

# Natural Gas Processing Plant Practices for Protection of the Environment

API RECOMMENDED PRACTICE 50  
SECOND EDITION, DECEMBER 1995

REAFFIRMED, JANUARY 2013



AMERICAN PETROLEUM INSTITUTE

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**Exploration and Production Department**

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## FOREWORD

RP 50, First Edition was issued January 1975 (Reissued May 1982).

These recommended practices were prepared by the API Subcommittee on Gas Plant Practices for Protection of the Environment. This standard is under administration of the American Petroleum Institute Exploration & Production Department's Executive Committee on Drilling and Production Practices.

It is intended that these voluntary recommended practices serve as a guide to promote protection of the environment in gas processing plant operations. Users of this publication are reminded that constantly developing technology, specific company requirements and policy, and specialized or limited operations do not permit coverage of all possible operations, practices, or alternatives. This standard is not so comprehensive as to present *all* possible practices for protecting the environment in gas processing plant operations. Alternative operating procedures and/or equipment are available and routinely used to meet or exceed recommended practices or performance levels set forth herein. Recommendations presented in this publication are not intended to inhibit developing technology and equipment improvements or improved operating procedures. This publication, or portions thereof, cannot be substituted for qualified technical/operations analysis and judgment to fit a specific situation.

There may be federal, state, or local statutes, rules, or regulations requiring gas processing plant operations to be conducted in a certain manner. Organizations or individuals using this standard are cautioned that requirements of federal, state, or local environmental laws and regulations are constantly evolving and should be reviewed to determine whether or not the practices recommended herein are consistent with current laws and regulations. Gas processing plant operations must comply with the applicable requirements of federal, state, or local regulations.

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Suggested revisions are invited and should be submitted to the director of the Exploration and Production Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.



# Natural Gas Processing Plant Practices for Protection of the Environment

## 0 Introduction

It is important that environmental issues relating to processes and equipment be given high priority in the initial planning or modification of natural gas processing plants. The selection of certain processes or equipment can have a significant impact on emissions and waste generation, thereby affecting permitting, regulatory compliance, monitoring, and disposal.

This publication is intended to assist gas plant operators in understanding their environmental responsibilities. It is intended to be used primarily by environmental, engineering, and operations personnel and management involved in building, maintaining, modifying, and operating gas processing plants.

There are numerous federal, state, and local environmental statutes, rules, and regulations that deal directly or indirectly with environmental issues that may impact gas processing plant operations. Site-specific permits, notification, and documentation may be required.

## 1 Scope

Operations within the scope of this standard include natural gas processing and associated gas compression facilities. The publication coverage begins with initial plant planning, permitting, and construction and ends with plant closure and site restoration procedures. General guidelines are provided to be used at gas plant locations to develop site-specific environmental programs.

This standard does not address safety or operational issues except where environmental, safety, and operational issues are intertwined. Process design and equipment selection are not addressed in detail. This publication does not specifically address requirements of process safety management (refer to 29 *CFR* Part 1910.119) that must be considered in gas plant design and operations.

## 2 References

### 2.1 STANDARDS

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision, and users are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

### API

*Environmental Guidance Document: Onshore Solid Waste Management in Exploration and Production Operations*

Bull D16 *Suggested Procedure for Development of Spill Prevention, Control, and Countermeasure Plans*

Bull E1 *Generic Hazardous Chemical Category List and Inventory for the Oil and Gas Exploration and Production Industry*

Bull E2 *Bulletin on Management of Naturally Occurring Radioactive Materials (NORM) in Oil and Gas Production*

Bull E4 *Environmental Guidance Document: Release Reporting for the Oil and Gas Exploration and Production Industry as Required by the CWA, CERCLA, and SARA Title III*

### GPA<sup>1</sup>

8162-70 *LP-Gas Loading Practices Manual*

8166-70 *Manual for Driver-Attended Loading of LP-Gas*

### 2.2 OTHER REFERENCES

There are numerous federal regulations and laws that may be applicable to gas processing plant operations. These regulations and laws should be carefully studied to determine their impact on and applicability to specific operations. The following are some of the major regulations and laws that apply.

#### 2.2.1 Regulations

##### EPA<sup>2</sup>

40 *Code of Federal Regulations* Part 51

40 *Code of Federal Regulations* Part 52

40 *Code of Federal Regulations* Part 60

40 *Code of Federal Regulations* Subchapter C, Part 61

40 *Code of Federal Regulations* Part 110

40 *Code of Federal Regulations* Part 112

40 *Code of Federal Regulations* Part 116.4

40 *Code of Federal Regulations* Part 122

40 *Code of Federal Regulations* Part 144

40 *Code of Federal Regulations* Part 146.5

40 *Code of Federal Regulations* Part 147

<sup>1</sup>Gas Processors Association, 6526 East 60th Street, Tulsa, Oklahoma 74145.

<sup>2</sup>Environmental Protection Agency. The *Code of Federal Regulations* and *Federal Register* are available from U.S. Government Printing Office, Washington, D.C. 20402.

40 *Code of Federal Regulations* Subpart C, Parts 261.20 through 261.24  
 40 *Code of Federal Regulations* Part 302  
 40 *Code of Federal Regulations* Part 302.4  
 40 *Code of Federal Regulations* Part 355  
 53 *Federal Register* 25446, July 6, 1988  
 DOT<sup>3</sup>  
   44 *Code of Federal Regulations* Part 192  
 OSHA<sup>4</sup>  
   29 *Code of Federal Regulations* Part 1910.119  
   29 *Code of Federal Regulations* Part 1910.120  
   29 *Code of Federal Regulations* Part 1910.1000  
   29 *Code of Federal Regulations* Part 1910.1200

### 2.2.2 Legislative<sup>5</sup>

Clean Air Act (as amended) (CAA)  
 Clean Air Act Amendments of 1990 (CAA-90)  
 National Ambient Air Quality Standards (NAAQS)  
 Clean Water Act (as amended) (CWA)  
 Safe Drinking Water Act (as amended) (SDWA)  
 Resource Conservation and Recovery Act (as amended) (RCRA)  
 Comprehensive Environmental Response, Compensation, and Liability Act (as amended) (CERCLA)  
 Emergency Planning and Community Right-To-Know Act (EPCRA) (SARA Title III)  
 National Environmental Policy Act (NEPA)  
 Oil Pollution Act of 1990 (OPA '90)  
 Toxic Substances Control Act (TSCA)  
 Fishery Conservation and Management Act  
 Migratory Bird Treaty Act  
 Wild and Scenic Rivers Act  
 Rivers and Harbors Act  
 Endangered Species Act (ESA)  
 Coastal Zone Management Act (CZM Act)

### 2.2.3 Other Regulatory References

EPA

AP-42 Manuals    *Compilation of Air Pollutant Emission Factors* (Volumes 1 & 2)

### 2.2.4 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this publication:

|                  |                                                                                                                         |
|------------------|-------------------------------------------------------------------------------------------------------------------------|
| AOR              | Area of Review                                                                                                          |
| API              | American Petroleum Institute                                                                                            |
| AST              | Aboveground Storage Tank                                                                                                |
| BACT             | Best Available Control Technology                                                                                       |
| BOD              | Biological Oxygen Demand                                                                                                |
| CAA              | Clean Air Act                                                                                                           |
| CAS              | Chemical Abstract Service                                                                                               |
| CERCLA           | Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)                                       |
| CFR              | <i>Code of Federal Regulations</i>                                                                                      |
| CO               | Carbon Monoxide                                                                                                         |
| COD              | Chemical Oxygen Demand                                                                                                  |
| CWA              | Clean Water Act                                                                                                         |
| CZM              | Coastal Zone Management                                                                                                 |
| CZM Act          | Coastal Zone Management Act                                                                                             |
| DMR              | Discharge Monitoring Report                                                                                             |
| DOI              | U.S. Department of Interior                                                                                             |
| DOT              | U.S. Department of Transportation                                                                                       |
| E&P              | Exploration and Production                                                                                              |
| EHS              | Extremely Hazardous Substance                                                                                           |
| EIR              | Environmental Impact Review (Environmental Impact Assessment)                                                           |
| EPA              | U.S. Environmental Protection Agency                                                                                    |
| EPCRA            | Emergency Planning and Community Right-To-Know Act (Title III of SARA, commonly called Right-To-Know or SARA Title III) |
| ER               | Enhanced Recovery                                                                                                       |
| ESA              | Endangered Species Act                                                                                                  |
| FWPCA            | Federal Water Pollution Control Act                                                                                     |
| GPA              | Gas Processors Association                                                                                              |
| HAP              | Hazardous Air Pollutant                                                                                                 |
| HMTA             | Hazardous Materials Transportation Act                                                                                  |
| HS               | Hazardous Substance                                                                                                     |
| H <sub>2</sub> S | Hydrogen Sulfide                                                                                                        |
| HSWA             | Hazardous and Solid Waste Amendments (1984 RCRA Amendments)                                                             |
| LAER             | Lowest Achievable Emission Rate                                                                                         |
| LEPC             | Local Emergency Planning Committee                                                                                      |
| MACT             | Maximum Achievable Control Technologies                                                                                 |
| MMS              | Minerals Management Service (U.S. Department of Interior)                                                               |
| MSDS             | Material Safety Data Sheet                                                                                              |
| NAAQS            | National Ambient Air Quality Standards                                                                                  |
| NEPA             | National Environmental Policy Act                                                                                       |
| NESHAPS          | National Emissions Standard for Hazardous Air Pollutants                                                                |
| NO <sub>x</sub>  | One or more compounds of nitrogen oxides                                                                                |
| NORM             | Naturally Occurring Radioactive Material                                                                                |

<sup>3</sup>U.S. Department of Transportation. The *Code of Federal Regulations* is available from U.S. Government Printing Office, Washington, D.C. 20402.

<sup>4</sup>Occupational Safety and Health Administration, U.S. Department of Labor. The *Code of Federal Regulations* is available from U.S. Government Printing Office, Washington, D.C. 20402.

<sup>5</sup>Available from Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

|                 |                                                                                                               |
|-----------------|---------------------------------------------------------------------------------------------------------------|
| NPDES           | National Pollutant Discharge Elimination System                                                               |
| NRC             | National Response Center                                                                                      |
| NSPS            | New Source Performance Standards                                                                              |
| OSHA            | Occupational Safety and Health Administration, U.S. Department of Labor                                       |
| PCB             | Polychlorinated Biphenyls                                                                                     |
| PE              | Potential Emission                                                                                            |
| PPA             | Pollution Prevention Act                                                                                      |
| PSD             | Prevention of Significant Deterioration                                                                       |
| RACT            | Reasonably Available Control Technology                                                                       |
| RCRA            | Resource Conservation and Recovery Act                                                                        |
| RP              | Recommended Practice(s)                                                                                       |
| RQ              | Reportable Quantity                                                                                           |
| RSPA            | Research and Special Programs Administration (DOT)                                                            |
| SARA            | Superfund Amendments and Reauthorization Act                                                                  |
| SDWA            | Safe Drinking Water Act                                                                                       |
| SERC            | State Emergency Response Commission                                                                           |
| SO <sub>2</sub> | Sulfur Dioxide                                                                                                |
| SO <sub>x</sub> | One or more compounds of sulfur oxides                                                                        |
| SPCC            | Spill Prevention Control and Countermeasure                                                                   |
| SRU             | Sulfur Recovery Unit                                                                                          |
| Superfund       | Refer to CERCLA                                                                                               |
| TCLP            | Toxicity Characteristic Leachate Procedure (40 <i>CFR</i> 268–Appendix I)                                     |
| TDS             | Total Dissolved Solids                                                                                        |
| Title III       | Title of SARA mandating public disclosure of chemical information and development of emergency response plans |
| TPQ             | Threshold Planning Quantity                                                                                   |
| TSCA            | Toxic Substances Control Act                                                                                  |
| UIC             | Underground Injection Control                                                                                 |
| USDW            | Underground Source of Drinking Water                                                                          |
| UST             | Underground Storage Tank                                                                                      |
| VHAP            | Volatile Hazardous Air Pollutant                                                                              |
| VOC             | Volatile Organic Compound                                                                                     |

### 3 Definitions

For the purpose of this standard, the following definitions are applicable.

