed to control those particular risks associated with the management of used oil (e.g., uncontrolled burning, improper storage practices by used oil handlers) pursuant to section 3014 of RCRA.

The reason for EPA's imposition of a 1% limit on the amount of used oil contained in mixtures of used oil and crude oil being stored or transported to a crude oil pipeline or petroleum refinery prior to insertion into the refining process is that, while we have determined that the small amounts of used oil that are being added to crude oil under current practices pose no incremental risk over normal crude oil, we have not evaluated whether larger amounts of used oil also pose no incremental risk. Given the information provided to EPA by the petroleum refining industry regarding the inherent limitations on the amount of used oil that is or should be contained in mixtures of used oil and crude oil (i.e., less than 1%), and given that EPA has received no information, either recently, or in response to previous rulemakings that provides basis for an alternative limit, the Agency sees no point in imposing a higher cap. Imposition of a higher cap could have the effect of encouraging mixing of used oil with crude oil that would not otherwise occur during the normal course of petroleum refining operations. Such an incentive might lead to increased incremental risk from management of large amounts of used oil, exempt from the part 279 standards, at petroleum refineries. EPA also concluded that a less precise limit (i.e., "de minimis" or "small amounts"), as was suggested by some commenters from the petroleum refining industry, would needlessly cause uncertainty, given that EPA was told repeatedly that amounts currently introduced are far less than 1%.

3. Section 279.10(g)(3)--Used Oil Inserted Into the Petroleum Refining Process Without Prior Mixing and Mixtures of Greater Than One Percent Used Oil

As previously stated, under today's rule, mixtures of used oil and crude oil containing less than 1% used oil that are transported to or stored at a petroleum refinery, and are introduced prior to crude distillation or catalytic cracking, are exempt from part 279 standards under Sec. 279.10(g)(2). It is EPA's understanding, based on information received from petroleum industry representatives, that used oil can potentially be inserted directly into the petroleum refining process prior to crude distillation or catalytic cracking without either: (1) Mixing the used oil with crude oil feedstocks, or (2) pre-processing of the used oil to ensure that any contaminants in the used oil will not interfere with the refining process (e.g., contaminants fouling a catalyst, etc.). Based on this understanding, today's exemption also applies to used oil that is introduced directly into the petroleum refining process at a point prior to crude distillation or catalytic cracking as long as the used oil comprises less than 1% of the crude oil feed to a petroleum refining facility process unit at any given time. Again, because of the high ratio of crude oil to used oil, EPA considers these mixtures to be equivalent to crude oil for regulatory purposes. Therefore, the Agency believes that this activity would pose no significant increase in risk.

Used oil that is inserted directly into the petroleum refining process (at a volume of less than 1% of the crude oil process unit feed at any given time) is considered mixed, and therefore exempt from part 279, at the point at which it enters the process. This exemption applies both

to used oil generated at the petroleum refining facility where the used oil is being inserted, and to used oil generated off-site that is collected and transported to the petroleum refining facility for insertion into the refining process prior to crude distillation or catalytic cracking.

Used oil that is inserted into the petroleum refining process without first being mixed with crude oil feedstocks (e.g. in crude oil stock tanks) is subject to part 279 standards prior to insertion. Used oil that is generated on-site and then stored without prior mixing and used oil generated on-site that constitutes greater than 1% of a mixture of used and crude oil continues to be subject to the part 279, subpart C standards for generators. With the exception of used oil that is exempt from the part 279 standards because it constitutes less than 1% of a mixture of used oil and crude oil, used oil that is generated off-site and then transported to or stored at a petroleum refining facility, continues to be subject to the applicable part 279 requirements i.e., to the requirements for used oil transporters and transfer facilities while being transported and to the requirements for used oil processors upon receipt at the petroleum refining facility. Petroleum refining facilities that receive used oil from off-site for direct insertion into the petroleum refining process are subject to the used oil processor standards from the point at which they receive the used oil up until the point at which the used oil is inserted into the petroleum refining process. Finally, it is important to reiterate that the exemptions provided under both Secs. 279.10(g)(2) and 279.10(g)(3) of today's rule apply at the point of mixing and only to mixtures that contain less than 1% of used oil.

Although petroleum industry representatives have raised concerns that a 1% limit on the amount of used oil that can be inserted directly into the petroleum refining process may be technology limiting, EPA has not received any information that would support this position, nor has the Agency received information to support an alternative level. The Agency believes that by limiting the amount of used oil that can be introduced directly into the refining process exempt from the used oil processing standards, it can better ensure against mixing only to avoid compliance with the part 279 processing standards. If information becomes available that the 1% limit is inhibiting used oil recycling, the Agency will consider whether any change to the rules is necessary.

In the draft rule, EPA proposed to regulate petroleum refining facilities that receive used oil from off-site as used oil transfer facilities prior to mixing. However, EPA agrees with comments on the draft rule that petroleum refining facilities that receive used oil from off-site pose the same potential concerns associated with receipt of adulterated used oil and improper storage of used oil as used oil re-refiners. Petroleum refining facilities that receive used oil from off-site may not have adequate information to ensure that the used oil has not been improperly mixed with listed hazardous waste. Also, the volumes of used oil that may be managed require adequate planning for dealing with emergency releases. EPA has therefore revised the final rule to provide that petroleum refining facilities that receive and store used oil from off-site are subject to the used oil processor standards prior to mixing. The principal effect of this change is that petroleum refiners that receive used oil from off-site must prepare a waste analysis plan to ensure that the used oil has not been mixed with hazardous waste and must maintain an operating record to document compliance with the waste analysis plan. In addition, such refineries will have to adopt or amend emergency contingency plans to address used oil in accordance with Sec. 279.52 of the used oil management standards.

4. Section 279.10(g)(4)--Used Oil Inserted Into the Petroleum Refining Process After Crude Distillation or Catalytic Cracking

Under Sec. 279.10(g)(4) of today's rule, used oil that is inserted into the petroleum refining process after crude distillation or catalytic cracking is exempt from the part 279 standards provided that the used oil meets the used oil specification prior to insertion. Used oil remains subject to part 279 standards up until its actual insertion into the petroleum refining process. As previously discussed, used oil generated on-site must be stored according to part 279,

subpart C standards for used oil generators. Used oil generated off-site must be transported according to the part 279, subpart E standards for transporters and transfer facilities and stored according to the part 279, subpart F standards for used oil processor/re-refiners.

EPA's use of the terms "before" and "after" crude distillation or catalytic cracking is intended to distinguish between the initial part of the petroleum refining process where crude oil is the primary feedstock and is refined by undergoing crude distillation or catalytic cracking and the latter part of the petroleum refining process where crude oil residuals constitute the primary feed, and coke and asphalt are the primary products. Refinery processes that occur after crude distillation or catalytic cracking do not provide refining to the same extent as that which occurs as a result of crude distillation or catalytic cracking. Crude distillation or catalytic cracking is expressly designed to remove, alter, or otherwise immobilize contaminants in the normal course of the refining process. EPA has insufficient information on post-crude distillation or catalytic cracking units identified by commenters (e.g., asphalt towers, petroleum cokers), and is concerned about the possible environmental effects (e.g., air emissions, transfer of inorganics to asphalt or petroleum coke) of placing large amounts of off-specification used oil into the petroleum refining process without passing through the crude distillation or catalytic cracking units. In contrast, on-specification used oil may be burned in the same manner as virgin petroleum fuel in other situations, therefore it makes little sense to restrict its use as a feedstock to the petroleum coker (or in any other process "after" crude distillation or catalytic cracking).

It should be noted that if off-specification used oil is inserted into petroleum refining processes after crude distillation or catalytic cracking (e.g., a coker), the facility would be subject to the used oil processing requirements in part 279, subpart F. In addition, petroleum refining facilities that wish to insert on-specification used oil into the refining process after crude distillation or catalytic cracking and that are the first to claim that the used oil is on-specification (whether generated at the refinery, or at an off-site location), would be defined as marketers subject to the requirements for used oil marketers found in part 279, subpart H.

5. Section 279.10(g)(5)--Used Oil Captured by the Refinery's Hydrocarbon Recovery System or Wastewater Treatment System and Inserted Into Petroleum Refining Process

Section 279.10(g)(5) of today's rule exempts from the part 279 standards used oil that incidentally enters and is recovered from a petroleum refining facility's hydrocarbon recovery system or its wastewater treatment system (e.g., process sewer, storm sewer, or wastewater treatment units), if the recovered used oil is subsequently inserted into the petroleum refining process. Oil (that may contain small amounts of used oil) that has been recovered from a refining facility's hydrocarbon recovery or wastewater treatment system is typically used as a feedstock in petroleum refining to produce more petroleum products. EPA understands that used oil, generated from routine refinery process operations and that incidentally enters a refinery's recovery or wastewater treatment system (e.g., drips, leaks, and spills from compressors, valves, and pumps), represents a small portion of the total oil that enters (and is then recovered from) the recovery or wastewater treatment system. Thus, the oil recovered from the system is more properly characterized as crude feedstock than used oil. Provided the used oil is inserted into the petroleum refining process, EPA believes that regulation under part 279 standards is unwarranted. This exemption from the part 279 standards does not extend to used oil which is intentionally introduced into a petroleum refinery's recovery or wastewater treatment system (e.g., pouring collected used oil into any part of the hydrocarbon recovery system, storm or process sewer system or into wastewater treatment units). Used oil may not be introduced to the refinery's hydrocarbon recovery or wastewater treatment system as a way to avoid meeting the conditions specified in Sec. 279.10(g)(4).

