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Environmental Law: Exploring the Influence on Engineering Design

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Introduction

Engineering design is not simply a reflection of vision and creativity; it is also an innovative response to physical principles and regulatory controls. Among the regulatory controls that shape the course of engineering design are environmental laws. This report is created both to introduce the basic framework of environmental law and to illustrate how that framework influences engineering decision-making.

Section I of this report provides a basic overview of the structure, actors, and concepts that make up the backbone of environmental law. The section addresses the role that federal, state, and local government play in shaping environmental law; the types of regulatory targets, objectives, and obligations that emerge from environmental laws; and the process by which environmental laws and regulations are made.

Section II of this report introduces the obligations imposed by some of the basic environmental federal statutes, international treaties, and common law doctrines. Specifically, Section II outlines the purpose, scope, requirements, and enforcement schemes of the following federal statutes: the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response Compensation and Liability Act, Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, National Environmental Policy Act, Emergency Planning and Community Right to Know Act, Occupational Health and Safety Act, and the Pollution Prevention Act. In addition the Section discusses the potential for liability under common law doctrines such as trespass, strict liability, nuisance, negligence, and toxic torts. The significance of the Montreal Protocol, the Kyoto Protocol, and the International Organization for Standards are addressed to explore the impact of international agreement and organizations on engineering design in the United States.

Once the environmental law framework is laid down in Section I and II, Section III illuminates the influence of this framework on engineering design. First, Section III uses a life cycle analysis to conceptualize the web of environmental laws that can influence a product or process throughout its life cycle – from the extraction of the materials that create a product to the product's disposal at the end of its life. Next, Section III focuses on how product performance standards are derived from environmental statutes and the challenges that federal agencies may face when establishing those performance standards.

This report concludes with a discussion in Section IV of the importance of designing beyond compliance. Not only do companies that design beyond compliance often benefit from monetary saving, but they also enjoy improved reputations in the community and they avoid the risk of having to react quickly to changing environmental regulations. In addition, designing beyond compliance can protect human health and the environment where regulations do not necessarily succeed in doing so.

Section I: A Structural Overview of Environmental Law

Understanding environmental law and appreciating the innumerable influences that environmental statutes, regulations, and policies exert over engineering design requires at least a broad picture of the actors, concepts, and processes that form the complex web of environmental law. In order to provide this basic overview, this section addresses: the role that federal, state, and local government play in shaping environmental law; the types of regulatory targets, objectives, and obligations that emerge from environmental laws; and the process by which environmental laws and regulations are made.

A. The Relationship Between Federal, State, and Local Laws

While Sections II-IV of this report focus on the impact of federal environmental statutes on the work of engineering professionals, federal environmental statutes are not the sole sources of environmental legal obligations. "Environmental law" encompasses any environmental protections or obligations that have been created from the following sources[1]:

1. Legislation passed as federal statutes, state statutes, or local ordinances;
2. Regulations promulgated by federal, state, and local agencies;
3. Court decisions that interpret statutes and regulations;
4. Common law;
5. United States Constitution and state constitutions;
6. International treaties; and
7. Regulations passed in foreign countries.

Full compliance with environmental laws, therefore, requires compliance not only with the applicable federal statutes but also with any other source of environmental obligations.

The role of state law in environmental issues is derived from essentially two sources: the police power and the delegation of federal authority under specific environmental statutes. The police power is the inherent authority of the states to protect the health, safety, and welfare of its citizens. Through this police power, the states have broad, inherent authority to develop state environmental law. Therefore, state laws could reach areas where there is no uniform federal program. The following laws are examples where states have taken the initiative to provide their citizens and the environment with protection beyond that generally available under the federal system:[2]

[1] *See* Thomas F.P. Sullivan, ed., Environmental Law Handbook, (15th ed. 1999) §2.0. Note that tribal laws could also be included in this list because tribes hold a unique position in their trust relationship with the United States government. The inherent sovereignty of tribes entitles them to self-governance, allows them to create their own laws, and immunizes them from suit by individuals and states. *See id.* at §5.4.2.

[2] *See* Sullivan, *supra* note 1, §3.3.

- Massachusetts has a Toxic Waste Minimization Law that imposes mandatory waste reduction objectives on companies that use or generate toxic or hazardous wastes.[3]
- California Proposition 65 is an Environmental Full Disclosure Law that requires companies to undergo significant efforts to make the public aware of health risks associated with products or environments to which they are exposed.[4]
- New Jersey has a Property Transfer Environmental Law that requires extensive investigation and cleanup of contaminated sites before they are sold or transferred.[5]
- Many if not most states have detailed permit programs to protect groundwater even though there is no federal legislation protecting groundwater yet.[6]

Other areas in which states typically have environmental laws separate from federal programs include facility siting laws, laws that govern the operation of publicly owned treatment works and landfills, and laws that compel cleanup of hazardous substances sites that are not on the federal Superfund list.[7]

Sometimes state environmental law is not separate from federal law but is an extension of federal law because the state has been delegated federal authority to operate a federal program. This type of approach to regulation is called cooperative federalism[8], which means that a state may assume responsibility for administering national environmental standards set by federal agencies. Or, the state may leave the task of implementation to the federal agency.

For example, if a state wishes to carry out the programs established under the Clean Air Act and the Clean Water Act, both discussed *infra* in Section II, the state would have to designate a lead state environmental agency and pass state air and water pollution control statutes that parallel the federal statutes. When the federal EPA Administrator is satisfied that the state program is adequately staffed, funded, and designed to meet minimum federal EPA standards, the EPA delegates the program to the states, along with federal funds to help run the program. State officials make local decisions, but the federal EPA sets minimum standards and oversees compliance. The state may set standards that are more stringent than the federal standards but may not thwart the federal statute by setting lower standards. If the state does administer the program in a way that undermines the federal program, the EPA could regain exclusive control over the program and administer the program itself.

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[3] Massachusetts Toxics Use Reduction Act added by St. 1989, c.265, §3, approved July 24, 1989.
[4] California Safe Drinking Water and Toxic Enforcement Act, adopted as Prop. 65 in 1986, Cal. Health and Safety Code §§ 25249.5-25249.13 (West Supp. 1987).
[5] NJ Stat. Anno. 13:1K-6 *et seq.*, Environmental Responsibility Act L. 1983, c.330, §1.
[6] *See e.g.*, Groundwater Permit Act (Cities, Villages, Municipal Corporations), Neb. Rev. Stat. 1943, 46-638 *et seq.*; Ground Water Basin Protection Act (Porter-Dolwig), Cal. Water Code §12920 *et seq.*
[7] *See* Sullivan, *supra* note 1, §3.3. The federal Superfund list is a list of contaminated sites that are eligible for federal monies to fund cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act, discussed *infra* Section II.
[8] *See* Robert V. Percival, et al., Environmental Regulation: Law, Science, and Policy, (2000) 120 (discussing the merits of cooperative federalism).

If the state does not wish to implement a federal program, the federal government has the burdensome task of administering the program. The federal government need to delegate programs to states because there are not enough federal employees to carry out the programs in all fifty states. Fortunately, the combination of federal pressure, public opinion, and financial inducement through federal subsidies has resulted in overwhelming state participation under the Clean Air Act and the Clean Water Act.[9]

There are several reasons why the federal government creates national programs even if it ultimately wants the states to implement the program. First, minimum federal standards are necessary to prevent competition among states which could undermine environmental quality.[10] This is called the "race-to-the-bottom" rationale because without minimum standards one state may lower compliance standards to attract industry. In theory, another state would then lower standards even further to compete with the first state and so on, thus "racing to the bottom" of environmental quality standards. Another reason for imposing minimum federal standards to protect against the inequity that would result from exposing citizens of different states to fundamentally unequal levels of risk.[11] Also, sometimes national programs can better envision and address problems of transboundary pollution.[12] Lastly, establishing federal standards which are then implemented by the states prevents duplicative efforts. Each state, then, does not have to determines, for example, what the carcinogenic risk of PCBs is and at what level to set a standard in order to avoid those risks.[13]

In addition to state laws, local laws can play a particularly important role in environmental law because local governments hold the power to implement many of the life-style changes needed for pollution prevention.[14] For example, zoning, which is the primary means of controlling land uses and planning, occurs at the county and city levels. Also, recycling of household garbage is most efficiently implemented at the local level. The willingness of the local governments to take initiative to plan for the future and protect the environment in individual communities can greatly affect the success of environmental protection programs.