**3.1 air toxics major source:** A source having the potential to emit 10 tons per year or more of the listed Hazardous Air Pollutants (HAPs) (refer to Clean Air Act Amendments of 1990, Title III), or 25 tons per year or more of any combination of listed HAPs.

**3.2 attainment area:** An area that EPA has found to meet the National Ambient Air Quality Standards (NAAQS) for the pollutant under review.

**3.3 environment:** (1) The navigable waters, the waters of the contiguous zone, and the ocean waters of which the natural resources are under the exclusive management authority of the United States (U.S.) under the Fishery Conservation and Management Act of 1976; (2) any other surface water, ground water, drinking water supply, land surface or subsurface strata, or ambient air within the U.S. or the jurisdiction of the U.S. Refer to 40 *CFR* Part 302.

**3.4 fugitive emissions:** Emissions that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening. Examples of fugitive emissions sources are valves, flanges, and seals.

**3.5 hazardous substances:** Substances designated under CERCLA (40 *CFR* Part 302, Table 302.4). There are also unlisted hazardous substances.

**3.6 navigable waters of the United States:** Waters as defined in Section 502(7) of the Federal Water Pollution Control Act (FWPCA), and includes: (1) all navigable waters of the United States, as defined in judicial decisions prior to passage of the 1972 Amendments to the FWPCA (Pub. L. 92-500), and tributaries of such waters; (2) interstate waters; (3) intrastate lakes, rivers, and streams from which fish or shellfish are taken and sold in interstate commerce; and (4) intrastate lakes, rivers, and streams that are utilized by interstate travelers for recreational and other purposes. Also refer to a more inclusive definition at 40 *CFR* Part 110.1.

**3.7 oil:** 40 *CFR* Parts 110 and 112 define oil as oil of any kind in any form, including, but not limited to petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil. Also refer to Section 100 of the Oil Pollution Act.

**3.8 prevention of significant deterioration (PSD) major modification:** A modification to an existing major source that produces a potential emission increase of a regulated pollutant in excess of a significant designated value (e.g., 40 tons per year for NO<sub>x</sub>; 100 tons per year for CO).

**3.9 prevention of significant deterioration (PSD) major source:** A new source of 28 specified categories whose potential emission for any criteria pollutant equals or exceeds 100 tons per year, or any other new source, including gas processing plants, whose potential emission for any regulated pollutant equals or exceeds 250 tons per year.

**3.10 reconstruction:** 40 *CFR* Part 60 (CAA regulations) defines reconstruction as the replacement of components of an existing facility if the cost exceeds 50 percent of the cost required to construct a comparable new facility.

**3.11 release:** 40 *CFR* 302 (CERCLA regulations) defines release as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment.

**3.12 stormwater:** Defined by the EPA as stormwater runoff, snow melt runoff, and surface runoff and drainage.

**3.13 underground source of drinking water (USDW):** An aquifer, or its portion, that supplies any public water system or contains a sufficient quantity of water to supply a public water system; and currently supplies drinking water for human consumption; and contains fewer than 10,000 milligrams per liter of Total Dissolved Solids (TDS); and is not an exempted aquifer (40 *CFR* Part 144.3).

Note: Some state agencies have lowered the TDS for USDW, and requirements of individual states should be verified.

**3.14 volatile organic compounds (VOCs):** Basically the  $C_3$  through  $C_{7+}$  hydrocarbons. Compounds of carbon or mixture of carbon compounds, excluding methane, ethane, and other non-regulated compounds. Examples of VOCs that may be present in gas plant operations are: propane, butane, benzene, xylene, ethylbenzene, toluene, and so forth.

## 4 Regulatory Compliance

### 4.1 INTRODUCTION

Compliance with environmental laws, regulations, and permit requirements is an integral part of gas plant operations. However, interpretation of the environmental requirements is often difficult and complex. In many instances, federal, state, and local regulations must be addressed. Issues are further complicated when existing laws or regulations are amended or new laws and regulations are created. Gas plant operators must be aware of the environmental requirements in order to develop the necessary compliance procedures. In addition, operators should be aware of the need to consult with their respective environmental, construction, engineering, or other groups, as necessary, to discuss environmental issues related to plant design, operation, or modification (equipment design, process changes, and so forth).

### 4.2 ENVIRONMENTAL AGENCIES

Many of the environmental requirements impacting plant operations are regulated by the Environmental Protection Agency (EPA). Additionally, each state has its own agency (for example, Department of Environmental Quality) to administer and enforce state environmental regulations. Upon approval by EPA, state agencies can administer and enforce specified portions of the EPA regulations. EPA-approved state regulations must be at least as stringent as the corresponding EPA (federal) regulations. Some states have regu-

lations that are more stringent than the EPA regulations. Sometimes, both the EPA and the state have overlapping jurisdiction over certain plant operations; in such cases, an operator must comply with both EPA and state regulations.

Other federal and state agencies may also regulate certain environmental aspects of gas plant operations. Federal agencies may include the Department of Transportation, Army Corps of Engineers, U.S. Geological Survey, U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Coast Guard, and Federal Energy Regulatory Commission. State agencies may include departments for conservation, health, transportation, air and water quality; oil and gas boards; and local (for example, county) agencies for planning, zoning, sanitation, and solid waste disposal. Plant operators should consult respective federal, state, and local agencies to determine all applicable requirements.

### 4.3 ENVIRONMENTAL LAWS AND REGULATIONS

A listing of all potential environmental rules, regulations, and permit requirements for each state is beyond the scope of this document. However, since gas plants in all states must meet minimum federal requirements, the more common federal laws that may impact plant operations are briefly summarized in 4.3.1 through 4.3.13. Many of these laws are further explained in this publication. Additional information is contained in *API Environmental Guidance Document: Onshore Solid Waste Management in Exploration and Production Operations* and *API Bulletin E4, Environmental Guidance Document: Release Reporting for the Oil and Gas Exploration and Production Industry as Required by the CWA, CERCLA, and SARA Title III*. Some of the more significant federal laws are as follows:

#### 4.3.1 Clean Air Act (CAA)

The CAA, first enacted in 1970 and amended several times since then, has several features that can lead to significant regulation.

Under the CAA, EPA has established national ambient air quality standards for several air pollutants: sulfur oxides, nitrogen oxides, ozone, carbon monoxide, particulate matter, and lead. The CAA provides for emission standards (not limited to the criteria pollutants) for new, modified, and existing sources and requires permits for all major emission sources (for example, flares, heaters, engines, and other sources—refer to CAA Section 502 and 40 *CFR* Part 70.3). On an ambient standard-by-standard basis, every area of the United States is classified as attainment or nonattainment. This classification determines, in part, what additional controls on emission sources are required and the timetable for implementation.

EPA is also authorized, under the CAA, to set new source performance standards (NSPS) for certain categories of sta-

tionary sources and separate standards for listed hazardous air pollutants (HAPs). These requirements often take the form of technology standards, but may take the form of performance standards or work practice standards.

Overall, EPA assumes the authority for regulating new sources, whereas states assume the authority for regulating existing sources. In addition, state standards are often applicable only to nonattainment areas, whereas federal standards are generally applicable to both attainment and nonattainment areas.

Standards aside, the CAA also imposes permitting requirements. Depending on an emission source's nature, emission profile, size, and geographic location, a new source (or major modification) may require a preconstruction review permit. Irrespective of preconstruction review permits, existing sources also generally require operating permits, which are intended to be the vehicle for all applicable source requirements.

#### 4.3.2 Clean Water Act (CWA)

The CWA was enacted in 1972 with a goal to restore the surface waters for protection of fish and wildlife and for recreation by the elimination of pollutant discharges from point sources into "Waters of the United States." These "Waters" are very broadly defined and include any conveyance, including dry stream channels, that leads to waterways, including the oceans. The CWA created the National Pollutant Discharge Elimination System (NPDES) permitting program (or state equivalent) for all point source and non-point source discharges, including stormwater. The discharge permit program regulates discharges of 297 chemical substances through receiving water quality limits and application of best available control technology (BACT), best conventional pollutant control technology (BCT), best practical control technology (BPT), and new source performance standards (NSPS). Permits for onshore discharges are issued by the states (which have been delegated primacy from the EPA), the EPA, or both.

The CWA also established regulations covering the response to an oil spill which could reach navigable waters (including "Waters of the United States"), adjoining shoreline, or the exclusive economic zone. Spill prevention, control, and countermeasure (SPCC) plans are required for any facility (including temporary fuel storage facilities) storing 42,000 gallons or more of oil in underground tanks or with more than 1,320 gallons of aboveground storage capacity or with a single tank of more than 660 gallons of storage capacity. The SPCC plan must be written to address the specific location and state the most likely course of the runoff. The plan must be written within six months of beginning an operation, be certified by a registered professional engineer as to its technical feasibility, and be implemented within one year. A copy of the plan should

remain at the facility or on location, if manned at least eight hours per day, or at the nearest field office if unmanned. The plan must be reviewed at least once every three years and be recertified if significant changes to the plan are required. Refer to API Bulletin D16 for additional information.

Any spill of a reportable quantity (RQ) of oil or hazardous chemicals listed in the CWA requires immediate reporting to the National Response Center at (800) 424-8802 by the person in charge of the facility. An RQ of oil is one that creates a sheen on navigable waters, adjoining shoreline, or the exclusive economic zone, or that causes a violation of applicable water quality standards. Refer to API Bulletin E4 for additional information.

The CWA requires permits for dredging and filling wetlands. The U.S. Army Corps of Engineers regulates the dredging and filling of navigable waters. In order to discharge dredged material into these waters, operators must first obtain a permit from the Corps of Engineers.

#### 4.3.3 Safe Drinking Water Act (SDWA)

The SDWA, enacted in 1974, regulates the nation's sources of drinking water. The legislation outlines primary and secondary drinking water standards by establishing maximum contaminant levels (MCLs), which cover mainly metals and organics. To protect the nation's ground water supply, the underground injection control (UIC) program was developed. This program requires permits and establishes operating criteria for underground injection of fluids (for example, gas processing plant waste waters) as well as guidelines for maximum allowable concentrations of contaminants in drinking water. The program classifies underground aquifers, with waters containing less than 10,000 parts per million total dissolved solids (TDS) designated as underground sources of drinking water (USDW). All injection of fluids must be permitted, and a new permit will not be issued until the applicant can demonstrate the injection operation will not endanger a USDW. The oil and gas industry injection wells are regulated as Class II wells in the UIC program. States that have been delegated primacy for this program by the EPA are responsible for the issuance of permits.

The EPA is responsible for issuing permits for injection activities in nonprimacy states and on most federal and Indian lands.

Class II injection wells can be used for enhanced oil recovery projects to dispose of nonhazardous exploration and production (E&P) wastes and must not endanger a USDW. These wells must be protected from surface water entering the wellbore and must maintain mechanical integrity and be tested periodically. Injection of hazardous waste is regulated under the Resource Conservation and Recovery Act (refer to 4.3.4).