For the purposes of the exemption in today's rule, the examples cited in the existing de minimis wastewater exclusion (Sec. 279.10(f)) provide guidance on what types of releases to a refinery's

hydrocarbon recovery or wastewater treatment system would be considered "routine" or "incidental". The exemption is intended to cover losses from drippage, minor spillage, etc., that cannot be reasonably avoided. For example, used oil that has been collected from equipment or vehicle maintenance activities and intentionally introduced into a refinery's wastewater treatment system would not be exempt under Sec. 279.1(g)(5) from the part 279 standards once recovered. Similarly, used oil that is generated off-site and is brought to the refinery may not be added to any portion of the refinery's wastewater treatment system (i.e., process sewer, storm sewer, or wastewater treatment units), and still be exempt under Sec. 279.10(g)(5) once recovered; such oil is clearly not "incidentally captured" by the refinery's wastewater treatment system. In fact, unless specifically exempted under Sec. 279.10(g)(2) or Sec. 279.10(g)(3) of today's rule, this type of activity would meet the definition of used oil processing under the existing used oil management standards (see 40 CFR 279.1).

Today's rule does not preclude intentional introduction of used oil in to the facility's recovered oil tanks. EPA is aware that used oil from both on- and off-site is often added directly to the petroleum refining facility's recovered oil tanks. Mixtures of used oil and recovered oil that contain greater than 1% used oil are regulated as used oil. Mixtures of used oil and recovered oil that contain less than 1% used oil and are inserted into the petroleum refining process prior to crude distillation or catalytic cracking are exempt from the part 279 used oil management standards under Sec. 279.10(g)(2). Mixtures of used oil and recovered oil that contain less than 1% used oil and are inserted into the petroleum refining process after crude distillation or catalytic cracking are exempt from the part 279 standards (under Sec. 279.10(g)(4)) only if the used oil meets the used oil specification prior to mixing with recovered oil.

6. Section 279.10(g)(6)--Stock Tank Bottoms

Section 279.10(g)(6) of today's rule exempts tank bottoms from stock tanks containing exempt mixtures of used oil and crude oil from the part 279 standards. Like the actual mixtures of used oil and crude oil, the bottoms from these mixtures are expected to contain insignificant amounts of used oil. Therefore, the Agency does not believe that the bottoms from tanks (or other units) containing mixtures of used oil and crude oil should be subject to the used oil management standards. The tank bottoms are subject to all other applicable requirements, i.e., the Sec. 262.11 requirement to determine if they are hazardous waste.

D. Used Oil Transportation

Section 279.1--Definition of Transfer Facility

Today's rule revises the definition of transfer facility to allow used oil to be held at a location (i.e., a transfer facility) temporarily prior to activities that are not subject to the processor standards as a result of today's rulemaking. In the September 10, 1992 final rule, a transfer facility was defined as a transportation-related facility where shipments of used oil are held for more than 24 hours but less than 35 days during the normal course of transportation. Today's rule expands that definition to allow used oil to be held for more than 24 hours but less than 35 days during the normal course of transportation or prior to an activity performed pursuant to Sec. 279.20(b)(2). Under the amended definition, as discussed below in section F of this preamble, a site to which used oil from oil-bearing electrical transformers is transported for filtering prior to reuse would be considered a transfer facility under today's definition.

E. Section 279.20(b)(2)(ii)--Used Oil Processing by Generators and Transfer Facilities

Since the promulgation of the September 10, 1992, Used Oil Management Standards, a number of parties have raised concerns regarding the definition of used oil processor and the types of activities that are covered by that definition. The commenters are concerned that a broad construction of the term processor inappropriately includes a number of very basic

on-site generator activities that the Agency did not intend to regulate under the used oil processor standards (e.g. reconditioning/maintenance to extend the life of used oil, separation of used oil from wastewater discharge, etc.). EPA agrees that activities such as these, when performed by the generator, were not intended to be covered under the used oil processor standards because used oil processing is not their primary purpose, as explained below in greater detail. In fact, too broad an interpretation of the processor definition may discourage environmentally beneficial recycling and waste minimization activities by imposing an unwarranted regulatory burden on owners and operators that EPA did not intend to regulate as used oil processors.

Therefore, today's rule revises the used oil management regulations to clarify the Agency's intent regarding the definition of a used oil processor by specifying those on-site maintenance, filtering, and separation activities that are not, and were not intended to be subject to the used oil processing standards. Under today's rule, generators¹ who only handle used oil in a manner specified under Sec. 279.20(b)(2)(ii) are not processors provided that the used oil is generated on-site and is not being sent directly off-site to a burner of on- or off-specification used oil fuel. (Section 279.20(b)(2)(ii) also applies to collection centers and aggregation points since these entities are regulated as generators.)

Activities that EPA did not intend to include under the definition of used oil processor are described below. EPA does not believe that the activities identified in Sec. 279.20(b)(2)(ii) should be subject to the used oil processor standards because used oil processing is not the primary purpose of these activities i.e., the primary purpose of these activities is not to produce from used oil or to make it more amenable for the production of used oil derived products, and the Agency does not expect these limited activities will pose the same kinds of environmental problems that may occur at processor facilities. Instead, in these cases, the act of mixing, filtering, separating, draining etc., used oil by the generator constitutes a basic step that is incidental or ancillary to a primary activity which is distinct from used oil processing. It is important to note, however, that owners or operators who generate used oil as a result of any of the activities specified in Sec. 279.20(b)(2)(ii) are considered used oil generators and are subject to the generator standards in subpart C.

EPA is allowing on-site but not off-site burning of used oil generated from designated on-site activities because the Agency believes that this approach best enables EPA to strike a reasonable balance between encouraging beneficial on-site reuse and recycling activities that should pose very limited risks, on one hand, and ensuring that activities undertaken primarily to make used oil more amenable for burning (i.e., used oil processing) are adequately controlled under the more stringent used oil processing standards.

The definition of a used oil processor is based on the purpose for which used oil is being filtered, separated, or otherwise reconditioned (i.e., whether the activity is designed to produce used oil derived products or to make used oil more amenable for the production of used oil derived products). The Agency is concerned that in situations where used oil is being filtered, separated or otherwise reconditioned and then sent to off-site burners, the purpose of the activity may prove difficult to discern and that consequently, Sec. 279.20(b)(2)(ii) provisions may be used as a means to avoid compliance with the used oil processor standards (i.e., by persons who claim not to be used oil processors under the Sec. 279.20(b)(2)(ii) provisions but whose primary purpose is to make the used oil more suitable for burning). Therefore, EPA believes it is necessary to adopt an objective measure of the purpose of the activity. The Agency believes that a prohibition against sending used oil generated from specified on-site activities to off-site burners provides the most practical and effective way to ensure that activities undertaken only to make used oil more amenable for burning are subject to the used oil processor standards.

1. Definition of Used Oil Processor

(A) Reconditioning used oil before returning it for reuse by the generator. Under today's rule facility owners or operators who clean, separate, or otherwise recondition used oil generated on-site and then reuse it are not considered used oil processors, provided that the reconditioned used oil is being reused by the owner or operator who generated it. Examples of activities covered under this category include filtering of metalworking fluids for reuse, and filtering and then replacing oil from oil-bearing transformers and turbines during routine maintenance.

Most manufacturing facilities have in place central filtration systems designed to remove contaminants from and extend the life of water-soluble metal working fluids (e.g., lubricants and coolants), used in machining, grinding, and boring equipment. These filtration systems are on-site systems that filter chips, metal fines, dirt, water, and other contaminants from cutting fluids, drawing lubricants and coolants used in machining operations. The filtration of these extraneous materials is designed to extend the life of the reusable coolants and lubricants and is incidental to the production process. Today's rule clarifies that this type of filtration activity is not subject to the used oil processing standards when the generator reuses the filtered oil.

Similarly, during regularly scheduled maintenance of oil-bearing transformers and turbines, the oil in the electrical equipment is removed so that repairs/maintenance can be performed. In some instances, the oil is filtered prior to replacement. The filtering of the used oil is done to extend the life of the used oil, not because the oil is no longer useful, and is therefore ancillary to the equipment repair and maintenance. While, under today's rule, the owner or operator would not be considered a processor in these cases, the draining of the used oil from the transformer constitutes generation of used oil so that the facility would be considered a used oil generator.