International laws too are playing an increasing role in shaping environmental obligations. For example, the Kyoto Protocol[15], if ratified by the United States, would commit the United States to reduce carbon dioxide emissions by 7% below the 1990 levels. These reductions should be achieved between 2008-2012. This type of commitment would surely be translated into regulations that would affect coal-fired power plants and automobile fuel efficiencies. In addition to international treaties, regulations in foreign nations can also affect the engineering processes and designs adopted by companies if those companies export their products to foreign nations or have global manufacturing plants outside the United States.

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[9] *See* Celia Campbell-Mohn, et al., Sustainable Environmental Law, (1993) 120.
[10] *See* Percival, *supra* note 8, at 121.
[11] *See* Percival, *supra* note 8, at 122-23.
[12] *See id.*
[13] *See id.*
[14] *See* Campbell-Mohn, *supra* note 9, at §3.2(C).
[15] Discussed *infra* in Section II.

B. Regulatory Considerations: Scope, Objective, and Obligations

Several questions shape how federal, state, or local governments choose to draft environmental legislation: What is the scope of the conduct, pollutants or entities that should be regulated? What is the desired level of protection that the regulation should secure? What type of obligations will the regulation impose?[16] These considerations are not only important in shaping the creation of legislation, but they are also important in analyzing and understanding environmental laws once they have been drafted because they determine the scope of the regulation, the objective of the regulation, and the obligations imposed by the regulations.

1. Scope of the Regulation

The choice of who or what the proposed regulation will affect can ultimately impact the success of a regulatory scheme. A program that regulates a few easily identifiable targets will be much easier to implement and enforce than a program that attempts to regulate numerous, poorly identifiable, or widely dispersed entities. In addition, while environmental regulation generally benefits society and the environment, it also imposes costs on those that are subject to the regulation. Choosing regulatory targets often determines who will bear the costs of the regulation. If the regulatory targets are politically powerful, they may be successful in lobbying against environmental regulation that will affect them and may therefore disrupt the success of the regulation.
The following are examples of regulatory targets that form the basis of some of the current environmental laws:

- Products. Legislation targeted at products can be broad like the Toxic Substances Control Act (TSCA), which regulates any chemical substance or mixture. Or, legislation can be more specific like the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which only governs pesticide chemicals.
- Pollutants. Virtually every pollutant resulting from industrial, commercial, or domestic activities fall within the scope of a federal environmental statute.
- Industrial Facilities. Federal regulation targeted at industrial facilities is the most popular and perhaps the easiest form of regulation to enforce because the facilities are fewer in number than individuals. For example, the EPA can more easily impose requirements for emissions reduction against car manufacturers as opposed to individual car owners.
- Government Agencies. Governmental entities may be regulated if they own certain kinds of facilities that are part of the pollution problem, e.g. public water supply systems.

[16] *See* Percival, *supra* note 8, at 147-56 for a discussion about regulatory targets, bases of control, and regulatory types.

- Individuals. Regulation of individual conduct is less popular than regulation of facilities for both political and practical reasons.
- Land Uses. While most private land use decisions are regulated only at the local level, some of the federal environmental laws contain provisions that effect land use decisions. The Clean Water Act, for example, requires individuals to obtain permits before dredge and fill operations are conducted on wetlands.

2. Objectives of the Regulation

While environmental regulations by their definition seek to improve environmental quality, the regulations differ in the intensity of the standards that they impose. The intensity is dependent on whether the standards are health-based, technology-based, or based on the balancing of risks and costs.

- Health or Environment Based Standards. Some statutes require standards to be rooted purely in health or environment objectives. The Clean Air Act, for example, requires the EPA to set ambient air quality standards at a level that protects human health with an adequate margin of safety.[17] In setting those standards, the EPA is specifically instructed not to account for the cost in achieving the standards set or the technological feasibility of reaching those standards.[18]
- Technology or Feasibility Based Standards. The regulatory standards established under other statutes are driven by the capabilities of technology. For example, under the Clean Air Act new sources receive operating permits whose emissions limits are based on the limits achievable using the best control technology that has been adequately demonstrated for that industry.[19]
- Balancing Standards. Standards that are based on balancing require some comparison between the gains of a proposed standard with the costs. For example, the Toxic Substances Control Act (TSCA) requires the EPA to protect against "unreasonable risks", which is determined by balancing the environmental and health effects of chemicals against the economic consequences of regulation.[20]

3. Obligations imposed by regulations

Regulations must be expressed so that the regulatory target can easily understand the obligations created by the regulations and so that the regulations can easily be enforced. The type of regulation deployed by the drafters of legislation determines what obligations are imposed on the regulatory target and what costs are associated with the regulation. For example, if companies have to pay a fee for emissions that they could previously

[17] 42 U.S.C. §7408(a)(2). *See also* a discussion of the Clean Air Act, *infra* Section II.
[18] 42 U.S.C. §7408 and 7409. *See also* a discussion of the Clean Air Act, *infra* Section II.
[19] 42 U.S.C. §7503. *See also* a discussion of the Clean Air Act, *infra* Section II.
[20] 15 U.S.C. §2601(b). *See also* a discussion of the Toxic Substances Control Act, discussed *infra* Section II.

discharge for free, the regulation imposes a significant cost burden on the polluter. But, if the pollution control scheme allowed polluters to sell the right to pollute under a permit, the regulation creates the incentive for emissions reduction by making it profitable to sell pollution credits which are not being used. Some of the major types of regulation include:

- Design Standards or Technology Specifications These specify how a certain plant piece of machinery, or pollution control apparatus should be designed.
- Performance Standards or Emissions Limits. These set an objective standard for the regulatory target to meet without specifying the method for obtaining these standards, e.g. emissions limits that set a rate of pollutant that can be emitted from a given source.
- Ambient or Harm Based Standards. These establish a level of environmental quality to be achieved or maintained in a particular environment, e.g. lake or stream. For example, pursuant to the Clean Air Act, the EPA sets National Ambient Air Quality Standards for criteria pollutants such as ozone and lead, which set a maximum acceptable concentration of lead of ozone in the air.[21] These standards are incomplete, however, because they are not directed at a particular regulatory target.
- Product Bans or Use Limitations. These prohibit a product or limit its use. They typically involve products such as chemicals, pesticides, or food additives. For example, the Federal Insecticide, Fungicide, and Rodenticide Act prohibits the sale of any pesticide that is not registered with the EPA.[22]
- Marketable Allowances. These permit companies to buy and sell emission rights, using market forces to ensure that pollution is reduced in the least costly manner. The 1990 Clean Air Act Amendments use this regulatory type by providing electric utilities with tradable allowances to emit sulfur dioxide.
- Planning or Analysis Requirements. Environmental regulation sometimes requires certain information to be gathered and analyzed or requires certain plans to be prepared prior to undertaking environmentally significant decisions. The National Environmental Policy Act[23], for example, requires federal agencies to analyze the environmental impacts and alternative courses of action of any major federal action before commencing the project.
- Information Disclosure Requirements. These require the regulatory target to disseminate information. The Emergency Planning and Community Right to Know Act (EPCRA)[24], for example, requires facilities to report annual release of toxic substances. Such reports are made available to the public and generate public pressure to reduce emissions.

C. Making of Laws and Translating Laws into Directed Regulations

[21] National Ambient Air Quality Standards are described further in the Clean Air Act discussion, *infra* Section II.
[22] The Federal Insecticide, Fungicide, and Rodenticide Act is discussed *infra* Section II.
[23] The National Environmental Policy Act is discussed *infra* in Section II.
[24] EPCRA is discussed *infra* in Section II.