#### 4.3.4 Resource Conservation and Recovery Act (RCRA)

RCRA was enacted in 1976 to address the management of wastes (including hazardous waste) and this legislation developed the concept of “cradle-to-grave” responsibility. Hazardous waste, which is regulated under Subtitle C of RCRA, may be solid, liquid, or contained gas, and be regulated either because it is “characteristically” hazardous or is one of more than 400 listed wastes. The characteristics of ignitability, reactivity, corrosivity, or toxicity cause a waste to be regulated as hazardous. Toxicity is generally determined by an acid solubility test termed the toxicity characteristic leachate procedure (TCLP). The TCLP requires analysis for a list of 39 chemical substances, composed of 8 metals, 6 pesticides, and 25 organic substances. The regulations covering hazardous wastes can be onerous and contain elements that can result in significant environmental liability. At present, nearly all hazardous wastes are prohibited from land disposal (“land ban”) until they meet specified treatment standards. States must be delegated the responsibility for preparing programs to manage hazardous wastes.

EPA, in a 1988 regulatory determination, decided that oil and gas E&P wastes were high-volume and low-toxicity wastes that should continue to be exempt under Subtitle C. These wastes include produced water, drilling fluids, drill cuttings, rigwash, drilling fluids and drill cuttings from offshore operations when disposed onshore, well completion/treatment/stimulation fluids, basic sediment and water and other tank bottoms, accumulated materials from separators and fluid treating vessels and production impoundments, pit sludges, workover wastes, glycol compounds from gas dehydration units, gas plant sweetening wastes, cooling tower blowdown, spent filters/media, backwash from exempt waste streams, packing fluids, produced sand, pipe scale, hydrocarbon-bearing soil, pigging wastes, constituents removed from produced water before injection or other disposal, liquid hydrocarbons removed from production streams but not from oil refining, waste crude oil from E&P operations, ejected blowdown materials, gases from production streams, and volatilized light organics from exempt wastes. It should be noted that not all wastes generated by E&P operations are exempt under Subtitle C. Care must be taken to avoid commingling nonexempt wastes, such as paint wastes, cleaning solvents, and batteries, with exempt wastes, as the resultant mixture will be considered nonexempt and regulated under Subtitle C.

Underground storage tanks (USTs) are regulated under RCRA Subtitle I. For applications in this standard, a UST is defined as any tank and piping system with more than 10 percent of its volume underground and containing petroleum or a CERCLA hazardous substance other than a RCRA hazardous waste. Tanks containing RCRA hazardous wastes are regulated under RCRA Subtitle C. Existing USTs

must undergo modification to provide for leak detection, overfill protection, monitoring of vapors, monitoring of liquids in soils, and monitoring of tank content volume. A new UST must have overfill protection, monitoring, leak detection, and cathodic protection, as provided by regulation. Secondary containment is required for USTs containing hazardous substances. Proof of financial responsibility must be available to cover cleanup costs and compensation if leaking does occur. Leaks and contamination of soil surrounding a UST must be reported to the National Response Center (NRC) or to the appropriate state agency within 24 hours of discovery.

Some states have solid waste programs in place that are more stringent than federal RCRA requirements. Some states do not recognize the RCRA Subtitle C exemptions for E&P wastes. Individual state regulations should be carefully reviewed for compliance before managing wastes from E&P operations.

#### 4.3.5 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

CERCLA, which has become known as “Superfund,” established a program to identify and remediate sites from which hazardous substances are, or there is a substantial threat that they could be released into the environment. It identifies over 700 substances as “hazardous” and creates a process to provide funding to investigate and clean up sites. The EPA has initiated investigation and cleanup action at over 2000 sites and has sought to find the potentially responsible parties (PRPs) to finance and/or finish the cleanup of these sites.

CERCLA also requires notification of the National Response Center in the event of a release of a reportable quantity (RQ) of a hazardous substance. Refer to API Bulletin E4 for additional information.

The CERCLA definition of hazardous substance does contain an exclusion for petroleum, including crude oil and fractions thereof, which is not otherwise specifically listed by one of the five environmental statutes referred to in the definition of hazardous substance. The General Counsel of EPA has opined that this exclusion does not apply to hazardous substances that are added to petroleum or that increase in contamination solely as a result of contamination of petroleum during use. The CERCLA definition of hazardous substance includes RCRA wastes and excludes drilling fluids, produced waters, and other wastes associated with the exploration, development, and production of crude oil or natural gas. The EPA has not always treated RCRA-exempt production wastes as excluded from the definition of CERCLA hazardous substance. Legal counsel should be consulted if clarification of this issue is needed.

CERCLA provides EPA with broad authority to require PRPs to remediate sites and to pay for the agency’s work on

sites. It establishes strict liability for remediation without regard to degree of responsibility. EPA can also impose “joint and several” liability, with each party potentially responsible for the entire cleanup. Past and present generators, transporters, storage owners, and operators can be considered PRPs.

#### 4.3.6 Emergency Planning and Community Right-To-Know Act (EPCRA, Also Known as SARA Title III)

The Superfund Amendment and Reauthorization Act of 1986 (SARA) reauthorized and extended the Superfund law that was established under CERCLA. SARA Title III, known as the Emergency Planning and Community Right-To-Know Act (EPCRA), is a separate statute that addresses the concern for potential release of toxic chemicals into surrounding communities.

EPCRA has been amended by the Pollution Prevention Act (PPA) and has three major sections, Section 302–4, Sections 311–312, and Section 313.

Under Section 302–4, facilities producing, using, or storing listed extremely hazardous substances (EHSs) above the threshold planning quantity (TPQ) designated in the regulations must provide emergency planning notification to the State Emergency Response Commission (SERC) and Local Emergency Planning Committee (LEPC) and identify a facility representative. Releases over the RQ of those substances must be reported unless an exception applies. Simultaneous CERCLA reporting may also be required. Refer to API Bulletin E4 for additional information.

Under Sections 311–312, if threshold amounts of chemicals are present for which a material safety data sheet (MSDS) is required under OSHA’s Hazard Communication Standard (29 *CFR* 1910.1200), facilities must submit information on location and inventory amounts. Reporting is required at least annually or when threshold amounts of new materials come onsite, and so forth. Refer to API Bulletin E1 to help simplify compliance with Sections 311–312. Also refer to API Bulletin E4.

Under Section 313, toxic release inventory (TRI) reporting, releases to air, land, water, and certain waste disposal and recycling information must be reported annually for listed substances that meet the threshold criteria. E&P Standard Industrial Classification (SIC) codes are not yet covered under Section 313, but are under active consideration by EPA for inclusion for reporting. The PPA adds additional data elements for reporting on Section 313 TRI forms.

States may impose additional or different reporting requirements.

#### 4.3.7 Toxic Substances Control Act (TSCA)

The TSCA gives EPA authority to regulate chemical substances that potentially present a hazard to health or the en-

vironment. This authority includes the right to issue regulations requiring import and export notifications, premanufacture notification, testing of both new and old chemical substances, and various reporting requirements (for example, Section 8 inventory reporting updates and substantial risk notifications) and supplements existing toxic substances laws under the CAA, Federal Water Pollution Control Act (FWPCA), and Occupational Safety and Health Act (OSH Act). The chemicals most commonly associated with TSCA Section 6 controls include mercury, polychlorinated biphenyls (PCBs), asbestos, lead, and vinyl chloride. TSCA requires reporting and periodic updating of natural gas volumes (for example, butane, propane). The current TSCA inventory contains more than 67,000 different chemicals. New chemicals not on the inventory are subject to various requirements before manufacture or use.

#### 4.3.8 Oil Pollution Control Act of 1990 (OPA '90)

OPA '90 mandated amendments to the existing oil pollution prevention regulations (40 *CFR* Part 112 and as discussed in 4.3.2) that were originally established by the CWA.

OPA '90 requires operators of facilities meeting certain criteria to develop and submit a response plan that has been designed to handle routine and worst-case discharges of oil or hazardous substances. OPA '90 defines who is considered responsible when a spill occurs, what costs and damages they can be liable for, dollar limits of liability, and defenses to liability.

Operators should determine whether their facilities fall under applicable OPA '90 requirements and take appropriate action. OPA '90 impacts those facilities that exceed trigger levels established for storage and handling of certain materials, including crude oil. Facilities that could reasonably be expected to cause significant and substantial harm to the environment by discharging oil into navigable waters (includes “Waters of the United States”) or the adjoining shorelines must prepare response plans and submit such plans to EPA, Research and Special Programs Administration (RSPA), United States Coast Guard, Minerals Management Service, or other applicable regulatory agencies, as appropriate. As of August 18, 1993, such facilities cannot handle, store, or transport oil without an approved plan, unless the owner or operator certifies, by contract or other approved means, the availability of personnel and equipment necessary to respond to a threat of or an actual worst-case discharge.

#### 4.3.9 Endangered Species Act (ESA)

The Fish and Wildlife Service of the U.S. Department of the Interior and the National Marine Fisheries Service of the U.S. Department of Commerce are responsible for identifying threatened and endangered plant and animal species, protecting critical habitats for those species, and preparing recovery plans for listed species. The ESA also requires all

federal agencies to consider the impact of any of their actions (including the granting of approvals, rights-of-way, or permits of any type) on threatened and endangered species. The ESA also prohibits “incidental take” of endangered species on either public or private lands.

#### 4.3.10 Migratory Bird Treaty Act

The Fish and Wildlife Service, U.S. Department of the Interior, is responsible for the identification and protection of threatened migratory birds. As such, the destruction or possession of the bird, nest, or eggs, in whole or in part, either intentional or incidental, is punishable by fine, imprisonment, and/or confiscation of all equipment related to the destruction of said items. For intentional acts, penalties include fines of no more than \$2,000, imprisonment for no more than 2 years, or both. Protection status is dependent on bird population, time of year, and economic and environmental considerations. Due to the variability of protection status, local agencies should be consulted for specifics.

#### 4.3.11 Coastal Zone Management Act (CZM Act)

The CZM Act establishes guidelines for protection and conservation of natural resources within designated coastal areas and requires activities in these coastal areas to be consistent with state coastal management programs.

#### 4.3.12 Occupational Safety and Health Act (OSH Act)

The standards written under authority of the OSH Act are directed primarily at protecting employees. The standards address a broad area of subjects ranging from mechanical specifications to work procedures, recordkeeping, training, written procedures, physical hazards, and emergency response plans. Some of the OSHA standards that address environmental issues as well as personnel safety include the following:

- a. HAZCOM (refer to 29 *CFR* Part 1910.1200) requires that employees be informed of the physical and health hazards of chemicals in the work place.
- b. Management of Process Hazards (refer to 29 *CFR* Part 1910.119) requires employers to manage hazards associated with processes using highly hazardous chemicals, including crude oil, condensate, and natural gas. The standard has specific requirements for developing process safety information, performing hazards analysis, developing operating procedures, providing training to employees, ensuring mechanical integrity, and performing audits.
- c. HAZWOPER (refer to 29 *CFR* Part 1910.120) requires that employees be appropriately trained and equipped to respond to emergency events.
- d. Toxic and Hazardous Substances (Air Contaminants) (refer to 29 *CFR* 1910.1000) establishes workplace exposure limits for certain toxic and hazardous substances.

#### 4.3.13 Other Laws

Other federal laws that may contain environmental requirements applicable to plant operations include the Wild and Scenic Rivers Act and National Environmental Policy Act (as amended) (NEPA).