The Agency is aware that not all used transformer oil is drained and filtered in the field. Instead, the oil-bearing electrical equipment may be transported to a central location where the oil is removed, filtered, and replaced. Or, the used oil may be removed from the transformers or turbines in the field and then transported separately in a tanker truck to a central location where it is filtered and put back into electrical equipment. Under today's rule, in cases where electrical equipment containing used oil is transported to a central location, the transporter of the oil bearing electrical equipment would not be considered a used oil transporter. However, the owner or operator would become a generator at the point at which the used oil is drained from the equipment (i.e., at the site where the oil is drained and filtered).

In cases where the used oil is removed from the transformers or turbines in the field and then transported separately in a tanker truck to a central location for filtering prior to replacement into electrical equipment, the owner or operator would become a generator in the field (i.e., at the point at which the used oil is drained). The person who then transports the used oil would also be considered a used oil transporter subject to the transporter standards. In these cases, the location at which the used oil is filtered would be considered a used oil transfer facility subject to the transfer facility standards in Sec. 279.45, provided that the used oil is stored at the site for more than 24 hours and less than 35 days. If the used oil is filtered within 24 hours of being drained (i.e., during transport) only the part 279 standards for used oil transporters would apply. This filtering activity should not raise the kind of environmental concerns that would be present at used oil processors; essentially, the filtering is incidental to the transportation and storage and should not change a facility's regulatory status. As discussed in more detail below, today's rule provides that transporters of used oil that is removed from electrical transformers and turbines and filtered by the transporter or at a transfer facility prior to being returned to the same use are not subject to the processor or re-refiner requirements in subpart F. In accordance with Sec. 279.10(e), once the used oil has been reclaimed to the point where it is ready for reuse without further processing, it is not subject to regulation as used oil.

(B) Separating used oil from wastewater to make wastewater acceptable for discharge or reuse. Today's rule clarifies that oil/water separation activities designed to make wastewater acceptable for discharge or reuse are not subject to the used oil processor standards. Facilities often use oil/water separators to remove oil (which may contain used oil) from oil/water mixtures collected from the facility's storm sewer, process sewer, sumps and other wastewater containment areas. These separation systems use chemical and physical methods to break the oil/water emulsion and recover oil from the wastewater in order to make the wastewater or storm water acceptable for discharge or reuse in compliance with local, state and federal regulations.

This type of pretreatment of wastewater containing oil is designed primarily to ensure that the wastewater meets established limits for water discharge to streams and POTWs, and not to produce used oil derived products or to make used oil more amenable for the production of used oil derived products. This type of oil/water separation activity is therefore not subject to the used oil processor standards as clarified under today's rule. It should be noted, however, that any used oil recovered from separator units would be subject to the used oil generator standards. It is also important to note that this provision applies only to used oil that is generated on-site. The provision would apply, for example, to simple oil water separation activities conducted (for purposes of wastewater discharge) by a used oil processor on wastewater which has been generated by that processor. However, persons who perform oil/water separation activities on oily wastewater received from off-site would be considered used oil processors.

(C) Using oil mist collectors to remove droplets of used oil from in-plant air to make plant air suitable for continued recirculation. As clarified under today's rule, the act of removing used oil from ambient air in the workplace is not subject to the used oil processor standards. At manufacturing facilities, droplets of used oil from machining operations are often dispersed into in-plant air. Oil mist collectors physically remove the small droplets of oil present in the ambient air. This activity is not subject to the used oil processing standards because it is intended primarily to make plant air suitable for continued recirculation and not to produce products from used oil or to make it more amenable for the production of used oil derived products. However, the oil removed from oil mist collectors is subject to the used oil generator standards.

(D) Removing used oil from materials containing or otherwise contaminated with used oil in order to remove excessive oil. Under Sec. 279.10(c) of the used oil standards, materials containing or otherwise contaminated with used oil from which the used oil has been properly drained or removed to the extent possible such that no visible signs of free-flowing oil remain in or on the material are not used oil except when burned for energy recovery. Today's rule clarifies that the Agency does not consider the removal of used oil from materials containing or contaminated with used oil in order to remove excess oil in accordance with Sec. 279.10(c) to be used oil processing. The production of used oil derived products is clearly not the primary reason for removing used oil from materials containing or contaminated with used oil. Instead, the activity is conducted primarily to clean the materials (e.g., machine tools, scrap metal, etc.) prior to reuse, recycling, or disposal and is therefore not subject to the used oil processing standards as clarified by today's rule. However, in removing the used oil from the materials, the owner or operator becomes a used oil generator subject to the Subpart C used oil generator standards.

(E) Filtering, separating, or otherwise reconditioning used oil before burning it in a space heater. Under Sec. 279.23 of the used oil standards, used oil may be burned in a used oil-fired space heater under specified conditions, and provided that the space heater burns only used oil that the owner or operator generates and/or used oil obtained from household DIY oil changers. Prior to burning, the used oil must often be filtered to remove impurities. Today's rule clarifies that filtering of used oil for the purpose of removing contaminants prior to burning the used oil in a space heater is not considered processing of used oil.

EPA provided a regulatory exemption from the used oil burning standards for generators who burn used oil in on-site space heaters (in accordance with Sec. 279.23) because the Agency believes that burning of small amounts of used oil in space heaters poses insignificant risks due to the small volume of used oil burned (see 50 FR 49194, Nov. 29, 1985). The Agency believes that, because of the small volumes of used oil involved, filtering, separating, or otherwise reconditioning used oil that is generated on-site prior to burning it in a space heater would also not pose significant risk. Therefore, although the purpose of the filtering activity in this case is to make the used oil more amenable for burning, because of the small amounts of used oil being filtered for this purpose, the Agency does not believe that imposition of the used oil processor standards is warranted. EPA is therefore adding a regulatory clarification (Sec. 279.20(b)(2)(ii)(F)) that the used oil processor standards do not apply to filtering of used oil prior to burning it in a space heater, provided that the used oil is generated on-site or obtained from households or "do-it-yourself" oil changes.

F. Section 279.41--Restrictions on transporters who are not also processors or re-refiners and changes to the definition of transfer facility.

Today's rule amends Sec. 279.41 to provide that transporters of used oil that is removed from oil-bearing transformers and turbines and filtered by a transporter or at a transfer facility before being returned to its original use are not subject to the used oil processor and re-refiner requirements. As previously discussed, during routine maintenance of oil-bearing transformers and turbines (or similar equipment), the oil in the electrical equipment is removed so that repairs/ maintenance can be performed. In some cases, the used oil is removed from the transformers or turbines in the field and then transported separately in a tanker truck (subject to the used oil transporter standards) to a central location where it is filtered and put back into electrical equipment. As discussed above, under today's rule the filtering of the used oil would not be considered used oil processing provided that the filtered oil is reused in the same or similar manner. And, in these cases (i.e., where the used oil is removed from the equipment and transported to a separate location for filtering), the location at which the oil is filtered would be considered a transfer facility provided that the used oil is stored for more than 24 hours and less than 35 days. If, as sometimes occurs, the used oil is filtered within 24 hours of being stored at the central location (i.e., during transport) the only applicable standards would be the part 279 standards for used oil transporters (i.e., the Sec. 279.45 requirements for used oil storage at transfer facilities would not apply).

Section 279.41(c) of today's rule provides conforming changes to the used oil transportation standards to allow transporters or transfer facilities to filter the used oil without being subject to the used oil processor standards. It should be clearly noted, however, that if the used oil is stored at a site for more than 35 days, greater environmental concerns may be present, so the site would no longer be considered a transfer facility and the processor standards would apply.

In addition, this rule expands the definition of transfer facility to allow used oil to be held at a location (i.e., a transfer facility) temporarily prior to activities that are exempt from or performed pursuant to the part 279 standards as a result of today's rulemaking. Under today's revised definition, used oil can be held at a transfer facility for more than 24 hours but less than 35 days prior to an activity and performed pursuant to Sec. 279.20(b)(2). As a result of this change, a site where used oil that has been drained from oil-bearing transformers and turbines is held for more than 24 hours and less than 35 days prior to being filtered for reuse would be considered a transfer facility.

G. Section 279.46--Tracking Today's rule revises the Sec. 279.46 tracking requirements as they apply to rail transporters. Under amended Sec. 279.46, a signature is not required on records of acceptance or records of delivery of used oil shipments that are exchanged between rail transporters. The Agency is making this change in response to comments submitted by the

railroad industry regarding the impracticability of requiring signed receipts when used oil is transferred from one rail transporter to another. EPA is aware that rail cars are typically transferred from one railroad company to another without the face-to-face contact that occurs in, for example, the motor carrier industry. The Agency also recognizes that, unlike non-rail transporters, railroads rely on sophisticated electronic tracking and information systems for recording rail-to-rail transfer of cargo. Given these unique circumstances, and in light of the fact that 40 CFR 263.20(f) regulations for hazardous waste transporters do not include signature requirements for intermediate rail carriers, EPA agrees that the signature requirements are unduly burdensome and unnecessary when applied to intermediate used oil rail transporters. EPA is therefore revising the used oil regulations to eliminate the Sec. 279.46 signature requirements between intermediate rail carriers.