Federal environmental statutes are enacted through the legislative process.[25] First, a bill is introduced in either the House of Representatives or the Senate. Bills are referred to committee for consideration. The committee(s) considering a bill may hold hearings, study, investigate, or issue a report and recommendation on whether the bill should pass. When a bill is reported out of committee, it is placed on the calendar, considered, and debated in each house.

In the environmental field, the House and Senate generally pass different bills and then a conference is needed between the House and Senate representatives to resolve the differences. After passage in both the House of Representatives and the Senate, the act is sent to the President of the United States. The act becomes law if it is signed by the President or if it is not vetoed within ten days.

Drafting, debating, and passing a bill is a time consuming process that results in confusing language in order to embody all the compromises necessary for its passage. Given the long and difficult process, it is not surprising that most congressional statutes do not include enough detail to implement the statute without further regulations.

The specific environmental regulatory requirements that are imposed on industry are rarely articulated in the federal environmental statute itself. In federal environmental statutes, Congress typically outlines the objectives of the legislation and provides a regulatory framework. The details, such as setting emissions standards or articulating the format of permit applications, are left to the federal agency that has been authorized by Congress to implement the statute.[26] Leaving the details for the agencies to develop makes use of the agency's expertise in a given area, e.g. environmental protection and risk analysis. In addition, by making an agency determine what level of emissions is adequate to protect human health and the environment, Congress does not have to weigh environmental benefits against costs to industry and therefore avoids having to agree on controversial policy decisions.

In order for the regulations promulgated by the agency to be valid, the agency must follow procedures articulated either in the Administrative Procedure Act (APA) or the federal statute from which the regulations are derived[27]. Today, most rulemaking is done in accordance with the informal rulemaking procedures in the APA, which requires that agencies provide: (1) public notice in the Federal Register of the proposed rulemaking actions, (2) an opportunity for the public to submit written comments, and (3) publication of the final rules in the Federal Register accompanied by a concise statement of their basis and purpose.

Despite the relatively minimal procedural requirements imposed by the APA, the informal rulemaking process is becoming increasingly more difficult for agencies. Agencies must contend with several constraints on their ability to complete complex rulemaking efficiently. First, their budgets usually provide only enough funds to complete

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[25] This description of the legislative process is provided in Sullivan, *supra* note 1, §2.1.

[26] Note that federal agencies are located in the executive branch of government. They are not given any inherent powers in the Constitution. Agencies, therefore, only have the authority to develop regulations if they are delegated this authority by Congress. Congress has historically been allowed to delegate broad authority to agencies. Most federal environmental regulations are found in Title 40 of the Code of Federal Regulations which occupies more than 20 volumes (more than the number allotted by the IRS for tax regulations).

[27] The description of the APA requirements is taken from Percival, *supra* note 8, at 169-72.

a handful of major rulemakings in a year. Second, the fear of judicial reversal for not providing a sufficient explanation or basis for the rule has caused agencies to supply detailed justifications for their actions, sometimes resulting in multi-volume data and documents that cost millions of dollars to complete.

D. Assessing Environmental Obligations

Because numerous sources give rise to environmental obligations, determining what environmental regulations apply to any given process or design can seem like a daunting task. There are, however, several sources of information that can help individuals and companies decipher their obligations. First, federal or state agencies can be useful contacts to determine what statutes or regulations may be applicable. However, because ultimately the responsibility for complying with environmental requirements rests on the individual or company, the advice of a federal or state contact should not end the inquiry.

In addition to state and federal agencies, individuals that work for corporations could discuss environmental obligations with the corporate environmental health and safety department or the legal counsel. Corporations may even have an environmental compliance manual to assist in identifying obligations.

Also, anyone can access regulations that are proposed and adopted by federal agencies through the Federal Register. The Federal Register can be accessed on-line at: *www.nara.gov/fedreg*. Proposed regulations contain information on where to send public comments and the deadline for submitting those comments. Public comments and background documentation for agency actions are also typically kept in dockets that are referenced in the Federal Register notices.

Section II: Environmental Laws: Federal Statutes, International Treaties, and Common Law

CAA: Clean Air Act

A. Scope and Background

In response to the increasing concern of air pollution after World War II, the federal government first entered the air pollution field in 1955 with the enactment of the Air Pollution Control Act.[28] This 1955 Act authorized a modest research and technical assistance program, which ultimately lead to the conclusive discovery that vehicle emissions caused the smog problems in cities like Los Angeles.[29] The voluntary nature of the 1955 Air Pollution Control Act, however, is a far cry from the complex web of regulation that makes up the Clean Air Act (CAA) today.[30] The Clean Air Act, in fact, owes its complexity to a history of attempts to control air pollution which have been amended as better regulatory solutions and more air pollution problems have come to light.

The original Clean Air Act was passed in 1970 and coincided with the establishment of the Environmental Protection Agency (EPA). The EPA was entrusted with the authority to develop and administer plans to ensure that states achieved compliance with ambient air quality standards. Ambient air standards protect public health and safety by limiting the pollution that is allowed to exist in the air. Point source controls were also adopted in the 1970 CAA, but only applied to new or modified facilities. In 1977, significant amendments to the 1970 CAA were enacted. These amendments provided for the prevention of significant deterioration of clean air areas, and imposed tougher standards for those areas that remained our of compliance (areas known as "nonattainment areas"). While point source standards were strengthened, they still remained largely inapplicable to existing sources of air pollution.

The last series of amendments to the Clean Air Act were enacted in 1990. The 1990 amendments moved the focus of compliance away from ambient air quality standards by

[28] Pub. L. No. 84-159, 69 Stat. 322., *cited in* James F. Berry & Mark S. Dennison, The Environmental Law and Compliance Handbook (2000) 260.

[29] *See* James F. Berry & Mark S. Dennison, The Environmental Law and Compliance Handbook (2000) 260.

[30] The legislation now known as the Clean Air Act is technically the Clean Air Act Amendments of 1970, which entirely revamped the 1967 Air Quality Act. The Clean Air Act is codified at 42 U.S.C. §7401 *et seq.* (West 1994). For a summary of the Clean Air Act, see Mark Squillace and David Wooley, The Big Picture: Summary of the Clean Air Act, in Air Pollution (3rd. ed. 1999), at 55. *See also The Plain English Guide to the Clean Air Act*, which is available on the World Wide Web at http://www.epa.gov/oar/oaqps/peg_caa/pegcaa10.html.

addressing the point source control both new and existing point sources, thus greatly expanding the number of facilities subject to point source regulation.
The following discussion of the requirements of the Clean Air Act addresses the Act in five parts. Part B describes national ambient air quality standards and relates them to each state's responsibility to develop State Implementation Plans (SIPs). Part C addresses permits and other requirements for stationary sources such as power plants and factories. Part D concerns programs that regulation mobile sources such as automobiles. Part E outlines the enforcement scheme of the CAA and the potential liabilities that a person or company can face for violating the Act.

B. NAAQS and SIPS

1. NAAQS

As required by the 1970 Clean Air Act, the EPA must establish ambient air quality standards for pollutants that may endanger public health or welfare and that result from numerous and diverse sources.[31] There are two sets of NAAQS standards – primary and secondary.[32] Primary NAAQS are health-based, developed to allow an adequate margin of safety that is requisite to protecting public health. Secondary NAAQS, which are welfare-based, are more stringent than primary standards because they are designed to prevent a broader set of environmental harms, like adverse effects on soil, water, crops, vegetation, and wildlife. Both primary and secondary NAAQS must reflect the latest scientific knowledge about the pollutants and their impact on public health and welfare.[33] Further, the EPA is prohibited from considering economics or cost when setting NAAQS levels.[34]

The pollutants regulated by NAAQ standards are referred to as criteria pollutants. Currently there are six criteria pollutants: total suspended particulates, sulfur dioxide, nitrogen oxides (NO_X), carbon monoxide, ozone, and lead.[35] Ozone is the most confusing pollutant because it is a by-product of two specific pollutants – volatile organic compounds (VOCs) and carbon monoxide.