Prior to and during plant design, all potential environmental issues (for example, waste disposal, air emissions, water quality, land use, and noise) should be identified and the appropriate agencies contacted. Once final permits and approvals have been obtained, procedures should be employed to maintain permit compliance.

### 4.4 NOTIFICATION AND REPORTING

Federal, state, and local regulations and permits may require notification (verbal, written, or both) of certain activities or events that cause, or threaten to cause, releases of contaminants (pollutants) to the environment. Prompt verbal notification is typically required for emergency incidents (for example, oil spill). Written notification is typically required as follow-up documentation for emergency incidents to report effluent testing and emission monitoring results, permitted discharge reports, and to provide requested agency information (for example, annual report). For additional information, refer to Section 8 and API Bulletin E4.

#### 4.4.1 Prompt Notification

Spills of oil into waters of the United States require immediate verbal notification to the National Response Center (800-424-8802 or 202-267-2675) in Washington, D.C. and applicable state agencies. Waters of the United States is broadly defined and includes all navigable waters and tributaries, wetlands, lakes, rivers, and even intermittent streams. Refer to 40 *CFR* Part 110 for more detail.

Under CERCLA, the accidental release of a hazardous substance into the environment (for example, land, air, or water) in an amount greater than the specified RQ requires immediate verbal notification to the National Response Center and applicable state and local agencies. If the RQ escapes the plant boundary, EPRCA (SARA Title III) requires additional notification to local emergency planning committees (LEPCs). Refer to 40 *CFR* Parts 302 and 355 for more detail.

Under EPRCA, Section 304, emergency release notification to the SERC and LEPC is required when a facility owner or operator incurs an offsite release of an EHS in volumes greater than the chemical-specified RQ. In many instances, the RQ of an EHS is lower than its TPQ. Release notification must be both oral (immediate) and written (follow-up).

Environmental permits may also specify prompt notification for permit noncompliances (for example, control equipment malfunction). State and local regulations may also require prompt notification for various events (for ex-

ample, leaking underground storage tanks and smoking flares). The appropriate state agencies should be contacted to determine reporting requirements.

#### 4.4.2 Other Notification Requirements

It is beyond the scope of this document to list all potential notification requirements; however, typical notifications are listed below:

- a. Storage and use of certain chemicals at a location may trigger one-time notice. Under EPCRA (SARA Title III), Section 302, notice of the presence of a Threshold Planning Quantity (TPQ) of an Extremely Hazardous Substance (EHS) must be provided to the SERC and LEPC. Examples of EHSs of concern in gas processing operations are hydrogen sulfide, sulfuric acid, chlorine, and so forth.
- b. Submission of annual chemical inventory reports (refer to Section 8) to state and local emergency planning committees. Additional instruction for these reports, which are required by EPCRA/SARA III, is also provided in API Bulletin E1.
- c. Monitoring data and test results (for example, oil and grease content) required by water discharge permits.
- d. Monitoring data (for example, from continuous emission monitors) and test results (for example, from stack testing) required by air emission permits.
- e. Monitoring and test results for Class II underground injection wells.

#### 4.5 ENVIRONMENTAL TRAINING AND REVIEW

Some regulations require training and documentation. For example, employees are required to have training on preventing oil spills (refer to 40 *CFR* Part 112) and for appropriately responding to spills of oil or hazardous substances (refer to 29 *CFR* Part 1910.120). To ensure compliance, routine training on environmental issues should be provided and documented for all applicable plant employees. Training methods can include seminars, workshops, instruction letters, and compliance manuals.

Environmental audits of plant facilities and documentation should be periodically conducted. These audits should be performed by individuals familiar with plant environmental requirements but who are not directly responsible for plant operation. It is considered good operating practice to consult with legal counsel prior to undertaking an environmental auditing program.

## 5 Surface and Groundwater

### 5.1 INTRODUCTION

Section 5 provides guidance for dealing with surface and groundwater issues impacting a gas plant. The discussion in-

cludes issues such as National Pollutant Discharge Elimination System (NPDES), permitting, sampling, subsurface disposal, spill prevention, plant site drainage, aboveground and underground storage tanks (ASTs and USTs), surface pits, process design, and sanitary systems.

### 5.2 NPDES INTRODUCTION

The Clean Water Act (CWA) was passed in 1972 to protect water resources. Section 402 requires NPDES permits for wastewater discharge from any point source into waters of the United States. It is important to determine if a facility is regulated by this program and to ensure that it is in compliance with the requirements as identified by the Environmental Protection Agency (40 *CFR* Part 122). The permit under which a facility operates will have specific limitations on the pollutants that may be discharged. The permit also may have other requirements, including monitoring and reporting.

#### 5.2.1 NPDES Definitions

The following general definitions are applicable to this discussion of the National Pollutant Discharge Elimination System (NPDES):

**5.2.1.1 pollutant discharge:** Any discharge of wastewater that has been used in the production process or may have otherwise become contaminated (refer to 5.2.3). Even precipitation that runs across the facility may become contaminated by process materials and, therefore, may be regulated. Heat (for example, cooling water) is included in this definition.

**5.2.1.2 point source:** A pipe, weir, or ditch through which water is discharged. Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged.

**5.2.1.3 waters of the United States:** Almost any naturally occurring body of water may fit this definition. A nearby ditch, even though it is typically dry, can be included. Refer to 40 *CFR* Part 110.

#### 5.2.2 Permitting

EPA forms used when applying for an NPDES permit are the EPA General Information Form 1 and Application Form 2c. The state in which the facility operates may also regulate wastewater discharge instead of, or in addition to, the EPA.

Another class of NPDES permit that may be available is the general permit that authorizes a category of discharges within a geographical area. These may be granted to facilities having similar operations, discharges, or monitoring requirements.

Oil and gas extraction facilities located in the United States west of the 98th meridian can obtain beneficial-use permits. To qualify, it must be shown that the discharged wastewater can be used for wildlife or livestock watering or other agricultural uses.

### 5.2.3 Stormwater Permitting

Construction may require permitting if the disturbed area involves more than 5 acres. Stormwater permitting is also required if the stormwater runoff is contaminated. If stormwater is impounded and not discharged, permitting is not required. Gas plants that have had a release of an RQ of oil or hazardous substance due to a stormwater event at any time since November 16, 1987, are required to submit a permit application. It should be ascertained from the EPA or other permitting authority which type of permit will be issued. A reportable quantity (RQ) of oil is defined as the amount that violates applicable water quality standards or causes a film or sheen upon or discoloration of the surface of the water.

### 5.2.4 Sampling

NPDES permits require that samples of the water from all permitted discharge points be collected, analyzed, and reported as specified in the permit. Required discharge parameters from gas plants may include temperature, flow, pH, oil and grease, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), and Total Dissolved Solids (TDS).

### 5.2.5 Reporting

The NPDES program has been designed as a self-monitoring program. It is the responsibility of the holder of the permit to comply with the permit, report the analytical results, and inform the agency of noncompliance. To meet these requirements, it is necessary to submit the Discharge Monitoring Report (DMR). Most permits will require a minimum sampling frequency. It is also the responsibility of the permittee to report when permit limits are exceeded and to do so within the time frame specified by the permit. Depending on jurisdiction, concurrent reporting may be required to federal, state, or local agencies.

### 5.2.6 Penalties

If a discharge exceeds the effluent limits or other conditions of the permit, the EPA (or state) has the authority to levy penalties and/or fines and force corrective action. Penalties and fines allowed under the Clean Water Act (CWA) can be both criminal and civil.

## 5.3 SUBSURFACE DISPOSAL

### 5.3.1 Underground Injection Control (UIC) Regulations

Since uncontrolled subsurface placement of fluids can potentially contaminate ground water, Congress established a federal UIC program under the provisions of the Safe Drinking Water Act (SDWA). Injection wells are divided into five classes (refer to 40 *CFR* Part 146.5). Gas processing plants will normally use Class II wells, which are used for oil and gas operations. All new Class II wells are required to have a

permit prior to construction or injection. State and tribal governments can apply for primary administrative authority (primacy) for the UIC program. EPA directly administers the program in the absence of state or tribal primacy.

The goal of the regulations is to prevent contamination of Underground Sources of Drinking Water (USDW). A USDW is defined as an aquifer, or its portion, that supplies any public water system, or contains a sufficient quantity of water to supply a public water system; and currently supplies drinking water for human consumption; and contains fewer than 10,000 milligrams per liter TDS and is not an exempted aquifer (some state programs have lowered this level; requirements of individual states should be verified). Even though some aquifers are not currently being utilized, they are protected under the regulation as a future USDW.

### 5.3.2 UIC Program Well Classification

Injection wells are divided into five classes (refer to 40 *CFR* Part 146.5) for the purpose of regulation. The principal factor used to define the well class is the type of fluid being injected (for example, Class I—Hazardous Waste). Injection wells associated with the disposal of fluids from oil and gas production, including gas processing and injection for the purpose of enhancing oil and gas production, are defined as Class II wells [refer to 40 *CFR* Part 146.5(b)(1) through (3)]. Common Class II injection wells are:

- Salt Water Disposal (SWD), including wells disposing of certain waste streams from gas sweetening and dehydration and liquid processing plants, as well as fluids from production facilities.
- Enhanced Recovery (ER), including wells used for maintenance of reservoir pressure and for tertiary recovery of oil and gas.

These type wells are authorized to inject under the UIC program, either by rule or by permit (refer to 40 *CFR* Parts 144 and 147). Only certain fluids allowed by regulation can be injected into Class II wells [refer to 40 *CFR* Part 146.5(b)].

### 5.3.3 Major Technical Requirements for Permitting

Permit applications for Class II wells generally include information to demonstrate that USDWs will be protected as follows:

- Description of casing and cementing operations to prevent movement of injected fluid into or between USDWs.
- Assurances that the owner or operator maintains financial responsibility to properly plug and abandon the wells.
- A maximum operating pressure calculated or established by step rate test to avoid initiating fractures in the confining layer that could allow fluid movement into a USDW.

- d. Monitoring and reporting requirements (including record-keeping requirements).
- e. Schedule for demonstrating mechanical integrity of the well at least every five years, or per regulatory agency requirements.
- f. Plans for plugging and abandoning the well.
- g. Area of Review (AOR) to evaluate nearby wells.

Requirements for Class I wells are more restrictive, and additional information is required.

## 5.4 SPILL PREVENTION

### 5.4.1 Spill Prevention Regulations—Oil Spills

The objective of the Spill Prevention, Control, and Countermeasure (SPCC) regulations is to prevent the discharge of oil in harmful quantities into navigable waters of the United States or adjoining shorelines or wetlands. To accomplish this objective, EPA regulations require the preparation and implementation of an SPCC Plan for all nontransportation related facilities that have discharged or could reasonably be expected to discharge oil into navigable waters of the United States. EPA's SPCC regulations are contained in 40 *CFR*, Part 112. API has published Bulletin D16 to assist with conformance to the requirements of these regulations. Bulletin D16 discusses details of the regulations as well as providing suggested forms for use in preparing SPCC plans.

All gas processing and associated facilities must be evaluated with respect to location and storage capacity to determine whether or not provisions of the SPCC regulations apply. If SPCC regulations apply, the operator must prepare and implement an SPCC Plan. All facilities having a total aboveground storage of 1320 gallons or more of oil are subject to SPCC regulations if they have the potential for discharging into navigable waters of the United States. Single containers with 660 gallons of oil or more would also be subject to the regulations.