H. Corrections to the Regulatory Language

1. Requirements for Enforcement Authority

The Agency published a correction notice on May 3, 1993, which amended several sections of the part 279 used oil management standards that were originally promulgated on September 10, 1992. In the May 3, 1993, correction notice, EPA incorrectly amended regulatory Sec. 271.16, that addressed the requirements for States to have adequate criminal enforcement authority for hazardous waste. EPA amended the regulation to include enforcement authority for used oil handlers that manage used oil incorrectly, but EPA inadvertently deleted from Sec. 271.16 enforcement authority for the improper management of hazardous waste. Therefore, today's rule corrects this section to include enforcement authority for the improper management of both hazardous waste and used oil.

2. Rebuttable Presumption

The final used oil regulations published on September 10, 1992, allow persons to rebut the presumption that used oil containing more than 1,000 ppm total halogens is a hazardous waste by using an analytical method from SW-846, Third Edition, to show that the used oil does not contain hazardous waste. In the regulations, the Agency provided information on the cost of SW-846, Edition III and how to obtain it. However, the Agency misquoted the cost of the document. The actual cost was \$319.00 rather than \$110.00 as quoted throughout the September 10, 1992, regulations. To avoid having to amend the regulations as a result of future changes in the cost of the document, the Agency is deleting reference to the cost of SW-846, Edition III from the used oil regulations.

3. Characteristic Hazardous Waste

Today's rule revises Sec. 279.10(b)(2)(iii) by deleting reference to the listing status (under part 261, subpart D) of a hazardous waste that is mixed with used oil. This change is necessary to correct a contradiction in the regulations regarding applicability of the used oil management standards to mixtures of used oil and hazardous waste that is listed in subpart D solely because it exhibits one or more of the characteristics of hazardous waste identified in subpart C. In technical corrections to the used oil management standards published on May 3, 1993, (57 FR 26420), EPA amended Sec. 279.10(b)(2) to correct an error in the September 10, 1992, standards regarding how these mixtures are regulated. At that time, conforming changes should have been, but were not made to Sec. 279.10(b)(2)(iii). As amended by today's rule, Sec. 279.10(b)(2)(iii) correctly provides that mixtures of used oil and hazardous waste that solely exhibits one or more hazardous waste characteristic and mixtures of used oil and hazardous waste that is listed in subpart D solely because it exhibits one or more subpart C hazardous characteristics are regulated as used oil if the mixture is of used oil and a waste which is hazardous solely because it exhibits the characteristic of ignitability and the resultant mixture does not exhibit the characteristic of ignitability.

IV. State Authorization

As explained in the preamble to the May 3, 1993, Technical Correction to the September 10, 1992, rule, EPA is treating the majority of the final used oil management standards in the same manner as "non-HSWA" Subtitle C requirements. The used oil management standards became effective on March 8, 1993, only in those States and Territories that do not have RCRA base program authorization and on Indian lands. States are required to revise their Subtitle C base programs to adopt the new used oil requirements (including those promulgated in today's rule) by July 1, 1994, or by July 1, 1995, if a statutory change is necessary. See 58 FR 26420 and 57 FR 41605.

Authorized States are only required to modify their programs when EPA promulgates Federal standards that are more stringent or broader in scope than the existing Federal standards. Section 3009 of RCRA allows States to impose standards more stringent than those in the Federal program. For those Federal program changes that are less stringent or reduce the scope of the Federal program, States are not required to modify their programs. See 40 CFR 271.1(k). Except for the amendments made to Sec. 279.20(b), the standards promulgated today are less stringent than or reduce the scope of the existing Federal requirements. The amendments made to Sec. 279.20(b) merely provide clarification of the existing used oil regulations and are therefore not considered to be less stringent than the current Federal program. Therefore, with the exception of the provisions added at Sec. 279.20(b)(2)(i), authorized States would not be required to modify their programs to adopt requirements equivalent to or substantially equivalent to the provision listed above.

V. Executive Order 12866

Under Executive Order 12866, 58 FR 51735 (October 4, 1993) the Agency must determine whether the regulatory action is "significant" and therefore subject to OMB review and the requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a rule that may: (1) Have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipient thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the "Executive Order."

OMB has exempted this regulatory action from E.O. 12866 review.

VI. Paperwork Reduction Act

The reporting and recordkeeping requirements of part 279 have been approved by OMB and generally assigned the control number 2050-0124 (See 58 FR 34374 (June 25, 1993)), which remains in effect. As today's rule does not impose any new such requirements, a separate information collection request was not prepared.

VII. Regulatory Flexibility Act

Today's rule does not impose any new regulatory requirements, and indeed, decreases the costs of compliance for a number of facilities. I therefore certify that today's rule will not have a significant impact or a substantial number of small entities.

VIII. Administrative Procedures Act

Today's rule takes final action on EPA's 1985 and 1991 proposals to exempt used oil inserted into primary refining processes from the used oil management standards. EPA did not address these issues in its September 10, 1992, final rule, and therefore those proposals remained outstanding until today's rule. Since these issues were fully addressed in those proposals, further public comment on today's rule is unnecessary. The other changes being made in today's rule either correct errors or clarify the language contained in the September 10, 1992 rule. No comment is necessary on these provisions.

List of Subjects

40 CFR Part 271

Environmental protection, Administrative practice and procedure, Confidential business information, Hazardous materials transportation, Hazardous waste, Indians--lands, Intergovernmental relations, Penalties, Reporting and recordkeeping requirements, Water pollution control, Water supply.

40 CFR Part 279

Petroleum, Recycling, Reporting and recordkeeping requirements, Used oil.

Dated: February 25, 1994.

Carol M. Browner,
Administrator.

For the reasons set out in the preamble, title 40, chapter I of the Code of Federal Regulations is amended as follows:

PART 271--REQUIREMENTS FOR AUTHORIZATION OF STATE HAZARDOUS WASTE PROGRAMS

1. The authority citation for part 271 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), and 6926.

2. Section 271.16 is amended by revising paragraph (a)(3)(ii) to read as follows:

Sec. 271.16 Requirements for enforcement authority.

(a) * * *

(3) * * *

(ii) Criminal remedies shall be obtainable against any person who knowingly transports any hazardous waste to an unpermitted facility; who treats, stores, or disposes of hazardous waste without a permit; who knowingly transports, treats, stores, disposes, recycles, causes to be transported, or otherwise handles any used oil regulated by EPA under section 3014 of RCRA that is not listed or identified as a hazardous waste under the state's hazardous

waste program in violation of standards or regulations for management of such used oil; or who makes any false statement, or representation in any application, label, manifest, record, report, permit or other document filed, maintained, or used for purposes of program compliance (including compliance with any standards or regulations for used oil regulated by EPA under section 3014 of RCRA that is not listed or identified as hazardous waste). Criminal fines shall be recoverable in at least the amount of \$10,000 per day for each violation, and imprisonment for at least six months shall be available.

* * * * *

PART 279--STANDARDS FOR THE MANAGEMENT OF USED OIL

3. The authority citation for part 279 continues to read as follows:

Authority: Sections 1006, 2002(a), 3001 through 3007, 3010, 3014, and 7004 of the Solid Waste Disposal Act, as amended (42 U.S.C. 6905, 6912(a), 6921 through 6927, 6930, 6934, and 6974); and sections 101(37) and 114(c) of CERCLA (42 U.S.C. 9601(37) and 9614(c)).

4. In Sec. 279.1 the definition of "Petroleum refining facility" is added in alphabetical order and the definition of "Used oil transfer facility" is revised to read as follows:

Sec. 279.1 Definitions.

* * * * *

Petroleum refining facility means an establishment primarily engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, and lubricants, through fractionation, straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking or other processes (i.e., facilities classified as SIC 2911).

* * * * *

Used oil transfer facility means any transportation related facility including loading docks, parking areas, storage areas and other areas where shipments of used oil are held for more than 24 hours and not longer than 35 days during the normal course of transportation or prior to an activity performed pursuant to Sec. 279.20(b)(2). Transfer facilities that store used oil for more than 35 days are subject to regulation under subpart F of this part.

Sec. 279.10 [Amended]

5. Section 279.10(b)(1)(ii) is amended by removing the phrase "for the cost of \$110.00."

6. Section 279.10 is amended by revising paragraphs (b)(2)(iii) and (g) to read as follows:

Sec. 279.10 Applicability.