The EPA must review and revise NAAQS every five years to reflect the latest scientific knowledge.[36] Because of this review, some criteria pollutants have been added to and deleted from the current list. Lead was added as a criteria pollutant following several court opinions that argued for its inclusion. Hydrocarbons were removed from the list because establishing a link between health effects and the pollutant became a

[31] 42 U.S.C. §7408(a)(1).
[32] 42 U.S.C. §7409(b).
[33] 42 U.S.C. §7408(a)(2).
[34] 42 U.S.C. §7408 and 7409.
[35] *See* 40 C.F.R. Part 50.
[36] 42 U.S.C. §7409(d)(1).

problem. NAAQS, therefore, are subject to change and updates as scientific knowledge demands.[37]

2. SIPs

Once NAAQS are developed by the EPA, each state is required to determine how to attain and maintain NAAQS by developing a State Implementation Plan (SIP). SIPs are submitted to the EPA for approval. In developing a SIP, the state must first designate each area of the state as an "attainment area" (the air meets primary or secondary NAAQS), "nonattainment area" (the air does not meet primary or secondary NAAQS), or unclassifiable (not enough information is available to classify). This process of designating areas is repeated for every criteria pollutant. The control measures included in a SIP depend on whether or not the state areas are in attainment.

SIPs for states with nonattainment areas must incorporate all reasonably available control measures; require reasonable further progress; and require existing sources in the area to install reasonably available control technology (RACT).[38] In addition, major new sources can only be constructed in nonattainment areas if the emissions were offset by obtaining emission reductions greater than their contributions. And, the new sources must use technology that would generate the lowest achievable emissions rate (LAER).[39] Under the 1990 Amendments, there are additional nonattainment area requirements particular to ozone, PM_{10}, and carbon monoxide.

The 1977 Amendments further required that states implement a program to prevent the significant deterioration (PSD) of air quality in those areas that exceed the NAAQS.[40] All areas of a state which meet the NAAQS are originally designated Class II, except for certain national parks and wilderness areas which are specially designated Class I areas. Before an area may be redesignated Class III, the local governing bodies representing the majority of the residents must concur in the redesignation. Major new facilities in PSD areas must meet special permitting requirements, including the requirement that they use best available control technology. These requirements are described further in the new source permit discussion below. States with Class I designations must submit a SIP that requires the identification of Best Available Retrofit

[37] The total suspended solids (TSP) parameter currently refers to any solid or liquid with a diameter greater than 10μm that remain suspended in the air. The EPA has proposed a TSP standard that would regulate particles as small as 2.5μm because it has been demonstrated that small particles pose a greater health risk than larger ones because the their ability to become lodged in the lungs. Industries vehemently opposed this standard, arguing that it would be prohibitively expensive (recall that the EPA must set NAAQS without regard to cost analysis pursuant to the CAA). The Court of Appeals for the District of Columbia invalidated the new standard in *American Trucking*, 175 F.3d 1027 (D.C. Cir. 1999), concluding that the EPA failed to articulate an intelligible principle on which to base the 2.5μm standard. It is unclear whether the EPA will continue to pursue this standard. Should an engineer designing a process system or scrubber technology design for PM_{10} (the 10μm limit) or anticipate an EPA decision by going forward with the $PM_{2.5}$ standard? What ethical responsibility may there be on an engineer, knowing that the EPA would like to set a $PM_{2.5}$ standard because of health risks?

[38] 42 U.S.C. §7502(c)(1).

[39] 42 U.S.C. §7501(3) and 7503(a)(2).

[40] 42 U.S.C. §7470-7479.

Technology (BART) for each existing facility which can be identified to cause or contribute to the impairment of visibility in a mandatory Class I federal area.

Once a SIP is approved by the EPA, it can be enforced against regulated sources by the EPA and by any citizen who meets the requirement of the CAA citizen suit provision.[41] Therefore, while the requirements for SIPs have become increasingly complicated since the 1970 CAA, the importance of having knowledge of these requirements is of practical significance to air pollutant dischargers.

C. Stationary Sources[42]

1. Permits

(a) Generally

Title V of the Clean Air Act[43], the section governing permits, is part of the 1990 amendments and is modeled after the National Pollutant Discharge Elimination System (NPDES) permits of the Clean Water Act. Each permit must conform to the following basic permit requirements:

1. *Scope*: Every source regulated under the Act must have a permit. This includes major stationary sources, any hazardous air pollution source, sources subject to new source performance standards (NSPS), and any other source that the EPA determines via rulemaking procedures to be included in the permit program.[44] Even permits issued to numerous similar sources, or "general permits", via rulemaking must still be applied for individually and must still comply with all applicable requirements of Title V.[45] Permits are issued for a maximum of five years at a time.
2. *Standards:* Permits must contain enforceable emission limitations and/or standards to ensure compliance with the law.
3. *Monitoring*: Permits must include monitoring and reporting requirements, and reports must be filed every six months.
4. *Permit Fees*: All permitted sources must pay substantial annual fees to the regulatory authority. Fees are set at a minimum level of $25/ton, not to exceed 4,000 tons. Therefore, the maximum annual fee is $100,000.
5. *Permit Shield*: Compliance with the lawful permit is deemed to be compliance with the Act, but only if a permit shield provision is explicitly included in the permit.[46]

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[41] *See* Berry and Denison, *supra* note 29, at 269.
[42] See <http://mapsweb.rtpnc.epa.gov/RBCLWeb/blo2.htm.> for a clearinghouse of the various technologies that qualify as RACT, BACT and/or LAER for particular types of sources.
[43] 42 U.S.C. §7661.
[44] 42 U.S.C. §7661(a).
[45] 42 U.S.C. §7661c(d).
[46] 42 U.S.C. §7661c(f).

6. *EPA Veto Authority:* EPA must object to the issuance of any permit not in compliance with the law.

In addition, the EPA promulgated detailed rules establishing minimums standards for state permitting programs on July 21, 1992.[47] Among other things, these rules establish standards for: permit applications, permit content, permit issuance and revision, permit review, permit fees, and federal oversight and sanctions.

(b) New or Modified Sources

New or modified sources face standards and requirements under the Clean Air Act that existing sources do not, including new source performance standards (NSPS) and pre-construction review and permitting.

NSPS are emissions standards that are developed by the EPA for categories or classes of facilities that the EPA determines cause or contribute significantly to air pollution.[48] "New sources" for the purposes of this standard apply to any stationary source, the construction or modification of which was commenced after the EPA promulgated standard of performance regulations for that source. If the EPA determines that numerical emissions limitations are not feasible for a particular class of facilities, the EPA may promulgated design, equipment, work practice, or operational standards as the NSPS.[49]

In addition to complying with the NSPS, any major new or modified source must obtain a preconstruction permit. If the new or modified source will be located in an attainment area, then the source must obtain a PSD permit.[50] The emitting facility must show that it will use best available control technology (BACT) and will not cause the area to fall out of attainment.[51]

If the new or modified source is located in a nonattainment area, the source must obtain a non-attainment area permit. Further, its rate of emissions must meet the most stringent emission level contain in *any* state implementation plan for such a class, *or* the most stringent emission limit achieved by that class in practice, whichever is more stringent.[52] This level of achievement is called the lowest achievable emission rate (LAER). In addition, the emitting facility must offset their emissions by obtaining permanent reductions in emissions from other sources in an area.[53] The offset that is required depends on the pollutant that is not in attainment, but the offset is greater than one to one ratio so that the nonattainment can further its progress toward becoming an attainment area.

(c) Existing sources

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[47] 57 *Fed. Reg*. 32,250 (July 21, 1992).
[48] 42 U.S.C. §7411.
[49] 42 U.S.C. §7411(h).
[50] Mark S. Squillace and David R. Wooley, The Big Picture: A Summary of the Clean Air Act, *in* Air Pollution (3rd ed. 1999) at 62.
[51] *See id.*
[52] 42 U.S.C. §7503
[53] 42 U.S.C. §7503(a)(1)

Unlike new or modified sources, existing sources are not heavily regulated under the CAA. For instance, there is no specific emission level for criteria pollutants that existing sources must attain. Reductions may be required by the SIP, however, if necessary to achieve or maintain NAAQS.[54] In nonattainment areas, the existing source must implement reasonably available control technology.[55] Compare how relaxed this requirement is contrast to the LAER requirements for new sources in nonattainment areas.