Each SPCC plan must be reviewed and certified by a registered professional engineer. The SPCC plan must be maintained onsite if the facility is manned at least eight hours a day or at the nearest office if the facility is unmanned. The SPCC plan must be made available to EPA personnel for on-site review anytime during normal working hours.

All SPCC Plans must be reviewed at least once every three years. An amendment may be required if a review indicates more effective control and prevention technology will significantly reduce the likelihood of a spill event. SPCC Plans must also be amended within six months whenever there is a significant change in facility design, construction, operations, or maintenance procedures that materially affects the potential for an oil spill. All amendments must be certified by a registered professional engineer. Personnel changes do not require recertification.

In addition to the SPCC regulations, the Oil Pollution Act of 1990 (OPA '90) was signed into law on August 18, 1990. This Act created a comprehensive prevention, response, liability, and compensation regime for dealing with vessels and facilities that may cause oil pollution from spills into navigable waters of the United States. The Act requires development of regulations that require owners or operators of tank vessels as well as offshore facilities and some onshore facilities (which can include gas plants) to prepare and submit plans for, among other things, responding, to the maximum extent practicable, to a worst-case discharge of oil.

Through Presidential Executive Orders, authority has been delegated to prepare regulations that establish procedures, methods, equipment, and other requirements to prevent/respond to discharges of oil into navigable waters. This authority was delegated to:

- a. Environmental Protection Agency
- b. Department of Transportation (U.S. Coast Guard and Research and Special Programs Administration)
- c. Department of Interior (Minerals Management Service).

The EPA has responsibility for all onshore nontransportation related facilities, such as terminals, tank batteries, and gas plants. The general threshold criteria for applicability are:

- a. Facility has a maximum storage capacity equal to or greater than 42,000 gallons and transfers oil over water.
- b. Facility has a maximum storage capacity equal to or greater than one million gallons.

Other criteria, such as spill history, proximity to sensitive areas, and so forth, and at the discretion of an EPA Region Administrator, can bring a facility under the requirements of the EPA.

The main emphasis of the SPCC Plan and the OPA '90 regulations is the prevention of oil spills. Companies are expected to minimize human errors and the accidental discharge of oil by putting into effect design and operations countermeasures. Preventive measures discussed in 5.4.2 through 5.4.8 will reduce the risk of discharge into navigable waters of the United States.

### 5.4.2 Plant Site Drainage

Navigable waters of the United States should be protected from spills and releases via appropriate engineering design and techniques (for example, secondary containment). The containment should be large enough to hold all of the liquid from the largest tank or vessel that can drain into it plus allowance for precipitation (refer to API Bulletin D16). Remote impounding and other topics associated with storage of flammable liquids are addressed in Section 8.

Where regulations allow, diked storage areas should have manual valves, manually-activated pumps or ejectors, or

other acceptable alternatives to drain or empty retained stormwater. The condition of the water should be checked before drainage to ensure that no oil is discharged. Plant drainage systems for undiked areas should flow into either (a) ponds, lagoons, or catchment basins designed to retain oil or return it to the facility, or (b) a diversion system at the final discharge of all in-plant ditches that could contain an uncontrolled spill and return oil to the plant.

Drainage of stormwater from dikes into a storm drain or into an effluent discharge that empties into an open watercourse, lake, or pond may bypass the in-plant treatment system if the effluent is inspected (testing may be required) to ensure compliance with applicable water quality standards and that no harmful discharge will occur (refer to 5.2.3 for possible discharge permit requirements). Documentation may be required for discharges of rainwater from diked areas.

### 5.4.3 Aboveground Storage

Aboveground storage tanks (ASTs) should be built to generally accepted industry standards, such as those established, that embody suitable safety factors to ensure that tanks will safely contain their contents under normal operating conditions. ASTs may be subject to SPCC regulations (40 *CFR* Part 112 and refer to 5.4.1). Secondary containment should be provided to prevent offsite contamination.

Drainage trenches may be arranged so that a spill could be terminated and contained. Dikes, curbs, and pits are also commonly used for containment. Dikes should be sufficiently impervious to contain oil. Diking is less desirable than remote impounding for flammable liquids because it could expose a leaking tank or adjacent tanks to a ground spill fire.

ASTs should be subjected to appropriate integrity tests, including hydrostatic testing, visual inspections, or non-destructive internal and external testing.

### 5.4.4 Underground Storage

Some underground storage tanks (USTs) storing oil may be subject to both the SPCC regulations (40 *CFR* Part 112 and refer to 5.4.1) and the UST regulations (40 *CFR* Part 280). The current SPCC regulations are applicable to facilities having underground storage tank capacity greater than 42,000 gallons of oil when a spill from the facility could possibly reach navigable waters of the United States. The federal UST regulations pertain to any tank, including underground piping connected to the tank, that has at least 10 percent of its volume underground. A number of states have been authorized to administer the UST program in place of EPA. Some state and local authorities have regulations that are more stringent or broader in scope than the federal regulations. The regulations apply only to USTs storing petroleum (such as fuel tanks), used oil, or hazardous substances other than RCRA hazardous waste. Tanks used to

store RCRA hazardous waste must comply with RCRA Subtitle C tank regulations, regardless of whether the tank is aboveground or underground.

Some types of tanks not covered by the UST regulations are systems for collecting stormwater and wastewater and flow-through process tanks. If any USTs are subject to all the UST program regulations, then these tanks are excluded from the SPCC requirements. A useful guide to the UST regulation is available from the EPA in a publication entitled “Musts for USTs” and “Straight Talk on Tanks” (EPA/530/US T-90/12).

An “existing UST” is one that was in operation prior to December 22, 1988. New and existing USTs must comply with significant construction or retrofit standards upon installation or by 1998, at the latest. Aboveground equipment is much easier to inspect and repair and may be a preferred alternative.

### 5.4.5 Surface Pits

Regulations for the installation and operation of surface pits are administered by the states. The federal laws do not apply to surface pits unless the pit contents are classified as hazardous waste (refer to Section 7 for information on definition).

The trend is away from having surface pits. In many cases, it may be difficult to get a permit for a new pit. A well-designed pit will be built with impermeable materials or will utilize a liner to prevent loss of contents. In addition, provisions need to be made to ensure that birds, domestic animals, or wildlife will not be harmed by the contents of the pit by using netting, fencing, or other appropriate means of protection.

### 5.4.6 Process Piping, Vessels, and Equipment

Environmental regulations may dictate changes in original plant design, equipment installation, and operating and maintenance procedures. Some will primarily affect the design of new facility construction as well as retrofitting current gas plants.

The number of flanges and valves installed should be minimized to reduce possible leakage points, and they should be accessible for monitoring.

Process drainage, sight glass blowdown, and sample point streams should be routed to the process sewer to avoid contamination of the stormwater sump. Open-cup drain installation should be minimized to reduce the possibility of spillage. Temporary piping or hose routed to the drain system should be used instead of open-cup drains when use is infrequent. Process sewers should be routed to recovery facilities. Installation of double pipe or sand-filled plastic encasement, in addition to a leak detection system, will provide secondary containment. Sumps and foundations should be impermeable to enhance containment.

Start-up, shutdown, and safe emergency procedures should be evaluated for environmental impact by persons who are knowledgeable about the processes and the equipment involved. During maintenance of equipment, residual oil should be captured and recycled or recovered, whenever possible. Maintenance of large equipment that contains large volumes of product or treating materials may require steaming or flushing on an appropriate collection device such as a process sewer.

#### 5.4.7 Truck and Tank Car Loading

Tank trucks and rail cars should be inspected before and after filling, and all leaks should be repaired immediately. The loading arms at the facility should be equipped with an emergency release. Connections should be blinded or capped when not in service and, when removing blinds, spillage should be prevented.

Recommended loading practices are addressed in detail in *GPA Publication 8166-70: Manual for Driver-Attended Loading of LP-Gas* and *GPA Publication 8162-70: LP-Gas Loading Practices Manual*. In addition, some site-specific plans may have special practices for loading and unloading operations. All applicable DOT requirements must be followed during loading operations as well as in preparation for shipment if the material being shipped is a hazardous material (refer to 49 CFR Part 172).

#### 5.4.8 Marine Loading and Unloading

The terminal is responsible for providing hoses that are in good condition. Hose strings should be frequently examined for any possible defect that may be visible in the bore or outer covers such as blistering, abrasions, flattening of the hose, or evidence of leaks. Hoses to be used should be pressure tested to the manufacturer's specifications at recommended intervals and should be tested at least once per year.

A written emergency shutdown procedure and agreement should be maintained between the operator of the vessel and the terminal and be recorded on an appropriate form. The agreement should designate those circumstances in which operations must be stopped immediately. An emergency release device should be provided to permit the quick and safe release of the vessel in case of an emergency.

### 5.5 SANITARY SYSTEMS

Regulations for the installation and operation of sanitary systems vary from state to state. Septic tanks should only be used in areas where the water table is not near the ground surface. In areas with shallow ground water, small package sewage plants that treat and discharge may be installed, provided the appropriate discharge permit is obtained. Check with the local health department for installation requirements.

## 6 Air Emissions

### 6.1 INTRODUCTION

Section 6 provides guidance for dealing with federal and state air emission rules and regulations that will impact the operation of a gas processing plant. The discussion includes issues such as Prevention of Significant Deterioration (PSD), ozone nonattainment areas, permitting, and air toxics.

### 6.2 GENERAL

The Clean Air Act (CAA) was amended on November 15, 1990, greatly expanding the obligations of operators.

### 6.3 PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

The PSD requirements apply only in attainment areas for the critical pollutant under review where the pollutant emissions meet the PSD "major source" or PSD "major modification" definition. An attainment area is defined by the EPA as an area that meets the National Ambient Air Quality Standards (NAAQS) for the pollutant under review. A PSD "major source" is (1) a new source in one of 28 specified categories whose Potential Emission (PE) for any criteria pollutant equals or exceeds 100 tons per year [Note: A Sulfur Recovery Unit (SRU) is likely the only source in this category that impacts gas plants]; or (2) any other new source, including gas processing plants, whose PE for any regulated pollutant equals or exceeds 250 tons per year. A PSD "major modification" is a modification to an existing major source that produces a PE increase of a regulated pollutant in excess of a significant designated value (for example, 40 tons per year for  $\text{NO}_x$ ).

PSD permitting can typically take one to two years to obtain the permit and can be relatively expensive. Construction cannot begin until the permit is received. Emission controls and/or contemporaneous reductions can be used as methods of reducing emissions to a level where PSD permitting will not apply.

Prior to new construction or the modification of an existing plant, if PSD permitting applies, the requirements in 6.3.1 through 6.3.3 will need to be considered (refer to 40 CFR Parts 51 and 52 for additional information).

#### 6.3.1 Preconstruction Monitoring

If insufficient data exists, preconstruction monitoring may be required for the collection of on-site meteorological data and ambient pollutant concentration data.

#### 6.3.2 Air Quality Modeling

Air quality modeling is required to demonstrate the impact that emissions from the new source or modification will have on compliance with the NAAQS.

Table 1—Ozone Nonattainment Criteria

| Area     | Major Source,<br>tons per year | Major Modification,<br>tons per year |
|----------|--------------------------------|--------------------------------------|
| MARGINAL | 100                            | 40                                   |
| MODERATE | 100                            | 40                                   |
| SERIOUS  | 50                             | 25 <sup>a</sup>                      |
| SEVERE   | 25 <sup>b</sup>                | 25 <sup>a</sup>                      |
| EXTREME  | 10 <sup>b</sup>                | ANY INCREASE                         |

<sup>a</sup> Aggregated over five consecutive years.