* * * * *

(b) * * *

(2) * * *

(iii) Regulation as used oil under this part, if the mixture is of used oil and a waste which is hazardous solely because it exhibits the characteristic of ignitability (e.g., ignitable-only mineral spirits), provided that the resultant mixture does not exhibit the characteristic of ignitability under Sec. 261.21 of this chapter.

* * * * *

(g) Used oil introduced into crude oil pipelines or a petroleum refining facility. (1) Used oil mixed with crude oil or natural gas liquids (e.g., in a production separator or crude oil stock tank) for insertion into a crude oil pipeline is exempt from the requirements of this part. The used oil is subject to the requirements of this part prior to the mixing of used oil with crude oil or natural gas liquids.

(2) Mixtures of used oil and crude oil or natural gas liquids containing less than 1% used oil that are being stored or transported to a crude oil pipeline or petroleum refining facility for insertion into the refining process at a point prior to crude distillation or catalytic cracking are exempt from the requirements of this part.

(3) Used oil that is inserted into the petroleum refining facility process before crude distillation or catalytic cracking without prior mixing with crude oil is exempt from the requirements of this part provided that the used oil constitutes less than 1% of the crude oil feed to any petroleum refining facility process unit at any given time. Prior to insertion into the petroleum refining facility process, the used oil is subject to the requirements of this part.

(4) Except as provided in paragraph (g)(5) of this section, used oil that is introduced into a petroleum refining facility process after crude distillation or catalytic cracking is exempt from the requirements of this part only if the used oil meets the specification of Sec. 279.11. Prior to insertion into the petroleum refining facility process, the used oil is subject to the requirements of this part.

(5) Used oil that is incidentally captured by a hydrocarbon recovery system or wastewater treatment system as part of routine process operations at a petroleum refining facility and inserted into the petroleum refining facility process is exempt from the requirements of this part. This exemption does not extend to used oil which is intentionally introduced into a hydrocarbon recovery system (e.g., by pouring collected used oil into the waste water treatment system).

(6) Tank bottoms from stock tanks containing exempt mixtures of used oil and crude oil or natural gas liquids are exempt from the requirements of this part.

* * * * *

7. Section 279.20 is amended by revising paragraph (b)(2) to read as follows:

Sec. 279.20 Applicability.

* * * * *

(b) * * *

(2) (i) Except as provided in paragraph (b)(2)(ii) of this section, generators who process or re-refine used oil must also comply with subpart F of this part.

(ii) Generators who perform the following activities are not processors provided that the used oil is generated on-site and is not being sent off-site to a burner of on- or off-specification used oil fuel.

(A) Filtering, cleaning, or otherwise reconditioning used oil before returning it for reuse by the generator;

(B) Separating used oil from wastewater generated on-site to make the wastewater acceptable for discharge or reuse pursuant to section 402 or section 307(b) of the Clean Water Act or other applicable Federal or state regulations governing the management or discharge of wastewaters;

(C) Using oil mist collectors to remove small droplets of used oil from in-plant air to make plant air suitable for continued recirculation;

(D) Draining or otherwise removing used oil from materials containing or otherwise contaminated with used oil in order to remove excessive oil to the extent possible pursuant to Sec. 279.10(c); or

(E) Filtering, separating or otherwise reconditioning used oil before burning it in a space heater pursuant to Sec. 279.23.

* * * * *

8. Section 279.41 is amended by adding paragraph (c) to read as follows:

Sec. 279.41 Restrictions on transporters who are not also processors or re-refiners.

* * * * *

(c) Transporters of used oil that is removed from oil bearing electrical transformers and turbines and filtered by the transporter or at a transfer facility prior to being returned to its original use are not subject to the processor/re-refiner requirements in subpart F of this part.

Sec. 279.44 [Amended]

9. Section 279.44(c) introductory text is amended by removing the phrase ``for the cost of \$110.00."'

10. Section 279.46 is amended by revising paragraphs (a)(5) and (b)(5) to read as follows:

Sec. 279.46 Tracking.

* * * * *

(a) * * *

(5) (i) Except as provided in paragraph (a)(5)(ii) of this section, the signature, dated upon receipt of the used oil, of a representative of the generator, transporter, or processor/re-refiner who provided the used oil for transport.

(ii) Intermediate rail transporters are not required to sign the record of acceptance.

(b) * * *

(5) (i) Except as provided in paragraph (b)(5)(ii) of this section, the signature, dated upon receipt of the used oil, of a representative of the receiving facility or transporter.

(ii) Intermediate rail transporters are not required to sign the record of delivery.

* * * * *

Sec. 279.53 [Amended]

11. Section 279.53(c) introductory text is amended by removing the phrase ``for the cost of \$110.00."'

Sec. 279.63 [Amended]

12. Section 279.63(c) is amended by removing the phrase ``for the cost of \$110.00."'

[FR Doc. 94-4818 Filed 3-3-94; 8:45 am]
BILLING CODE 6560-50-P

Footnote:

¹ A used oil generator is any person, by site, whose act or process produces used oil or whose act first causes used oil to become subject to regulations. For example, generators include all persons and businesses who produce used oil through commercial or industrial operations and vehicle services, including government agencies, and/or persons and businesses who collect used oil from households and ``do-it-yourself" oil changes.

NOTES

APPENDIX H

***SOURCE REDUCTION AND RECYCLING
RESOURCES***

NOTES

SOURCE REDUCTION AND RECYCLING RESOURCES

RAILROAD COMMISSION OF TEXAS, OIL AND GAS DIVISION

Waste Minimization Program

The Railroad Commission's Waste Minimization Program offers the following products and services to help oil and gas operators in their waste minimization efforts.

- The manual, Waste Minimization in the Oil Field
- Waste Minimization Workshops
- Technology Transfer on Request
- Service Company and Vendor Information
- On-Site Assistance in Waste Minimization Planning

Visit the **Waste Minimization Program Page** on the **Railroad Commission Web Site** at www.rrc.state.tx.us. The Waste Minimization Program page provides several documents on waste minimization for the various oil and gas operational areas and the *WasteMin* software described below above.

WasteMin, a Waste Minimization Planning Tool

The Waste Minimization Program offers ***WasteMin***, a waste minimization planning software. *WasteMin* is a Windows-based program for operators to use in developing an inventory and minimization plan for wastes generated in a specific area of operation. Multiple plans may be created using *WasteMin*. An added feature of *WasteMin* is a searchable database of technical references (e.g., Society of Petroleum Engineers papers) which provide waste minimization techniques for a wide variety of oil and gas wastes. *WasteMin* may be downloaded from the Waste Minimization Program page on the Railroad Commission's internet web site (see below). Contact the Waste Minimization Program to obtain *WasteMin* on diskettes (a nominal charge is required to cover costs for diskettes, mailers, and postage).

To contact the Waste Minimization Program call **Bart Sims at (512) 463-5405** or send e-mail to bart.sims@rrc.state.tx.us. Or write to:

Railroad Commission of Texas
Oil and Gas Division
Waste Minimization Program
P.O. Box 12967
Austin, Texas 78711-2967

Railroad Commission-Permitted Crude Oil Reclamation Plants

The Railroad Commission maintains a list of permitted crude oil reclamation plants (Statewide Rule 57). For information call:

Reclamation Plant Permits
Phone: (512) 463-6818

Railroad Commission Books, Manuals, Documents, and Subscriptions

The Railroad Commission publishes many documents of interest to oil and gas operators. A list of available Railroad Commission publications is available on the Commission's web site. For information on ordering available manuals, books, or other documents call:

Administrative Services Division
Phone: (512) 463-7255

OTHER STATE OF TEXAS AGENCIES

Texas Natural Resource Conservation Commission*

Small Business and Environmental Assistance Division
Office of Pollution Prevention & Recycling
P.O. Box 13087
Austin, TX 78711-3087

Phone: (512) 239-3100, or

Call the Recycling Hotline at 1-800-64TEXAS

Visit the TNRCC Web Site at **www.tnrcc.state.tx.us**.

The Texas Natural Resource Conservation Commission (TNRCC) offers Recycle Texas on their web site at www.tnrcc.state.tx.us (look under "R" using the agency "Index"). Recycle Texas lists companies that recycle a wide variety of wastes. This service is helpful in finding options for recycling oil and gas wastes. A hard copy of Recycle Texas may be ordered by calling the TNRCC toll free at 1-800-447-2827 (or 512-239-3100), or send e-mail to recycle@tnrcc.state.tx.us.

Also, TNRCC maintains a waste exchange named RENEW (Resource Exchange Network for Eliminating Waste). The network is a marketing channel for industries, businesses, and governmental units that want to sell surplus materials, by-products, and wastes to users who will reclaim or reuse them. RENEW is also available on the TNRCC web site (see location given above). A subscription to RENEW may be made by calling 1-800-447-2827 (or 512-239-3171).