Both new and existing sources must meet emissions limits for "designated pollutants", which are established for each class or category of facility under the NSPS program. However, in the SIP the individual states may set more lenient emissions limits for existing sources than for new sources.

2. Hazardous Air Pollutant Regulation (HAP)

Not surprisingly, the CAA regulates hazardous air pollutants. The 1990 amendments list 189 hazardous air pollutants.[56] The EPA may add a pollutant to this list if it threatens adverse human health effects or adverse environmental effects.[57] For each pollutant, the EPA promulgates standards that require the installation of technology that will result in the maximum achievable reductions (maximum achievable control technology, or MACT, standards). The standards are based on economic, energy, and environmental considerations, which makes them technology based standards.

Because MACT standards are technology based and not health based, the 1990 Amendments provides a second phase of regulatory controls aimed at protecting the public health with "an ample margin of safety." For known or suspected carcinogens, this subsection would require more stringent standards if the MACT standard does not reduce the level of lifetime risk to a level of less than one in a million.[58] Because these health based standards are revised as more information about the nature of the harm and risk of the pollutant becomes available, there is a potential for continually changing standards.

D. Mobile Sources

The CAA regulates mobile sources by putting strict tailpipe standards on cars, buses, and trucks.[59] In addition, improved gasoline formulations must be sold in some polluted cities to reduce emissions of carbon monoxide or ozone forming hydrocarbons. Other programs set low vehicle emissions standards to stimulate the introduction of cleaner cars and fuels. The current emissions standards may be cut in half beginning with

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[54] *See* Squillace and Wooley, *supra* note 50, at 63.
[55] *See id.*
[56] 42 U.S.C. §7412.
[57] 42 U.S.C. §7412(b)(2)
[58] 42 U.S.C. §7412(f)(1)
[59] *See* Berry and Denison, *supra* note 29, at 284-85.

the 2004 year models if the EPA deems that tighter standard are warranted, technologically feasible, and economical.

Regulation is not limited to road vehicles like cars and trucks. The "non road" category such as boats, farm equipment, bulldozers, lawn and garden devices, and construction machinery. The EPA has determined that emissions from these non-road engines are significant sources of urban air pollution and is working with industry and the public to develop effective control strategies.

E. Stratospheric Ozone Protection[60]

Title VI of the 1990 Amendments was essentially intended to implement the *Montreal Protocol* as it relates to U.S. emissions. Basically, the production of all substances listed as Class I substances (CFCs, halons, carbon tetrachloride, methyl chloroform) must be phased out by the year 2000. Methyl chloride production must be phased out by 2002. Class II substances (HCFCs), which are less significant ozone depleters, must be phased out by 2030. The EPA can add substances to this list. The EPA must also assign ozone depletion and global warming potential values to each listed substance. In addition, the 1990 Amendments establish requirements for warning labels for products containing ozone depleting substances, for the federal procurement of ozone depleting substances, and recycling of such substances.

Since the passage of the 1990 amendments, new evidence has become available supporting an accelerated schedule for phasing out various ozone-depleting substances. This evidence has spurred adjustments to the *Protocol* but have not necessarily been accounted for in Title IV yet. This may be an area where industry can expect more strict future standards.

F. Enforcement

1. Civil Penalties

Under section 113(b), the EPA may assess civil penalties up to $25,000 per day for certain specified violations of the Act.[61] In addition to penalties assessed under section 113(b), penalties may be assessed under section 120 to remove any economic benefit that an operator may receive from noncompliance.[62]

2. Field Citations[63]

[60] *See* Squillace and Wooley, *supra* note 50, at 69-70. *See also*, http://acd.vacr.edu/gdpf/ozone/mp/index.html for information about the current status of international agreements on ozone depletion.
[61] 42 U.S.C. §7413(b)
[62] 42 U.S.C. §7420
[63] 42 U.S.C. § 7413(d)(3)

The EPA is authorized to implement a field citation program that would allow federal inspectors to issue "traffic tickets" for minor violations of the Act. Fines for such citations may not exceed $5,000. The EPA must issues rules, however, which include an opportunity for public participation and comment before this authority can be exercised.

3. Criminal Penalties

Any person who "knowingly" violates one of several specific provisions of the law may be punished by a fine and imprisonment up to five years. Knowing releases of hazardous air pollutants, however, warrants a fine and up to fifteen years imprisonment. Moreover, the negligent release of hazardous air pollutants may result in a fine and imprisonment for up to one year.

"Responsible corporate officers" can be held liable for "knowing" violations simply by showing that the officer knew the act was being committed. The officer does not necessarily have to know that the particular act was unlawful.

Information obtained through a self-audit can not ordinarily form the basis of a criminal action.

4. Bounties[64]

Persons who furnish information leading to a criminal conviction or criminal or civil penalty may receive and award from the EPA. The reward may not exceed $10,000.

CWA: Clean Water Act

A. Scope and Background

The original Federal Water Pollution Control Act, which was enacted in 1948, recognized states as the primary authority to control water pollution.[65] The original Act also focused on maintaining a designated quality level in water bodies instead of focusing on the sources of pollution leading into a waterway. Focusing on ambient water quality standards made enforcement difficult when there were several discharges contributing to water quality problems. Without a means of identifying individual polluters, state enforcement authorities were unable to force cleanup of water bodies. The original Act was, therefore, ineffective at controlling water pollution.[66]

Due to the ineffectiveness of the original Federal Water Pollution Control Act, in 1972 Congress enacted amended the Federal Water Pollution Control Act. These 1972 amendments became known as the Clean Water Act and are a comprehensive federal response to the old, ineffective framework. The Clean Water Act shifted the primary focus of pollution control from the quality of receiving waters to control of individual

[64] 42 U.S.C. § 7413(f)
[65] Pub. L. No. 80-845, 62 Stat. 1155.
[66] *See* Berry and Denison, *supra* note 29, at 94-95.

dischargers. In addition, states are no longer the primary authority on water pollution control; any state program must be federally approved and the EPA retains ultimate enforcement authority.

The stated objective of the Clean Water Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[67] The Act seeks to achieve that objective through three fundamental and ambitious goals: 1) to eliminate the discharge of all pollutants into the waters of the United States (the "zero discharge" goal); 2) to make all water safe for swimming and fishing (the "fishable and swimmable" goal); 3) to prohibit the discharge of all toxic pollution in toxic amounts.[68] In order to accomplish those goals, the Act regulates through both water-quality based and effluent-based limitations, the Act constructs a permit program for point source discharges, and the Act contains strong enforcement mechanisms.

C. Water Quality Based Limitations

While the Clean Water Act focuses primarily on permitting individual dischargers and technological controls, the Act still retains water quality based limitations as a pollution control safeguard. The Act requires all states to classify the waters within the state according to an intended use, e.g. public drinking water supplies, propagation of fish and wildlife, recreational, industrial, and others.[69] Once a water body is classified by its intended use, the water quality standards established by the state consist of numerical and narrative criteria to protect those uses.

The state standards must help further the Act's "fishable, swimmable" goal wherever possible. And, under the EPA's "anti-degradation" policy, the state must maintain the water bodies at least at their intended use level, unless the state can demonstrate that the designated use is unattainable or infeasible for reasons permitted by the EPA regulations.

Water quality standards can form the basis for discharge limitations if the pollutants that are, or may be, discharged have a reasonable potential to cause or contribute to a departure above any state water quality standard.[70] In setting these water-quality based limitations, the permit writer has to calculate how much of the pollutant the permittee may discharge without causing ambient standards to be exceeded.[71] These water quality based limitations are typically more stringent than technology based effluent limitations.