<sup>b</sup> NO<sub>x</sub> applies in these areas as well as VOCs.

Note: NO<sub>x</sub> and VOCs are not added together; each stands alone.

### 6.3.3 Best Available Control Technology (BACT) Analysis

A BACT analysis of the emission control devices that could be installed to reduce emissions on the new source or modification is required. EPA requires that this be a “top down” review that includes reviews of existing control technologies.

## 6.4 OZONE NONATTAINMENT AREA

Nonattainment areas have been identified by the EPA as not in compliance with the NAAQS for one or more criteria pollutants. Areas are classified from marginal to extreme depending on the severity of nonattainment. Ozone nonattainment requires that Reasonably Available Control Technology (RACT) be installed in these areas on all existing major sources for VOC and NO<sub>x</sub> within specified time frames. For new major VOC sources and major modifications to existing major VOC sources, a more stringent standard referred to as Lowest Achievable Emission Rate (LAER) is required. Major modification levels depend on the area’s ozone nonattainment classification (refer to Table 1). The resulting increase in emissions must be offset by greater emissions reductions elsewhere.

## 6.5 PERMITTING, NSPS REQUIREMENTS, AND STANDARD EXEMPTIONS

### 6.5.1 Operating Permit System

All states must establish an operating permit system for new and existing facilities that meet the definition of “major source” in attainment and nonattainment areas. Major sources can be:

- Sources that emit any HAP equal to or greater than 10 tons per year or sources that emit an aggregate of 25 tons per year or more of several HAPs;
- Sources in attainment areas that emit 100 tons per year or

more of a criteria pollutant, including “grandfathered sources”; or

c. Sources in nonattainment areas that emit from 10 tons per year to 100 tons per year depending on the area’s severity. These new operating permits will be issued for periods of up to five years.

Although EPA’s operating permit regulations (40 *CFR* Part 70.3) allow states to temporarily exempt sources other than major sources, Section 502 of the CAA and EPA’s regulations require the following sources to have operating permits:

- Any source, including an area source, subject to a standard limitation or other requirement under Section 111 of the CAA;
- Any source, including an area source, subject to a standard limitation or other requirement under Section 112 of the CAA, except that a source is not required to obtain a permit solely because it is subject to regulations or requirements under Section 112(r) of the CAA;
- Any affected source; and
- Any source in a source category designated by the Administrator pursuant to Section 502.

### 6.5.2 General and Temporary Permits

States can also issue general permits (for large groups of sources) and temporary permits (for portable sources).

### 6.5.3 New Source Performance Standards (NSPS)

NSPS apply to a wide variety of equipment types including: turbines (40 *CFR* Part 60 Subpart GG); storage tanks (40 *CFR* Part 60, Subparts K, Ka, Kb); VOC fugitive emissions from onshore natural gas processing plants (40 *CFR* Part 60, Subpart KKK); and onshore natural gas plants processing SO<sub>2</sub> (40 *CFR* Part 60, Subpart LLL). The detailed information for each equipment type is contained in

40 *CFR* Part 60. NSPS permit provisions will require specific operating and/or performance standards.

Note: It is important to remember that an existing source can become an affected NSPS source if “reconstruction” occurs; refer to 40 *CFR* Part 60.15.

An example of NSPS is found in 40 *CFR* Part 60.630, Subpart KKK. These standards apply to onshore gas processing plants constructed or substantially modified after January 20, 1984. Two requirements of Subpart KKK are monthly leak detection/repair and semiannual reporting. Under these standards, there are frequently alternatives available; for instance, it is possible to reduce the amount of leak detection monitoring to quarterly or less by electing to comply with the requirements of 40 *CFR* Part 60.483-1 and 40 *CFR* Part 60.483-2.

### 6.5.4 Exemptions

Some states may elect to exempt sources that are considered “insignificant” and will excuse these sources from state permitting requirements. The exemption can usually be obtained by the facility providing a written notification to the regulatory agency describing the facility’s compliance or simply by following the exact details of the noted exception.

Note: Consult with applicable state regulatory agencies for specific details.

## 6.6 AIR TOXICS

The CAA Amendments of 1990 added Title III, which enhances and revitalizes the federal air toxics program. There are 189 Hazardous Air Pollutants (HAPs) regulated under Title III (refer to Table 2 for partial listing). An air toxics major source is defined as having the potential to emit 10 tons per year or more of any of the listed HAPs or 25 tons per year or more of any combination of listed HAPs. Air toxics major sources are required to obtain an operating permit and required to meet the Maximum Achievable Control Technology (MACT) standard within three years after promulgation of Title III.

## 6.7 NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPS)

NESHAPS was the air toxics program under the CAA before it was amended in 1990. The purpose of NESHAPS is to define hazardous air pollutants and provide procedures to protect personnel coming in contact with these designated pollutants. The original eight hazardous air pollutants were: asbestos, beryllium, mercury, benzene, vinyl chloride, radionuclides, inorganic arsenic, and coke oven emissions.

The following NESHAPS Subparts may have application in gas plant operations:

- Subpart A: *General Provisions*
- Subpart J: *Equipment Leaks (Fugitive Emission Sources of Benzene)*

Table 2—Common Hazardous Pollutants for Gas Plants

| CAS <sup>a</sup> Number | Chemical Name        |
|-------------------------|----------------------|
| 107028                  | Acrolein             |
| 107131                  | Acrylonitrile        |
| 1332214                 | Asbestos             |
| 71432                   | Benzene              |
| 106990                  | 1, 3-Butadiene       |
| 133062                  | Captan               |
| 75150                   | Carbon disulfide     |
| 56235                   | Carbon tetrachloride |
| 57749                   | Chlordane            |
| 7782505                 | Chlorine             |
| 126998                  | Chloroprene          |
| 100414                  | Ethyl benzene        |
| 107211                  | Ethylene Glycol      |
| 50000                   | Formaldehyde         |
| 100543                  | Hexane               |
| 7647010                 | Hydrochloric acid    |
| 7664393                 | Hydrogen fluoride    |
| 67561                   | Methanol             |
| 91203                   | Naphthalene          |
| 108952                  | Phenol               |
| 100425                  | Styrene              |
| 108883                  | Toluene              |
| 121448                  | Triethylamine        |
| 1330207                 | Xylenes              |

<sup>a</sup>CAS—Chemical Abstract Service

- Subpart M: *Asbestos*
- Subpart V: *Equipment Leaks (Fugitive Emission Sources)*
- Subpart Y: *Benzene Emissions from Benzene Storage Tanks*
- Subpart BB: *Benzene Emissions from Benzene Transfer Operations*
- Subpart FF: *Benzene Waste Operations*

At present, NESHAPS is considered a safety issue and will not be discussed further. Users should contact company safety personnel for more information.

## 6.8 EMISSION UNITS

Equipment that emits or leaks pollutants to the ambient air is considered an emission unit. Some examples are discussed in 6.8.1 through 6.8.7.

### 6.8.1 Internal Combustion/Turbine Engines

Emissions may include, but are not limited to, nitrogen oxide (NO<sub>x</sub>), carbon monoxide (CO), and volatile organic

compounds (VOCs). The emission rates may be estimated based on data obtained from: (1) stack testing, (2) manufacturer's data, or (3) EPA's *AP-42 Manual*.

### 6.8.2 Boilers/Heaters

Emission types are similar to those from engines, but normally have lower rates. The emission rates are typically determined by using factors found in EPA's *AP-42 Manual*.

### 6.8.3 Sulfur Recovery Units (SRUs)

The emissions from SRUs and their associated equipment include, but are not limited to, hydrogen sulfide ( $H_2S$ ), sulfur dioxide ( $SO_2$ ), reduced sulfur compounds such as  $CS_2$  and COS, CO,  $NO_x$ , VOC, and particulates (PM10). The emission rates are normally determined by a material balance, stack testing, or continuous emission monitors.

### 6.8.4 Vents and Flares

Emissions from vents and flares can include, but are not limited to,  $H_2S$ ,  $SO_2$ , CO,  $NO_x$ , VOC, and PM10. The emission rates are normally determined by a material balance or emission factors.

### 6.8.5 Fugitive Emissions

Fugitive emissions are emissions from valves, flanges, fittings, and so forth, that leak very small amounts, but, due to large numbers, can result in significant emissions. They will include, but are not limited to, VOCs. The emission rates are normally determined by a material balance, emission factors, or ambient leak detection programs.

### 6.8.6 Glycol Reboiler Vents

Significant VOC emissions, including benzene, toluene, ethylbenzene, and xylene (BTEX) can be emitted from this source. The glycol circulation rate is an important factor in emissions. The emission rates are normally determined by a material balance or stack test.

### 6.8.7 Storage Tanks

Significant VOCs can be emitted from tanks depending on tank size, working losses, breathing losses, and flushing losses. The emission rates are normally determined by tank calculations found in EPA's *AP-42 Manual*, which does not address the losses due to flashing.

## 7 Solid Waste Management

Section 7 addresses management of gas plant solid wastes from creation of the waste through treatment, transportation, and disposal.

## 7.1 INTRODUCTION

All gas processing facilities generate some amount of solid waste. In general, a solid waste is any solid, semi-solid, liquid, or contained gaseous material from industrial operations that is discarded. Regulations further elaborate on this definition (refer to 40 *CFR* Part 261.2). Certain solid wastes from gas processing facilities are exempt from the RCRA hazardous waste regulations. However, some solid waste from gas processing facilities is not exempt and may be hazardous if it is listed (40 *CFR* Part 261, Subpart D) or possesses characteristics rendering it hazardous (refer to 7.3 for more details about hazardous characteristics and listed hazardous waste). Sections 7.1.1 and 7.1.2 contain a list of some applicable wastes that are specifically exempt from RCRA hazardous waste regulation and some that are not exempt. Some states or company policies have stricter requirements that may require certain RCRA-exempt wastes to be managed as RCRA-nonexempt wastes.

### 7.1.1 List of Epa Exempt Gas Processing Wastes

The following wastes are listed as exempt in EPA's Regulatory Determination submitted to Congress in June 1988 (53 *Federal Register* 25446, July 6, 1988). This list *does not* include all wastes listed as exempt from RCRA Subtitle C by EPA, but only example wastes associated with some gas processing operations.

- Produced water.
- 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.
- 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 nonexempt wastes listed in the regulatory determination.
- Constituents removed from produced water before it is injected or otherwise disposed.
- 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 the process known as blowdown.
- Waste crude oil from primary field operations and production.
- Light organics volatilized from exempt wastes in reserve pits or impoundments or production equipment.

### 7.1.2 List of Epa Nonexempt Gas Processing Wastes

EPA's Regulatory Determination includes the following E&P wastes as nonexempt from RCRA Subtitle C. Waste materials from maintenance of production equipment, as well as transportation (pipeline and trucking) related waste, are nonexempt. Wastes that are not unique to E&P, especially those that do not contact oil and gas in normal operations, may not be exempt. While the following listed wastes are nonexempt, the wastes are not necessarily hazardous. *It is the waste generator's responsibility to determine if the waste is hazardous.* Again, EPA included many more waste types in its list of nonexempt waste, but only example wastes associated with some gas processing operations are shown below:

- 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.
- 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.
- Incinerator ash.
- Laboratory wastes.
- Sanitary wastes.

- Pesticide wastes.
- Drums, insulation, and miscellaneous solids.