The TNRCC also maintains a list of registered facilities that transport, store, process, and/or market used oil and used oil filters for recycling. This list of recycling facilities

is updated periodically and is available through the TNRCC or the Commission's Waste Minimization Program. Information on registered used oil and used oil filter recyclers may be obtained by calling TNRCC's Registration and Reporting section at (512) 239-6413.

Texas Department of Health

1100 West 49th Street
Austin, TX 78756

Phone: (512) 458-7111

OTHER STATES' PROGRAMS

Alaska Department of Environmental Conservation

The Alaska Department of Environmental Conservation has published three documents which offer waste minimization assistance to the oil and gas industry. "Pollution Prevention Opportunities for the Oil Field Service Industry" (1994) is a guide directed toward oil and gas service company activities. Alaska has also published the report, "Oily Water Recycling Systems Used by Oil Field Service Companies in Deadhorse, Alaska" (1992). For drilling and production operations, Alaska has published, in association with the Pacific Northwest Pollution Prevention Research Center, Pollution Prevention Opportunities in Oil and Gas Production, Drilling, and Exploration (1993). The waste minimization techniques discussed in these publications address operations in Alaska (i.e., the North Slope). However, they offer numerous waste minimization tips that can be applied in any geographic area.

Judd Peterson
State of Alaska
Dept. of Environmental Conservation
Division of Environmental Quality
Pollution Prevention Office
555 Cordova Avenue
Anchorage, Alaska 99501

Phone: (907) 269-7684
Fax: (907) 269-7655

New Mexico Oil Conservation Division

The New Mexico Oil Conservation Division (NMOCD) has published "Pollution Prevention Best Management Practices," which is comprised of two volumes. Volume 1 addresses the pollution prevention systems approach, pollution prevention opportunities (i.e., waste minimization, and tools for developing an effective pollution prevention plan). Volume 2 provides non-process specific information for wastes generated by various oil field operations. Volume 2 focuses on waste treatment and disposal, and end-of-pipe recycling opportunities. "Pollution Prevention Best

Management Practices” includes some regulatory summaries specific to New Mexico; however, the publication is a good tool for oil and gas operators in any state.

For information regarding “Pollution Prevention Best Management Practices” and other NMOCD information contact:

Martyne Kieling
New Mexico Energy Minerals and Natural Resources Department
Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505

Phone: (505) 827-7153
Fax: (505) 827-8177
E-mail: **mkieling@state.nm.us**

Also, visit the NMOCD web site at www.emnrd.state.nm.us/ocd/.

Oklahoma Corporation Commission

The Oklahoma Corporation Commission (OCC) has published two booklets. The first booklet, “Oilfield Pollution Prevention,” provides oil and gas waste minimization tips. The second booklet, “Pollution Prevention at Exploration and Production Sites for Erosion and Pollution Control,” discusses construction methods for roads and pads, which reduce sedimentation from stormwater runoff.

For information on the OCC publications contact:

Carl Solomon
Oklahoma Corporation Commission
Jim Thorpe Building, Room 460
Oklahoma City, Oklahoma 73105

Phone: (405) 521-2426
Fax: (405) 521-6045

FEDERAL AGENCIES AND PROGRAMS

EPA’s Natural Gas Star Program

An additional source for waste minimization techniques in natural gas treating and processing operations is the EPA Natural Gas STAR Program. The Natural Gas STAR Program is a voluntary government/industry partnership designed to accomplish environmental protection through **cost-effective** measures without regulation. The program was started in March of 1993 and it encourages natural gas companies to adopt “best management practices” that can reduce methane emissions.

Natural Gas STAR Partners sign a Memorandum of Understanding (MOU) with EPA agreeing to review and implement “best management practices” as appropriate. The

company then implements the plan over the next three years. The EPA supports the partners by assisting in training, analyzing new technologies, and removing unjustified regulatory barriers.

The Natural Gas Star web site at www.epa.gov/gasstar/ is an excellent source of information. Also, more information on the Natural Gas Star Program can be obtain by contacting the program at (202) 564-9793 or (202) 564-9736.

Natural Gas Star
U.S. EPA APPD (6202J)
401 M Street, SW
Washington, DC 20460

U.S. Environmental Protection Agency (EPA)

U.S. EPA, Region 6
Hazardous Waste Management Div.
Interfirst Two Building
1201 Elm Street
Dallas, TX 75270

Phone: (214) 665-6444

For answers to questions about hazardous waste regulation and other EPA regulatory programs call the **EPA RCRA Hotline** at **(800) 424-9346** *Toll Free*.

Department of Transportation (DOT)

Federal Highway Administration
Office of Public Affairs
HOA-1
400 7th Street SW
Washington, DC 20590

Phone: (202) 366-0660

Government Printing Office

Superintendent of Documents
Washington, DC 20402

Phone: (202) 783-3238

NATIONAL ORGANIZATIONS

Interstate Oil and Gas Compact Commission

The Interstate Oil and Gas Compact Commission (IOGCC) has adapted the Railroad Commission's manual, "Waste Minimization in the Oil Field," for use in all oil and gas producing states in the U.S. The IOGCC manual is titled "Guidelines for Waste Minimization in Oil and Gas Exploration and Production." IOGCC published the manual with grant assistance from the U.S. Department of Energy. IOGCC also has produced a companion waste minimization video that is about 40 minutes in length. The video is a shortened version of the Waste Minimization Workshop sponsored by the IOGCC.

For information on IOGCC programs and publications call (405) 525-3556, or send e-mail to **iogcc@iogcc.state.ok.us**. IOGCC's Internet web site is located at **www.iogcc.state.ok.us**.

Gas Research Institute

The Gas Research Institute (GRI) is headquartered in Chicago and manages a cooperative research, development, and commercialization program for the mutual benefit of the natural gas industry. GRI works with research organizations, manufacturers and its member companies to develop gas technologies and to transfer new products and information to the marketplace. GRI members also help transfer research results to the marketplace in the form of new products, tools, techniques, and information. The added participation of equipment manufacturers, service companies, major energy users, and government agencies enhances the effectiveness of the program.

GRI has published studies of waste generation and management in the natural Gas industry. "Waste Minimization in the Natural Gas Industry: Regulations, Methodology, and Assessment of Alternatives" is of particular interest. This publication provides a thorough overview of waste generation in the industry and methods for minimizing many of the waste streams.

Gas Research Institute
8600 West Bryn Mawr Avenue
Chicago, Illinois 60631-3562

Phone: (773) 399-8100
Internet: **www.gri.org**

American Petroleum Institute

The American Petroleum Institute (API) has established a program called "Strategies for Today's Environmental Partnership," called STEP. A component of STEP is compiling pollution prevention ideas, which should include source reduction and recycling options for the exploration and production industry. You can contact API's STEP by calling (202) 682-8468.

API has published several documents that are useful to your waste minimization efforts. One publication, "Environmental Guidance Document: Waste Management in Exploration and Production Operations," is particularly useful. API also has published a document that illustrates methods for measuring pollution prevention, as well as free pamphlets on pollution prevention. API will provide a catalog of publications. API publication sales may be contacted at:

American Petroleum Institute
Order Desk
1220 L Street, N.W.
Washington, D.C. 20005

Phone: (202) 682-8375
Fax: (202) 682-4776
E-mail: **publications@api.org**

Information on API programs and publications is also available on the internet at **www.api.org**.

"Keepin' It All Clean in the Oil Patch"

The National Environmental Training Association (NETA) has published waste minimization materials for the oil and gas exploration and production industry. The "Keepin' It All Clean in the Oil Patch" project produced: a sturdy "field guide" of waste minimization tips for use in the field; a "train-the-trainer" manual for use in developing an in-house training program; and a short video (produced by ARCO) that is a good waste minimization primer. The project was overseen by technical committees represented by industry and state regulatory agencies.

Funding for the "Keepin' It All Clean in the Oil Patch" project was provided by the U.S. EPA Office of Solid Waste and Emergency Response, with additional support from the American Petroleum Institute and the Gas Research Institute.

The field guide, train-the-trainer manual, and video may still be available from NETA. NETA provides the materials to independent companies at no charge. Major oil companies are charged a nominal fee.