Water quality standards can also play a role in effluent limitations when an entire receiving water body fails to meet its designated use. Section 303(d) of the Act requires states to identify those waters for which technology based effluent limitations are not stringent enough to meet water quality standards. Then, the state must develop total

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[67] 33 U.S.C. §1251.
[68] 33 U.S.C. §1251(a)(1)-(3).
[69] 33 U.S.C. §1313.
[70] 40 C.F.R. §122.44(d)(1)(i).
[71] *See* Lynn M. Gallagher, *Chapter 14: Clean Water Act*, *in* Environmental Law Handbook, (14th ed. 1997) (Sullivan, Thomas, ed.).

maximum daily load (TMDL) calculations for that water body.[72] A TMDL is an estimate of the total load of pollutants from point, nonpoint, and natural background sources that a segment of water can receive without exceeding applicable water quality criteria. Once this TMDL is determined, the permitting authority must determine how much of the total load can be contributed by an individual discharger. Even though the TMDL requirements have been a part of the Act since 1972, it is only within the last few years that states have been compelled to develop TMDLs. The development of these TMDLs is a complicated technical problem because often there is not enough data available to ascertain the sources and quantity of all pollutants entering a receiving body. The TMDL process also poses difficult regulatory questions, like how to allocate a total load equitably among point source dischargers and whether nonpoint source dischargers can be required to reduce their loads as well.

D. Effluent Limitations

The Clean Water Act operates from a baseline prohibition: all discharges of any pollutant by any person into the waters of the United States is illegal.[73] Therefore, all point sources must obtain a permit through the National Pollution Discharge Elimination System (NPDES) before discharging pollutants into water bodies.[74] A point source is considered "any discernible, confined, or discrete conveyance."[75] While a typical example of a point source is a discharge pipe, the definition of point source has been interpreted broadly to cover ditches, erosion channels, gullies or even humans. A pollutant is defined as "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water."[76] All unpermitted discharges constitute a violation of the Act and are subject to civil and criminal penalties.

The NPDES permit is either issued by the EPA or the state if the state has a federally-approved permitting program. Substantively, state programs must be at least as stringent as federal program requirements. States are free to implement more stringent limitations and requirements. Even though a state may be allowed to issue permits, the EPA retains ultimate enforcement and permitting authority; the EPA can veto a state issued permit or revoke the state permitting authority if the EPA feels the state is not adequately furthering the Act's purpose.

The purpose of NPDES permits is to establish enforceable effluent limitations. However, they also include other enforceable provisions, such as submitting self-

[72] 33 U.S.C. §1313(d).
[73] 33 U.S.C. §1311.
[74] 33 U.S.C. §1342.
[75] 33 U.S.C. §1362(14). Under the Clean Water Act, any source of pollution that does not fall within the point source definition is termed a "nonpoint source". Therefore, agricultural runoff is a nonpoint source because it does not enter the navigable waters through a discrete conveyance. As a result, the CWA has not been very successful at controlling nonpoint source pollution which represents the greatest remaining contributor to water quality degradation.
[76] 33 U.S.C. §1362(6).

monitoring reports to the permitting authority.[77] Effluent limitations are set through a two stage approach. First, all dischargers must meet treatment levels based on the EPA's assessment of the capabilities of treatment technologies for the discharger's particular industry. Those treatment technologies that form the basis of the EPA's evaluation must be economically and technologically achievable. If technology based effluent limitations are not sufficient to achieving water quality goals for a particular water body, water quality based limitations are adopted for that pollutant. Water quality based limitations are described further in the previous section.

Effluent limitations are derived from the EPA's national effluent guidelines that establish limitations for all types of dischargers within the industrial category (including direct and indirect dischargers, existing and new sources) and for specific types of discharges (i.e. process water, cooling water, and sanitary wastewater).[78] The effluent guidelines are enforceable only through their incorporation into an NDPES permit.

If the EPA has not issued effluent guidelines for a particular industry, the permit writer applies "best professional judgement" (BPJ) to establish permit limitations.[79] Because of EPA's "anti-backsliding policy", permit limitations based on BPJ may not be relaxed in subsequent permits even if the effluent guidelines that are later developed would have allowed less stringent limitations.[80]

Technology based controls are based on the "best available technology economically achievable" (BAT).[81] The BAT standards do not apply to conventional pollutants (i.e. biological oxygen demand, total suspended solids, fecal coliform, pH, and oil and grease). Instead, the more lenient "best conventional pollutant control technology" (BCT) applies.[82] The BPJ/BAT/BCT system of standards do not apply to new sources. The new source performance standards are based on "best available demonstrated control technology", which can be more stringent than BAT and do not necessarily have to be economically reasonable.[83]

Industrial dischargers that discharge into sewers which are connected to publicly owned treatment works (POTWs) are known as "indirect dischargers" and are regulated under the Clean Water Act's pretreatment program.[84] Pretreatment standards are promulgated by the EPA and reflect the "best available control technology" (BAT). They are designed to result in the same level of treatment that is achievable by direct dischargers. Indirect dischargers must treat their waste prior to discharge in order to remove the worst or the most toxic pollutants, preventing the "pass through" of pollutants into receiving waterways. [85] "Pass through" occurs when the POTW is unable to remove the pollutant with its treatment system or when the pollutant inhibits the treatment system from removing other pollutants passing through the system.

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[77] 40 C.F.R. §122.41; *see also* Gallagher, *supra* note 71, at 119, §6.5.
[78] *See generally*, Gallagher, *supra* note 71, at 122, §6.7.2.
[79] S*ee* 40 C.F.R. §125.3(c).
[80] 33 U.S.C. §1342(o).
[81] 33 U.S.C. §1311(b)(2)(A).
[82] 33 U.S.C. §1311(b)(2)(E).
[83] 33 U.S.C. §1316. *See also* Gallagher, *supra* note 71, at 124-25, §6.7.2.4.
[84] 33 U.S.C. §1317(b).
[85] 40 C.F.R. §403.5 (a)(1).

E. Dredge and Fill Permits

Section 404 requires dischargers to obtain permits before discharging dredged or fill materials into navigable waters, including wetlands.[86] Therefore, filling a wetland requires a 404 permit under the Act. Unlike the NPDES permits, the United States Army Corps of Engineers has primary responsibility for implementing dredge and fill permits; the Corps is also authorized to bring enforcement actions to collect fines of up to $25,000 per day and compel violators to restore filled areas.

F. Discharge of Oil/ Hazardous Substance

Through section 311, the Clean Water Act prohibits the discharge of oil and hazardous substances into water bodies and provides mechanisms for the clean up of oil and hazardous substance spills.[87] Any person in charge of a vessel or facility must notify the National Response Center, which is run by the Coast Guard, and state officials. This duty is triggered by the type of substance spilled and the quantity spilled.[88] Failure to notify the proper officials could result in up to 5 years imprisonment. Discharge is punishable by civil penalties of up to $250,000 and responsible parties are also liable for cleanup costs. Section 311 also created an emergency fund that can be used to pay for the cost of clean up.

G. Enforcement

Federal enforcement of the Clean Water Act can be in the form of an administrative order requiring compliance or assessing a penalty, an action for civil penalties, or an action for criminal penalties. Most cases will involve an administrative order, since this is the least resource intensive method of enforcement. A civil judicial action may be appropriate with the violations are long term, serious, or the violator is uncooperative. Criminal enforcement actions will be brought for serious violations that are knowing or negligent.

In civil judicial actions, penalties may be assessed up to $25,000 per day.[89] There are a number of factors that courts can weigh when determining the appropriate level of penalties: the seriousness of the violation, the economic benefit resulting from the violation, bad faith, and the history of violations. Civil action may also seek injunctive relief (i.e. shutting down the facility or requiring certain measures to be taken to ensure compliance like installing an new treatment unit).

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[86] 33 U.S.C. §1344. The EPA has veto power over all dredge and fill permits issued by the United States Army Corps of Engineers.
[87] 33 U.S.C. §1321.
[88] The EPA has established a "reportable quantity" for many of the estimated 300 substances that have been identified as hazardous when spilled or discharged. *See* 40 C.F.R. §§109-117.
[89] 33 U.S.C. §1319.

Criminal penalties can be sought when the violation was intentional (knowing) or due to carelessness (negligence).[90] Negligent violations may be punishable by a fine of up to $25,000 per day and 1 year imprisonment. Knowing violations can result in up to $50,000 per day in fines and up to 3 years imprisonment. Violations that involve false reports or illegal monitoring are subject to $10,000 fine and up to two years imprisonment.