Note: EPA's lists of exempt and nonexempt wastes are not all-inclusive. In deciding which waste streams were exempt, EPA focused on wastes necessary to conduct so-called "primary field operations" (including centralized facilities and gas plants). In some cases, determinations will need to be made on other incidental wastes. *Companies should make their own determination regarding whether these and other incidental wastes are exempt:*

- Sulfur-contaminated soil or sulfur waste from sulfur recovery units.
- Gas plant sweetening unit catalyst.
- Produced water contaminated soil.
- Production facility sweetening and dehydration wastes.
- Pigging wastes from producer-operated gathering lines.
- Production line hydrotest/preserving fluids utilizing produced water.
- Iron sulfide.

## 7.2 GENERAL WASTE MANAGEMENT GUIDANCE

There are some general waste management practices that can minimize waste management problems. Attempts should be made to reduce or eliminate waste before it is created. If waste is created, attempts should be made to reuse it or reduce its volume or toxicity, when feasible. Finally, waste which is unavoidably generated should be managed in an environmentally sound manner.

Attempts should be made to manage solid wastes on-site, if at all possible and allowed by applicable regulations. The following hierarchy outlines a waste management process that should be followed.

- a. Source Reduction/Elimination. Prevent waste as the first priority, followed by reduction of the quantity of the waste generated.
- b. Recycling. Reuse or reclaim as much of the waste generated as possible.
- c. Treatment. Employ techniques to reduce the volume or the relative toxicity of waste that has been unavoidably generated.
- d. Proper Disposal. Utilize environmentally sound disposal methods that protect human health and the environment.

This hierarchy is more fully explained in *API Environmental Guidance Document: Onshore Solid Waste Management in Exploration and Production Operations*.

## 7.3 RCRA WASTE CHARACTERIZATION

Under RCRA, there are two major criteria used to determine if a solid waste is hazardous. The first criterion is to determine if the waste is a "listed" waste. Listed waste is separated into several categories:

- Waste from nonspecific sources (F listed waste),
- Waste from specific sources (K listed wastes), and
- Waste from discarded commercial chemical products, off-specification species, container residues, and spill residues (P and U listed waste).

These waste lists can be found in 40 *CFR* Part 261, Subpart D. Solid wastes mixed with listed hazardous wastes and wastes generated by the treatment, storage, or disposal of a listed waste are automatically deemed to be a hazardous waste. If the waste is unlisted, the second criterion is to determine if it is hazardous due to any of the following four characteristics:

- Ignitability,
- Corrosivity,
- Reactivity, or
- Toxicity.

A complete explanation of these four characteristics can be found in 40 *CFR* Parts 261.20 through 261.24, and a brief summary of each of the four characteristics follows.

A solid waste is ignitable (with a few exceptions) if:

- a. It is a liquid with a flash point below 60°C (140°F),
- b. It is not a liquid but can cause fire and burn vigorously,
- c. It is an ignitable compressed gas, or
- d. It is an oxidizer as defined in 49 *CFR* Part 173.152.

A solid waste is corrosive if:

- a. It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, or
- b. It is a liquid and corrodes steel at a rate greater than 6.35 millimeters per year.

A solid waste is reactive if:

- a. It is normally unstable and readily undergoes violent change without detonating,
- b. It reacts violently with water,
- c. It forms potentially explosive mixtures with water,
- d. It generates dangerous quantities of toxic fumes when mixed with water or, in the case of cyanide- or sulfide-bearing wastes, when exposed to pH conditions between 2 and 12.5,
- e. It is capable of detonation when subjected to strong initiating sources of heat under confinement, or
- f. It is a forbidden explosive.

A solid waste is toxic if the extract from a sample of the waste contains any specified contaminant at or above the specified regulatory level.

A much more detailed and specific definition of each of these characteristics is found in 40 *CFR* Parts 261.20 through 261.24. This information should be reviewed prior to any actual determinations of characteristic hazardous waste.

Under Subtitle C of RCRA, the EPA strictly regulates the management of hazardous waste. Subtitle D contains guidelines for state regulation of solid waste. Subtitle C also addresses small quantity generators of hazardous waste. Congress, in 1980, decided that waste from several industries (including exploration and production) deserved special consideration. Thus, the 1980 RCRA amendments suspended Subtitle C regulation of E&P waste pending an EPA study. In

the resulting study, the EPA determined that Subtitle C regulation of E&P waste is not warranted and further issued a list of some specific E&P wastes that are exempted from Subtitle C regulation (refer to 7.1.1). This list of exempt E&P wastes follows the stated intent of only exempting waste that is uniquely associated with E&P operations. The E&P exemption from RCRA Subtitle C regulation is the basis for much of the gas processing industry's waste management policy, since gas processing is a part of the broad E&P industry.

In order to assist gas processing personnel with waste disposal questions, an example of waste from gas processing plants is discussed in the following paragraph. The discussion will focus on why the waste is or is not exempt from RCRA regulation based on the waste characteristics and the type of operation generating the waste. In general, wastes intrinsically associated with oil and gas exploration and development operations are exempt.

**Example:** Glycols are commonly used in gas processing plant operations to dehydrate gas and as antifreeze in engines. According to the EPA Regulatory Determination of June 1988, glycol waste resulting from gas dehydration operations (for example, spent glycol, glycol filters, and filter media) is exempt from RCRA hazardous waste regulation. However, glycol waste from engine antifreeze is not exempt, and, prior to disposal, it must be determined if the glycol waste is characteristically hazardous or not. The main difference in treatment of the two waste streams is that the gas dehydration operation is uniquely associated with gas processing while the engine antifreeze is not.

## 7.4 DISPOSAL TOPICS

This section addresses the manifesting, transportation, treatment, and disposal of gas processing waste.

### 7.4.1 Manifests

A manifest is a recordkeeping document used to keep track of off-site waste shipments. The manifest serves to document that waste that leaves a facility gets to its intended location intact. The manifest contains information on the waste type, waste volume, date of shipment, transporter, and disposal site. Manifests are always required for off-site hazardous waste shipments. Many state oil and gas agencies require manifests for gas processing waste shipments, and many others are considering adopting such regulations. While manifests are not always required by regulation for shipment of gas processing waste, they are helpful in tracking and recording the waste disposal process. If the waste being shipped is considered a hazardous material, the applicable DOT requirements must be followed.

### 7.4.2 Transportation

It is recommended that gas processing facilities audit transportation companies prior to use. The audit should en-

sure that the transportation company has all the necessary permits, be financially sound, be adequately insured, has the required training, has a good regulatory history, and understands the gas processing company's policies (such as manifests and loading procedures). The transporter is a very important part of the disposal process and should be examined as closely as the disposal company, including compliance with the necessary DOT requirements.

### 7.4.3 Treatment and Disposal

The choice of a treatment and/or a disposal method depends upon many factors, including the material to be managed. Some of the treatment and disposal options are:

- On-site or off-site injection well, hazardous or nonhazardous.
- Landfill, hazardous or nonhazardous.
- Incinerator.
- On-site burial.
- Recycling, on-site or off-site.
- Bioremediation or land spreading, on-site or off-site.
- Permitted discharge to surface waters, such as NPDES, on-site or off-site.

Final selection of a disposal method should be made only after a full review of the appropriate regulations. Permit requirements for each disposal method vary from state to state. Once a method has been selected, a contractor or disposal company may be required. Such companies should also be audited for acceptability. Since the liability of improper disposal is so large, a full compliance audit of all disposal companies is strongly recommended. This audit, and periodic follow-up audits or inspections, should cover the disposal company's permits, regulatory compliance history, financial status, on-site housekeeping, and allowable waste.

## 8 Release Reporting

### 8.1 INTRODUCTION

Section 8 discusses the reporting requirements for releases of hazardous substances and liquid hydrocarbons to the environment. Although federal, state, and local agencies have been established to facilitate monitoring and aid in handling the releases, spills, permit excursions, and other releases of "hazardous substances" into the environment (as defined in 3.3), Section 8 addresses federal requirements only.

Reporting a release to the environment is mandated by regulations that contain guidelines and procedures for reporting. An operator of a facility may be required to report a spill/release to one or several agencies based on criteria set forth in the regulations. Due to more than one statute governing releases to the environment, overlapping reporting obligations exist. Therefore, a released substance exempt un-

der one statute may require reporting under another regulation. There are three primary federal laws addressed in this Section that encompass the majority of reporting obligations. These laws are not discussed in detail. Refer to API Bulletin E4 for additional information or if clarification on a reporting procedure is needed.

### 8.2 SCOPE

The three primary federal statutes that require release reporting and that are addressed in Section 8 are the CWA, CERCLA, and EPCRA (SARA Title III). Other regulations or statutes are mentioned as they apply. State and local reporting obligations are not included due to differences in reporting laws from one state to another. However, State Emergency Response Commissions (SERCs) and Local Emergency Planning Committees (LEPCs) are referred to in EPCRA Title III, Section 304. SERCs and LEPCs may be able to provide additional information on state and local release reporting procedures and requirements.

### 8.3 CLEAN WATER ACT

The CWA prohibits the discharge of oil or hazardous substances (HSs) in or on the waters of the United States and their adjoining shorelines in quantities that may be harmful. The CWA is discussed as it applies to liquid hydrocarbon (petroleum) discharges/spills and effluent discharges in wastewater and stormwater only. All CWA HSs are listed in 40 *CFR* Part 116.4 and are also contained in the CERCLA listing of HSs (40 *CFR* Part 302.4) and are addressed in 8.4.1. The CWA and CERCLA have the same reporting requirements for the HSs except the CWA limits itself to navigable waters of the United States, while CERCLA controls releases to all phases of the environment. Furthermore, the CWA controls oil discharges while CERCLA has a petroleum exclusion.

#### 8.3.1 Oil Spills

The regulations issued under the CWA mandate that the National Response Center (NRC) will be notified immediately when an oil spill occurs in or upon navigable waters of the United States or adjoining shorelines (refer to Section 4). Under the CWA, a sheen of oil or sludge deposit below the water's surface triggers this reporting requirement. The telephone number for notification to the NRC is (800) 424-8802. 8.3.2 provides a listing of information generally required for notification.

#### 8.3.2 General Information Required for Reporting Releases

The following minimum information is generally required in notifying NRC of an oil spill/release:

- a. Location/time/date/volume of spill or release.

- b. Type of material or substance spilled, including technical and common names.
- c. Causes/source/complications of the spill.
- d. Injuries/deaths associated with the spill/release.
- e. Name(s) and phone number(s) of person(s) who discovered spill, reported spill, and are in charge of cleanup.
- f. Past/present/future corrective action plan to be implemented by the facility.
- g. Where applicable, permit numbers and permitted discharge volumes.

Notification should not be delayed to obtain detailed information about the spill. Furthermore, notification should be made by the persons or individual in charge of the facility. In addition to notification to the NRC, the SPCC regulations require follow-up written reporting to the regional office of the EPA for facilities that have a single spill in excess of 1000 gallons of oil or have two reportable spills in any twelve-month period. A facility's SPCC Plan and the information listed in 8.3.3 must be submitted to the EPA Regional Administrator within 60 days of triggering the reporting requirements.