National Environmental Training Association
2930 E. Camelback Rd., Ste. 185
Phoenix, Arizona 85016-4412

Phone: (602) 956-6099
Fax: (602) 956-6692

UNIVERSITIES AND COLLEGES

Gulf Coast Hazardous Substance Research Center (GCHSRC)

Dr. William Cawley
Lamar University
P.O. Box 10613
Beaumont, TX 77710

Phone: (409) 880-8707 or 8768

Other Texas colleges and universities that are members of GCHSRC:

University of Texas - Austin
University of Texas - Arlington
Texas A&M University
University of Houston

Environmental Institute for Technology Transfer (EITT) **University of Texas - Arlington**

Dr. Gerald Nehman, Director
Dr. Victorio Argento, Associate Director
P.O. Box 19050
Arlington, TX 76019

Phone: (817) 273-2300

Center for Environmental Technologies Texas Tech University

Dr. John R. Bradford
P.O. Box 43121
Lubbock, TX 79409-3121

Phone: (806) 742-1413

LIBRARIES

Railroad Commission of Texas

Susan Bains Rhyne
William B. Travis Building, 12th Floor
1701 North Congress
Austin, Texas

Phone: (512) 463-7160

Environmental Protection Agency, Region 6

U.S. EPA, Region 6
Library
Interfirst Two Building
1201 Elm Street
Dallas, TX 75270

Phone: (214) 665-6444

Universities and Colleges

Refer to universities and colleges listed on the preceding page. Also, the universities or colleges in your area may have waste minimization and management references.

INDUSTRY ASSOCIATIONS AND SOCIETIES

Note: The following contact information may change with time. Contact the Railroad Commission's Waste Minimization Program (see page H-1) if you have difficulty contacting any listed association or society.

American Association of Drilling Engineers

3300 Bingle Road
Houston, Texas 77055
(713) 895-7575, FAX 895-7586

American Gas Association

1515 Wilson Blvd.
Arlington, VA 22209
(703) 841-8400

American Petroleum Institute (API)

API Production Department
1201 Main Street, Suite 2535
Dallas, Texas 75202-3904

Association of Oil Pipe lines

1725 K St., Ste. 1205
Washington, DC 20006
(202) 331-8228

Association of Oilwell Servicing Contractors

6060 N. Central Expy., Ste. 428
Dallas, Texas 75206
(214) 692-0771

Association of Texas Intrastate Natural Gas Pipelines

604 West 14th Street
Austin, Texas 78701
(512) 478-2871

Chemical Marketing Association

11601 Katy Fwy., Ste. 223
Houston, Texas 77079
(713) 497-6202

East Texas Producers and Royalty Owners Association

P.O. Box 1700
Kilgore, Texas 75663
(903) 984-8676

Gas Processors Association

6526 East 60th Street
Tulsa, OK 74145-9247
(918) 493-3872

Gas Research Institute (GRI)

8600 West Bryn Mawr Avenue
Chicago, Illinois 60631
(312) 399-8333

International Association of Drilling Contractors (IADC)

P.O. Box 4287
Houston, Texas 77210
(713) 578-7171

Luling Oil Producers and Royalty Owners, Inc.

P. O. Box 962
Luling, Texas 78648
(830) 875-3135

National Association of Royalty Owners

P. O. Box 920
Ada, Oklahoma 74821
(580) 436-0034

National Solid Wastes Management Association

1730 Rhode Island Ave NW, Ste. 1000
Washington, DC 20036

National Stripper Well Association

10077 Grogan Mill Road, Ste. 200
The Woodlands, Texas 77380
(281) 364-7037

North Texas Oil & Gas Association

726 Scott Street, Ste. 801
Wichita Falls, Texas 76301
(940) 723-4131

Panhandle Producers & Royalty Owners Association

2201 Civic Circle, Ste. 500
Amarillo, Texas 79109-1843
(806) 352-5637

Permian Basin Petroleum Association

P.O. Box 132
Midland, Texas 79702
(915) 684-6345

Petroleum Equipment Suppliers Association

9225 Katy Fwy., Ste. 310
Houston, Texas 77024
(713) 932-0168

Society of Petroleum Engineers

222 Palisades Creek Drive
P.O. Box 833836
Richardson, Texas 75803-3836
(214) 669-3377

Society of Piping Engineers & Designers (SPED)

One Main Street
Houston, Texas 77002
(713) 221-8090

Texas Association of Environmental Professionals

P.O. Box 385533, Ste. 302
Houston, Texas 77238

Texas Gas Association

1111 IH 35 North, Ste. 200
Round Rock, Texas
(512) 388-4000

Texas Independent Producers & Royalty Owners Association (TIPRO)

515 Congress Avenue, Suite 1910
Austin, Texas 78701
(512) 477-4452

Texas Oil & Gas Association

304 West 13th Street
Austin, Texas 78701-1823
(512) 478-6631

Texas Mining & Reclamation Association

314 Highland Mall Blvd., Ste. 251
Austin, Texas 78752
(512) 467-1300

Texas Oil Marketer's Association

701 W. 15th St.
Austin, Texas 78701
(512) 476-9547

Texas Society of Professional Engineers

1303 Sherwood Forest
Houston, Texas 77043
(713) 659-2283

West Central Texas Oil & Gas Association

P.O. Box 2332
Abilene, Texas 79604
(915) 677-2469

APPENDIX I
GLOSSARY AND ACRONYMS

NOTES

GLOSSARY

Absorption Oil	A hydrocarbon liquid used to absorb and recover components from natural gas as it is processed.
Acid Gas	A gas that forms an acid when it is mixed with water. In petroleum production and processing, the most common acid gases are hydrogen sulfide and carbon dioxide.
Amine	Any of several compounds such as, but not limited to, monoethanolamine (MEA), employed in treating natural gas. The amines are generally used in water solutions to remove hydrogen sulfide and carbon dioxide from gas and liquid streams.
Asbestos	A mineral fiber, used for insulation, that can pollute air or water and cause cancer or asbestosis when inhaled. EPA has banned or restricted its use in manufacturing and construction and regulates its disposal.
Basic Sediment and Water (BS&W)	The water and other extraneous material present in crude oil
Bottoms	<ol style="list-style-type: none"> 1. The liquids and residue, such as heavy hydrocarbons, solids, sands, and emulsions that collect in the bottom of treating vessel or remain in the bottom of storage tanks after a period of service. 2. The residual fractions remaining in the bottom of a fractionating tower after lighter components have been distilled off as vapors.
Characteristically Hazardous Waste	A waste that is regulated by RCRA Subtitle C as hazardous because it displays one or more of the hazardous waste characteristics.
Clean Air Act (CAA) Amendments	1990 amendments to CAA expanding EPA enforcement powers and adding restrictions on air toxics, ozone-depleting chemicals, stationary and mobile emissions sources, and emissions implicated in creating acid rain and global warming.
Code of Federal Regulations (CFR)	Regulations based on federal statute; Reference notation is “[volume number] CFR (Code of Federal Regulations) [part.section].” For example: 29 CFR 1910.120

Comprehensive Environmental Responsibility, and Liability Act (CERCLA)	1980 Federal law authorizing identification and remediation of unsupervised hazardous waste sites and spill reporting. (Also called Superfund)
Contaminant	<p>Any physical, chemical, biological, or radiological substance or matter that has an adverse affect on air, water, or soil, or</p> <p>A harmful, irritating, or nuisance material in concentrations exceeding those normally found in the ambient air, water, or soil.</p>
Corrosion	A complex chemical or electrochemical process by which metal is destroyed (e.g., between water and pipes that the water contacts, chemicals touching a metal surface, or contact between two metals).
Corrosive	RCRA (40 CFR 261.22) defines corrosivity as having a pH #2 or \$12.5 or being able to corrode steel at a rate greater than 6.35 mm per year.
Department of Transportation (DOT)	The United States agency that enforces regulations governing the transport of hazardous and nonhazardous materials, including transportation by pipelines.
Emulsion	The dispersion of fine particles of an immiscible liquid and/or solids with another liquid in which the particles are suspended. A mixture of crude oil and formation water commonly creates an emulsion. It generally requires time, heat, and in some cases, chemicals to separate water and oil emulsions.
Enhanced Recovery	Efforts to increase ultimate production of oil and gas from a reservoir. This term will be considered to encompass other nomenclature in common usage such as pressure maintenance, secondary recovery, and tertiary recovery. All enhanced recovery techniques include methods for supplementing natural reservoir forces and energy, or otherwise increasing ultimate recovery. Such techniques include water injection, gas injection, gas cycling, and miscible chemicals and thermal processes.
Filtration	A treatment process for removing solid (particulate) matter from a fluid by passing the fluid through porous media such as sand or a man-made filter.
Fracturing Fluid	Materials used in formation fracturing well stimulation process.