Enforcement actions can be brought by the federal government, the states, or citizens.[91] Citizens may bring a suit against persons who violate effluent limitations or against the EPA administrator for failing to implement a nondiscretionary Clean Water Act duty. Before a citizen suit may be brought, however, 60 days notice must be given to the federal or state agency responsible for enforcement. If any of these authorities bring an action against the violator within those 60 days, the citizen suit is preempted.

RCRA: Resource Conservation and Recovery Act

A. Scope and Background

The Resource Conservation and Recovery Act (RCRA) was enacted in 1976.[92] The Act was a response to growing concerns that improper handling and disposal of solid and hazardous wastes posed a continuing threat to the environment and a danger to human health.[93] As a result, RCRA sets forth a comprehensive "cradle to grave" framework for the management of solid and hazardous wastes from generation to final disposal.

The EPA is the primary agency vested with the authority to carry out the requirements and intent of RCRA.[94] However, some states implement and manage their own solid and hazardous waste management programs in lieu of the federal RCRA program if they receive proper approval from the EPA.[95] A state program does not have to be identical to the federal program in order to be approved, but it must be at least as stringent as the federal program. In states that have not obtained federal approval to manage their own RCRA programs, the parties that generate, transport, store or dispose of solid and hazardous waste must obtain RCRA permits directly from the EPA. In addition, however, they must comply with the non-federally approved state program which may run in tandem with the federal program. Parties subject to RCRA in states

[90] 33 U.S.C. §1319.
[91] 33 U.S.C. 1365.
[92] 42 U.S.C. §§ 6901-91i, *amended by* the Hazardous and Solid Waste Amendments of 1984, Pub. L. 98-616, 98. Stat. 3221 (Nov. 8, 1984).
[93] 42 U.S.C. §6901(b).
[94] The EPA has detailed regulations setting forth criteria for identifying solid and hazardous waste, and imposing extensive storage, disposal, shipping, reporting, and recordkeeping requirements on generators and transporters of RCRA regulated wastes. *See* 40 C.F.R. 260-65.
[95] 42 U.S.C. §6926(b). *See also*, Berry and Denison, *supra* note 29, at 319-20.

without federally approved programs must therefore comply with two sets of waste programs.

While RCRA consists of several subtitles, three subtitles are of the greatest concern to companies and individuals that generate, store, or dispose of solid and hazardous wastes. Subtitle C addresses hazardous waste management. Subtitle D outlines standards for state solid waste management programs. And, subtitle I covers underground storage tank regulation. Before addressing those subtitles, this section will first discuss the classification of solid and hazardous wastes. Then, the relevant subtitles will be addressed. Finally, this section outlines the enforcement mechanisms of RCRA.

B. Waste Classification

Because RCRA regulates both solid and hazardous wastes, the logical starting point in discussing RCRA is the definition of solid and hazardous waste under the Act. Like most pieces of legislation, defining a seemingly simple term can be a daunting task.

1. Solid Waste Classification

RCRA generally defines the term "solid waste" to mean garbage, refuse, sludge, and any other discarded material.[96] The difficult issue under this definition is what is meant by "discarded material." According to the EPA regulations, a discarded material is any material which is (i) abandoned, (ii) recycled, or (iii) considered inherently waste-like.[97] Unfortunately, this regulatory definition is not self-explanatory either, so each type of discarded material will be analyzed separately. [98].

- *Discarded materials that are abandoned.* Discarded materials are deemed RCRA-regulated solid wastes if they are 1) disposed of, 2) burned or incinerated, or 3) accumulated, stored or treated before being disposed of, burned, or incinerated. The term "disposed of" includes any method through which a solid waste can enter the land, water or air, including non-intentional disposals through leaks and spills. To determine whether burning or incineration constitutes abandonment, the device being used and the purpose for using that device is an issue. The "accumulated, stored or treated" prong of the abandoned definition means that when any company or individual is storing or treating a material with the intent to subsequently abandon it, the material will be classified as a discarded material and a solid waste.
- *Discarded materials that are recycled*. While recycled materials may not ordinarily be thought of as discarded, the EPA purposefully included recycled materials in the definition of discarded materials in order bring recycled materials within the scope of solid waste management. Whether a recycled

[96] 42 U.S.C. §6903(27).
[97] 40 C.F.R §261.2(a)(2).
[98] For a detailed discussion of the criteria for solid waste, see Berry and Denison, *supra* note 29, at 322-29.

material is "discarded" depends on the type of recycling method used and the type of material produced from the recycling activity.

- *Discarded materials that are inherently waste-like*. No material can be considered inherently waste-like until the EPA determines, through a rulemaking proceeding, that the material has at least one of the two waste-like attributes set forth in the regulations and poses a potential hazard when recycled. These materials are specifically listed in the regulations.

Some materials are expressly excluded from the definition of solid wastes.[99] Such excluded materials include: domestic sewage; industrial wastewater discharges that are already subject to regulations under the Clean Water Act; irrigation return flows; and secondary materials that are reclaimed and returned to the original process or processes in which they were generated provided they meet certain criteria.

2. Hazardous Waste Classification[100]

Importantly, a substance to be considered a hazardous waste under RCRA, that substance must satisfy the definition of a solid waste *and* a hazardous waste. Such wastes are subject to the management requirements of Subtitle C. The EPA regulations identify three categories of solid waste that are considered hazardous waste:

1. Listed hazardous wastes;
2. Characteristics hazardous waste;
3. Solid wastes that have been mixed with listed or characteristic hazardous wastes

In determining whether or not a solid waste is considered hazardous, the initial place to look is in the EPA regulations 40 C.F.R. §§ 261.31, 261.32, and 261.33. Each of the hazardous wastes on these lists has been assigned an EPA Hazardous Waste Number and is considered a listed hazardous waste.

Because it would be virtually impossible to list every possible waste that would pose a danger to human health and the environment if improperly handled, the EPA devised the characteristics hazardous waste regulations. Therefore, if a waste generator determines that a solid waste is not a listed hazardous waste, the generator must next ascertain whether the solid waste exhibits certain hazardous waste characteristics. A solid waste is deemed a hazardous waste for purposes of Subtitle C if it exhibits any of the following characteristics: ignitability[101], corrosivity[102], reactivity[103], or toxicity[104].

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[99] 40 C.F.R. §261.4(a).

[100] For a more detailed discussion, see Berry and Denison, *supra* note 29, at 329-344.

[101] Ignitable waste is a liquid with a flash point less than 60 degrees centigrade, a solid capable of causing fire that burns vigorously and continuously so that it creates a hazard, an ignitable compressed gas or an oxider. *See* 40 C.F.R. §261.21.

[102] Corrosive waste has a pH less than 2 or greater than 12.5 or corrodes steel at a rate greater than 6.35 mm/year. *See* 40 C.F.R. §261.22.

In addition to the listed and characteristic hazardous wastes, a mixture of a hazardous waste and a solid waste is considered a hazardous waste unless the generator can prove that it is exempt (this is termed the "mixture rule").[105] The exemptions are provided in three cases: (1) if the listed hazardous waste in the mixture was listed solely because it exhibited a hazardous characteristic and the mixture does not exhibit that characteristic; (2) the hazardous substance in the mixture is a dilute component of a waste water mixture and is subject to regulation under the Clean Water Act; and (3) the hazardous substance in the mixture is due to minimal losses of commercial chemical product during manufacturing operations.

Similar to the "mixture rule", a waste that is generated during the treatment, storage, or disposal of a hazardous waste is also a hazardous waste unless it is exempted (this rule is termed the "derived-from" rule).[106] If the waste is derived from a listed waste, it is exempted through delisting. If the waste is derived from a characteristic waste, it is exempted if the waste does not exhibit a hazardous characteristic.