### **8.3.3 EPA Requested Information on Oil Spills (Spills to Waters of the United States, 40 CFR Part 112.4)**

The following information should be submitted to EPA regarding oil spills/releases to U.S. waters:

- a. Name of facility.
- b. Name(s) of owner or operator of facility.
- c. Location of facility.
- d. Date and year of initial facility operation.
- e. Maximum storage or handling capacity of the facility and normal daily throughput.
- f. Description of facility, including maps, flow diagrams, and topographical maps.
- g. A complete copy of SPCC plans with any amendments.
- h. The cause(s) of such a spill, including a failure analysis of system or subsystem in which failure occurred.
- i. The corrective action(s) and/or countermeasure(s) taken, including an adequate description of equipment repairs and/or replacements.
- j. Additional preventive measures taken or contemplated to minimize the possibility of recurrence.
- k. Such other information as the Regional Administrator may reasonably require pertinent to the SPCC plan or spill event.

Reporting of oil spills occurring on land and not reaching navigable waters is normally regulated by the state in which they occur. Individual states have designated agencies that regulate oil and gas operations. These agencies and the SERCs and LEPCs should be contacted for procedures in re-

porting at state and local levels. Facilities located on public lands or in state waters may have additional reporting requirements.

## **8.4 THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA)**

### **8.4.1 Hazardous Substances (HSs)**

CERCLA has established requirements for reporting the release of HSs to the environment. Under CERCLA, a release of an HS equal to or in excess of its reportable quantity (RQ) within a 24-hour period requires immediate notification to the NRC at (800) 424-8802. This statute is implemented by rules in 40 *CFR* Part 302.4, which gives a listing of HSs and their RQs. In addition, the release of certain "unlisted" HSs (40 *CFR* Part 302.4) is reportable under this statute. All RCRA hazardous wastes are also CERCLA HSs.

Releases of mixtures and solutions are subject to notification when an HS component of the mixture or solution is released in a quantity equal to or greater than its RQ. Characteristic hazardous wastes (that is, unlisted HSs) are reportable if released in quantities of 100 pounds, unless they are hazardous based on their toxicity. In that case, they are reportable at the level set for the toxic constituent with the lowest RQ listed in 40 *CFR* Part 302.4.

### **8.4.2 Wastewater and Stormwater Discharge**

Situations (upsets and bypasses) that result in the discharge of a pollutant in excess of federally-permitted conditions within wastewater or stormwater discharges require prompt notification to the EPA Regional Administrator. In addition, a written report must be filed within five days of the incident (unless this requirement is waived by EPA). Information requested by the EPA is summarized in 8.4.3 or may be found in 40 *CFR* Part 122 for the National Pollutant Discharge Elimination System (NPDES). Permits covering both wastewater and stormwater discharges will normally contain effluent limitations and monitoring and reporting procedures.

In addition, any discharges that are not addressed in the permit rules or regulations and were not addressed in the original permit application should be brought to the attention of the permitting agencies. These discharges are not federally permitted and are subject to CERCLA reporting. If the substances are regulated by CERCLA and exceed their RQ when released, the NRC should also be notified.

### **8.4.3 EPA Required Information for Wastewater or Stormwater Discharge Reporting Under 40 CFR Part 122**

The following information should be reported to the appropriate EPA Regional Administrator, as required by the NPDES (40 *CFR* Part 122).

- a. A description of the noncompliance and its cause.
- b. The period of noncompliance, including exact dates and times.
- c. If not corrected, the anticipated time the noncompliance is expected to continue.
- d. Steps taken or planned to reduce, eliminate, and prevent recurrence of noncompliance.

Note: Additional information may be required by permit or state regulations.

## 8.5 EPCRA (SARA TITLE III)

This statute establishes reporting requirements for Extremely Hazardous Substances (EHSs) and HSs. A list of EHSs and their reportable quantities is contained in 40 *CFR* Part 355. However, many of the substances found in 40 *CFR* Part 355 are also listed as CERCLA HSs and are subject to CERCLA reporting requirements in addition to the requirements established under EPCRA Title III. This statute, which established SERCs and LEPCs, requires notification to both agencies in the state where a reportable release occurs. A discharge that does not leave the boundary of the plant/facility and does not create a threat to personnel or the public health is not reportable under EPCRA Title III, although it may still be reportable under CERCLA (refer to 8.4.1).

## 8.6 EXEMPTED/PERMITTED RELEASES

CERCLA and SARA allow for releases to be exempt from reporting if the release is federally approved. Discharges authorized by permits under the CWA, CAA, or SDWA, for example, would be exempt. If the state programs enforcing these statutes obtain federal approval (for example, underground injection control), releases under the state programs would also be exempt.

## 8.7 PROCESS UPSETS

Processes that are interrupted or performed abnormally due to a failure may result in the release of an HS (above the reportable quantity) or waste to the surrounding environment. As discussed under CERCLA, an RQ release under CERCLA will require NRC notification unless the circumstances surrounding the incident allow application of a CERCLA exemption. Process upsets may trigger reporting governed by a facility's air or water permit. Releases in excess of permitted volumes/conditions are reportable to the agency issuing the permit and other agencies as outlined in the permit.

## 8.8 MATERIAL SAFETY DATA SHEET (MSDS)

MSDSs are required by OSHA's Hazard Communication Standard to be supplied by product (chemical) manufacturers. This requirement was implemented as a safety measure for workers at facilities using or producing hazardous chemicals. However, EPCRA Title III supplements the OSHA

standards by requiring that MSDSs or a list of chemicals used or stored at a facility in certain threshold quantities be distributed to LEPCs, SERCs, and local fire departments. Reporting requirements are governed by Sections 311 and 312 of EPCRA Title III and are addressed in 8.5.

# 9 Site Closure and Restoration

## 9.1 INTRODUCTION

Section 9 provides guidance for closing down a plant, temporarily or permanently, in an environmentally sound manner. In the gas processing industry, plants are sometimes shut down due to economics, declining gas supply, or outmoded technology. Some of the following guidance applies chiefly to permanent closures and should be modified, as necessary, for temporary closures.

## 9.2 PREPLANNING

Preplanning site closure and restoration from the first steps of construction planning through routine plant operations will make eventual closure of the plant easier, more economical, and more effective.

### 9.2.1 Design Criteria

One of the critical factors to be considered in selecting plant location is environmental risk potential. Key elements in this consideration include air, surface, and subsurface factors. Facilities should be designed according to appropriate codes and standards, including those dealing with integrity of the process equipment and prevention of leaks, spills, and other failures. Design should include sufficiently impermeable secondary containment for process and storage areas. Design should also include proper conveyances and storage for collected liquids.

### 9.2.2 Construction Criteria

Disturbance of surface and subsurface soils should be minimized during construction. When feasible, surface water run-on and run-off should be controlled. Guidance should be provided so that spills/leaks of fuels, lubricants, or other chemicals are prevented and that any accidental spill or discharge is completely and effectively cleaned up. Where practical, aboveground facilities including piping should be used. Complete "as-built" drawings for all facilities should be maintained throughout the site's construction or modification.

### 9.2.3 Operations Criteria

Establishment and communication of good housekeeping guidelines will effectively limit remediation required for eventual closure of a plant. This effort is even more effective when combined with an ongoing grassroots environ-

mental awareness program. Spills should be quickly remediated, contaminated soil managed according to regulatory and good management practices, and leaks promptly repaired to minimize migration of leaked material. Wastes should be segregated, kept undiluted, and stored (if necessary) so as to prevent migration. Wastes and excess equipment should be removed from the site as quickly as possible.

### 9.3 SITE RESTORATION

Some restoration procedures for gas processing plant sites are discussed in 9.3.1 through 9.3.10.

#### 9.3.1 Landowner Requirements

Property leases will often specify landowner requirements for the removal of equipment and foundations and for the restoration of surface and subsurface conditions. These requirements should be carefully negotiated and an understanding of them maintained by the landowners, the design and construction engineers, and the facility operations/maintenance personnel. Landowners cannot relieve the operator from legal responsibility for proper site closures.

#### 9.3.2 Permit Requirements

Permits seldom specify remediation necessary for closure of gas processing facilities. Asbestos regulations may be applicable to the dismantling of equipment. On-site water wells and disposal wells should be plugged and abandoned if no further use is planned. Plugging of disposal wells will require a permit.

#### 9.3.3 Removal of Chemicals

All chemicals used in processing, raw materials, and products should be completely removed from the site and recycled or properly disposed. Timing should fit with safe dismantling of residual equipment and structures and with avoiding risk of spills/leaks as a result of vandalism. All drums and containers should be removed from the site as part of the closure process.

#### 9.3.4 Remove or Inventory Equipment

Ideally, all equipment should be removed from the site. If this is not done, all remaining equipment should be inventoried. An appropriate Naturally Occurring Radioactive Material (NORM) survey should be conducted prior to removing or storing site equipment. Refer to API Bulletin E2 for additional information. The inventory should include documentation of the equipment's condition, any preservation measures used to protect equipment for future use, and updated drawings and process drawings reflecting the current site condition. The inventory should be periodically checked, updated, and maintained until the equipment is removed, sold, or otherwise no longer under control of the operator/owner.

#### 9.3.5 Pit Closures

Any pits should be emptied, lining materials (including contaminated soil) removed or remediated according to lease and regulatory requirements, and the excavation restored to original grade.

#### 9.3.6 Underground Storage Tank and Related Equipment Removal

USTs and sumps can be excavated and removed or abandoned in place. Any associated contaminated soil should be removed or remediated, and any excavation should be restored to original grade. Evacuation and removal is preferable to abandonment in place in order to limit future liability. Federal, state, or local regulations will require approval of the plans prior to removal or abandonment and restoration for regulated USTs.

To ensure unrestricted future use of the property and to reduce risk of unexpected subsurface environmental problems, underground piping and equipment should be removed at the time of closure. The lease agreement or local regulations may require the removal of such piping and equipment to some specified depth. Piping abandoned in place should be purged and its location documented.

#### 9.3.7 Mothballing Equipment

All equipment to be stored for future use (on-site or elsewhere) should be made ready for storage. Steps should be taken to prevent corrosion, physical damage, and unauthorized physical tampering with the equipment during storage. Equipment should be thoroughly cleaned before mothballing and storage. Stored equipment should be thoroughly inspected before reuse.

#### 9.3.8 Soil

Site soil should be inspected and, if deemed necessary, sampled and analyzed prior to closure to identify any soil areas requiring removal or on-site treatment. Methods used for site evaluation, including sample locations and analytical data, should be carefully documented and placed in the site closure file. If warranted by site conditions, site run-on and run-off should be prevented. On-site ponding of surface water should likewise be prevented. No conduits to the subsurface (wells, holes, sumps, drains, abandoned pipes, and so forth) should be left at the site.

#### 9.3.9 Labeling Stored Equipment

Equipment left on-site or removed for storage elsewhere should be labeled to clearly conform with site and process drawings. One should also assume that those attempting to identify the equipment may not be familiar with the site's use

prior to closure. Any remaining asbestos- and NORM-containing equipment should be labeled.

#### **9.3.10 Post-closure Inspections**

Scheduled inspections of the closed site should be made at appropriate intervals to assess site security and environmental condition. Any necessary remediation should be promptly conducted.

If equipment or other materials are to remain on-site following closure, the site should be fenced or otherwise secured so that access is restricted to those who need to be there. To maintain site security, a surveillance plan should be implemented and documented. The final disposition of the site should be documented.

### **9.4 PROPERTY TRANSFER**

Exchange, transfer, or sale of property should include a clear, complete, and documented understanding of all assets and liabilities associated with the site. A site assessment should be conducted before giving up possession and may include a detailed visual survey (photographs), surface sampling/analysis, and subsurface sampling/analysis. The site assessment and analytical work should be conducted by knowledgeable, experienced, and reliable professionals and accompanied by good quality assurance and quality control. The assessment information should be clearly and thoroughly documented for future reference.

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