Glycol	A group of compounds used to dehydrate gaseous or liquid hydrocarbons or to inhibit the formation of hydrates. Commonly used glycols are ethylene glycol (EG), diethylene glycol (DEG), and triethylene glycol (TEG).
Ground Water	The fresh water found under the surface of the earth in aquifers. Ground water is used for supplying wells and feeds springs.
Hazardous Materials Transportation Act (HMTA)	<p>Any substance designated or listed in the following sources, exposures to which results or may result in adverse affects on the health of safety of employees:</p> <ul style="list-style-type: none">○ Any substance defined under section 101(14) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA)○ Any biological agent and other disease-causing agent as defined in section 101(33) of CERCLA○ Any substance listed by the U.S. Department of Transportation as hazardous materials under 49 CFR 172.101 and appendices
Hazardous Waste	A solid waste that may pose a substantial or potential hazard to human health or the environment when improperly managed. It possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), and/or is listed as a hazardous waste as defined in 40 CFR 261
Hazardous Waste Characteristics	Any one of the four categories used in defining characteristically hazardous waste: ignitability, corrosivity, reactivity, and toxicity (defined in 40 CFR 261.20-261.24).
Hydrate	A solid material resulting from the combination of a hydrocarbon with water under pressure.
Ignitable	As a measure characterizing hazardous waste, ignitability applies to a liquid having a flash point less than 140°F.
Landfarming	A process in which waste deposited on or in the soil is naturally degraded by microbes.

Material Safety Data Sheet (MSDS)	Information required under the OSHA Hazard Communication Standard (HCS) on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions. Section 311 of SARA Title III requires facilities to submit MSDSs under certain circumstances.
Mud	The liquid circulated through the wellbore during rotary drilling and workover operations. In addition to its function of bringing cuttings to the surface, drilling mud cools and lubricates the bit and drill stem, protects against blowouts by holding back subsurface pressures, and deposits a mud cake on the wall of the borehole to prevent loss of fluids to the formation. Originally a suspension of clays in water, the mud used in modern drilling is a more complex mixture of liquids, reactive solids, and inert solids. The liquid phase may be fresh water, diesel oil, or crude oil, often containing one or more conditioners.
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	Federal emissions standards set by EPA for toxic air pollutants.
Neutralization	Decreasing the acidity or alkalinity of a substance by adding alkaline or acidic materials to it.
Naturally Occurring Radioactive Materials (NORM)	Elements that are radioactive in their natural physical states (i.e., not man-made) but do not include source or special nuclear material. NORM can be associated with oil and gas production and includes the elements uranium, thorium, radium, and radon and their daughter products. NORM has been found in downhole tubing scale, in above-ground processing equipment, salt water disposal/injection wells and associated equipment, and in soils contaminated by well workovers, tank cleaning, salt water leaks, pipe cleaning, and other associated operations.
pH	A measure of the acidity or alkalinity of a liquid or solid material.
Pig	A scraping tool forced through a pipeline or flowline to clean out accumulations of water, wax, rust, scale, and/or debris from the walls of the pipe.
Pig Trap	A pipeline quick connection for inserting or removing a pig.
Pigging Waste	Water, wax, rust, scale, and/or debris removed from the walls of pipelines after cleaning with a pig or scraper.

Pollutant	Any chemical or waste product that contributes to pollution.
Pollution	The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of land, air, or water that renders it harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to public health, safety or welfare, or impairs the usefulness or the public enjoyment of the land, air, or water for any lawful or reasonable purpose.
Polychlorinated Biphenyl (PCB)	A group of toxic, pathogenic, teratogenic, and persistent chemicals used in transformers and capacitors (and other oil-filled electrical equipment) for insulating purposes and in gas pipeline systems as a lubricant. PCBs may accumulate in human or animal tissue. PCBs were banned by law for sale in 1974.
Produced Water	The water (brine) brought up from the hydrocarbon bearing strata during the extraction of oil and gas. It may include formation water, water that has been injected into the formation, and any chemicals added downhole or during the oil/water separation process.
Recycle	<p>To reclaim the useful constituents of a waste for reuse, or to use or reuse a waste as a substitute for a commercial product, or as a feedstock in an industrial process.</p> <ul style="list-style-type: none">○ A material is "recycled" if it is used, reused, or reclaimed.○ A material is "reclaimed" if it is processed to recover a usable product, or if it is regenerated. Examples are recovery of lead values from spent batteries and regeneration of spent solvents. <p>A material is "used or reused" if it is either:</p> <ul style="list-style-type: none">○ Employed as an ingredient (including use as an intermediate) in an industrial process to make a product (for example, distillation bottoms from one process used as feedstock in another process). However, a material will not satisfy this condition if distinct components of the materials are recovered as separate end products (as when metals are recovered from metal-containing secondary materials)○ Employed in a particular function or application as an effective substitute for a commercial product.

Reserve Pit	Pit used to store additional drilling fluids for use in drilling operations and/or dispose of wastes generated by drilling operations and initial completion procedures. Usually an excavated, earthen-walled pit, typically temporary in nature, that receives natural rock cuttings, drilling fluids, and water runoff from around the drilling rig.
Resource Conservation and Recovery Act (RCRA)	1976, 1984; Federal law that established regulations for the management and disposal of solid and hazardous wastes currently generated, treated, stored, disposed, or distributed.
Rigwash	Waters used to wash down the rig floor, including rainwater. Its primary component is fresh water, sometimes containing minor amounts of household type detergents.
SARA Title III	Section of Superfund Amendments and Reauthorization Act requiring public disclosure of chemical information and development of emergency response plans.
Scale	A deposit formed in place by chemical action or temperature and pressure changes on surfaces in contact with water; e.g., calcium carbonate, magnesium carbonate, calcium sulfate.
Scrubber	A vessel through which a gas or fluid is passed to remove liquid and foreign matter.
Solvent	Substance (usually liquid) capable of dissolving one or more other substances to form a solution.
Sump	A pit or tank that catches liquid runoff for drainage or disposal. Also, a low place in a vessel or tank for accumulating settleings that are later removed through an opening in the bottom of the vessel.
Superfund	Commonly used to refer to the program, operated under the legislative authority of CERCLA, which funds and carries out the EPA solid waste emergency and long-term remedial activities. More specifically, the Superfund is the remediation fund for cleanups of sites contaminated by hazardous substances and for legal action to force those responsible for the sites to clean them up. It is funded by taxes on chemical feedstocks and petroleum products. Many states also have Superfund laws.

Superfund Amendments and Reauthorization Act (SARA)	1986 federal law reauthorizing and expanding the jurisdiction of CERCLA.
Surface Water	All water naturally open to the atmosphere, and all springs, wells, or other collectors directly influenced by surface water.
Surfactant	A substance, such as detergent or soap, that affects the properties of the surface of a liquid or solid by concentrating in the surface layer (e.g., assists in the cleaning of oily materials).
Toxic Substances Control Act (TSCA)	1976; Federal law authorizing EPA to gather information on chemical risks, and provide regulation and enforcement related to those risks.
Toxicity	A waste exhibits the characteristic of toxicity if, using the Toxicity Character Leachate Procedure, described below, the extract from a representative sample of the waste contains any of the contaminants listed by the EPA, at a concentration equal to or greater than the respective value given by the EPA.
Toxicity Characteristic Leachate Procedure (TCLP)	Required test under RCRA to determine if a waste will be defined as hazardous, because of its toxicity. TCLP determines the potential for the toxic constituents or the organic compounds of a waste to leach out and contaminate ground water. See 40 CFR 261, Appendix II.
Underground Injection Control (UIC)	The program under the Safe Drinking Water Act (SDWA) that regulates the use of injection wells to pump fluids into the ground.
Vapor Recovery System	Any combination of hoods or ventilation systems that captures or contains organic vapors and directs them to an abatement or recovery device.
Volatile	Description of any substance that evaporates easily (the tendency of a liquid to assume the gaseous state).
Volatile Organic Compound (VOC)	A highly evaporative organic material. Does not include compounds designated by EPA as having negligible photochemical reactivity.

Workover

The performance of one or more of a variety of remedial operations on a producing well to try to increase production. Examples of workover operations are deepening, plugging back, pulling and resetting liners, repairing mechanical equipment failures, squeeze cementing, or other work involved in changing the producing interval in a well.

ACRONYMS AND ABBREVIATIONS

API	American Petroleum Institute
BS&W	basic sediment and water
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAA.....	Clean Air Act
CFR.....	Code of Federal Regulations
CO ₂	carbon dioxide
COS.....	carbonyl sulfide
DOT	The United States Department of Transportation
E&P.....	Exploration and Production
EPA	The United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-To-Know Act
H ₂ S.....	hydrogen sulfide
HAZMAT.....	hazardous material, defined by OSHA and DOT
HMTA	Hazardous Materials Transportation Act
kg.....	kilogram
lb.....	pound
MEA	monoethanolamine
MSDS.....	Material Safety Data Sheet
NESHAPS.....	National Emissions Standards for Hazardous Air Pollutants
NGL.....	natural gas liquid
NORM	naturally occurring radioactive material
OSHA	The United States Occupational Safety and Health Administration

PCB.....polychlorinated biphenyl
pH.....potential of hydrogen, measure of acidity
ppm.....parts per million
RCRAResource Conservation and Recovery Act
RRC.....Railroad Commission of Texas
SARA.....Superfund Amendments and Reauthorization Act
SO₂.....sulfur dioxide
TDHTexas Department of Health
TNRCCTexas Natural Resource Conservation Commission

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