Certain wastes are exempt from Subtitle C requirements: household waste; agricultural wastes that are returned to the ground as fertilizer; and wastes from the extraction, beneficiation, and processing of ores and minerals, including coal.[107] Also, by showing that a waste does not contain the hazardous waste that triggered listing initially, generators can have that waste delisted.[108] Generators that produce less than 100 kilograms per month are not subject to Subtitle C's regulatory provisions.[109]

C. RCRA Regulation of Hazardous Wastes (Subtitle C)

1. Generator Requirements[110]

A hazardous waste generator is any person whose act or process produces characteristic or listed hazardous waste. No generator may treat, store, dispose of, or ship hazardous waste without first obtaining an EPA identification number and, if necessary, a state identification number. All generators are also required to maintain accurate and up-to-date records of the amount of waste that they generate and file biennial reports with the

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[103] Reactive wastes exhibit one or more of the following characteristics: normally unstable and undergoes violent change without detonating; reacts violently with water; forms explosive mixtures with water; generates toxic gases, vapors, or fumes; capable of detonation or explosive reaction; or is a forbidden explosive. *See* 40 C.F.R. §261.23

[104] Toxic wastes are wastes that are tested under the Toxicity Characteristic Leachate Procedure (TCLP) and produce an extract that contains specific quantities of certain contaminants including arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, endrin, lindane, methoxychlor, toxaphene, 2,4-D, and 2,4,5-TP. *See* 40 C.F.R. §261.24.

[105] *See* Berry and Denison, *supra* note 29, at 333-35.

[106] *See* Berry and Denison, *supra* note 29, at 335-36.

[107] 40 C.F.R. §261.4(b).

[108] 42 U.S.C. §6921(f).

[109] 40 C.F.R. §261.5.

[110] *See* Berry and Denison, *supra* note 29, at 345-46 for an additional reference on generator requirements.

EPA that specify where their wastes were sent for disposal. RCRA also requires proper preparation, labeling, and shipping containers for transportation of waste off-site.

One of the most important duties of a generator is to prepare Uniform Hazardous Waste Manifests, which is a shipping form that must accompany the waste at all times. Waste Manifests help to track where waste comes from, who is responsible for transporting the waste, and where the waste is disposed of. Generators must ensure that their hazardous waste reaches a designated disposal site by examining the manifest copy that is returned to the generator after the waste has reached its destination. If the manifest is not sent back, or is returned in an untimely manner, generators must file an "exception report" with the EPA or state.

Generators are subject to specific reporting, storage, treatment, disposal, and shipping requirements. The requirements depends on whether the generator is classified as (1) a conditionally exempt small quantity generator[111], (2) a small quantity generator[112], or (3) large quantity generator for purposes of the regulatory requirements.[113] Such classification is determined by the quantity of hazardous waste generated.

A conditionally exempt small quantity generator (CESQG) must not generate in a calendar month (1) more than 100 kilograms of hazardous waste, (2) more than 1 kilogram of a listed acutely hazardous waste, and (3) more than 100 kilograms of any residue or contaminated soil, or other debris resulting from the cleanup of a spill of any listed acute hazardous waste. CESQGs are exempt from the requirement that shipments leaving the site of generation be accompanied by a hazardous waste manifest. These generators are also allowed to bring their hazardous wastes to sanitary solid waste landfills, rather than the more costly hazardous waste disposal facilities.

EPA regulations for Small Quantity Generators (SQGs) are applicable to generators who produce between 100 kilograms and 1,000 kilograms of hazardous waste per calendar month, unless the state has more stringent regulations. SQGs are permitted to accumulate hazardous wastes on site for up to 180 days without a permit so long as the amount of stored waste does not exceed 6,000 kilograms. If the generator retains the waste for more than 180 days, or stores more than 6,000 kilograms, the generator must notify the EPA and comply with additional regulations for treatment, storage, and disposal (TSD) facilities.

Large quantity generators produce more than 1,000 kilograms of hazardous waste per month and are subject to the full set of regulations governing hazardous waste generators. They must also dispose of wastes within 90 days.

2. Transporter Requirements[114]

[111] Requirements for conditionally exempt small quantity generators are listed at 40 C.F.R. §261.5.
[112] Requirements for small quantity generators are listed at 40 C.F.R. §262.
[113] Large quantity generators are subject to the full set of RCRA regulations governing hazardous waste generators listed at 40 C.F.R. §264.
[114] *See generally*, Berry and Denison, *supra* note 29, at 348-49 for additional reference.

Anyone who transports hazardous waste must comply with the transporter requirements of Section 3003 of RCRA.[115] A transporter must apply to the EPA for an identification number and indicate on the application what specific waste(s) will be transported and by what mode of transport (i.e. highway, rail, water, airplane, etc.). For transport to be legal, the EPA hazardous waste number for a particular waste must be listed on the transporters permit.

Like generators, transporters are also required to participate in the Uniform Hazardous Waste Manifest system, which tracks the waste from generator to transporter to disposal facility. The transporter must keep the manifest in possession and available for inspection at all times. The waste can only by delivered to the TSD facility listed on the manifest and must deliver the entire shipment. The manifest is signed by the generator when the transporter picks up the waste and is signed by the TSD facility upon delivery. The transporter keeps the manifest for three years after shipment. If all or part of the transported waste leaks or is otherwise discharged from the transport vehicle when en route to the TSD facility, the transporter must clean up the waste or take other action to ensure human health and environmental safety.

In addition to RCRA's requirements and regulations, transporters are also subject the Department of Transportation regulations promulgated pursuant to the Hazardous Materials Transportation Act.[116] These regulations require transporters to use certain hazard communication labels, placards, and truck markings.[117]

3. Treatment, Storage, and Disposal (TSD) Facility Requirements

Facilities that accept hazardous waste for treatment, storage, or disposal are considered treatment, storage, and disposal (TSD) facilities under RCRA. Treatment is defined as "any method, technique, or process. . .designed to change physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste or as to render such waste nonhazardous, safer for transport, amenable for recovery, amenable for storage, or reduced in volume."[118] A "storage facility" is defined as a facility where hazardous wastes are held for a temporary period, at the end of which, the hazardous waste is treated, disposed of, or stored elsewhere.[119] A "disposal facility" is one where the hazardous waste is intentionally placed into or onto any land or water, and where waste is intended to remain indefinitely.[120] Generators who store hazardous wastes on-site for more than 90 days or generators who treat or dispose of their own waste are considered TSD facilities under RCRA.[121]

TSD facilities must obtain an identification number and operations permit from the EPA. Even though treatment, storage, and disposal (TSD) facilities are grouped

[115] 42 U.S.C. §6923.
[116] 49 U.S.C. §1801 *et seq.*
[117] 49 C.F.R. §171.
[118] 42 U.S.C. §6903(34).
[119] 40 C.F.R. §260.10.
[120] 40 C.F.R. §260.10.
[121] 40 C.F.R. §262.34.

together, the storage, treatment, and disposal of hazardous wastes are separately permitted functions. A facility may, for example, be permitted to store hazardous waste but not treat or dispose of it. Once permitted, a TSD facility may only accept the specific types of waste outlined in the permit.

TSD facilities must also comply with the Uniform Hazardous Waste Manifest system. The facility must sign the manifest and return a copy to the generator within 30 days of receiving the hazardous waste. The facility must also keep records of the type, quantity, and origin of the waste that is disposed of at the site as well as records concerning the methods of waste treatment, storage and/ or disposal. All of these records are subject to EPA inspection. The method of treatment, storage or disposal must be monitored to ensure it is protective of the public health and environment.

D. Solid Waste Management[122]

Subtitle D addresses the management of nonhazardous and exempt hazardous solid waste.[123] Most of the requirements under this section pertain to the design and monitoring of wastes that are disposed of in sanitary landfills. When enacting Subtitle D, Congress recognized that solid waste landfills are really pseudo-hazardous waste landfills because of the hazardous waste exempt from Subtitle C regulations. Therefore, the regulatory criteria set forth by Congress requires that at a minimum solid waste landfills have the same environmental controls found in Subtitle C regulations. These include groundwater monitoring, location requirements for new and existing facilities, and corrective action. These requirements, therefore, are mostly of concern to owners and operators of such facilities.

E. Underground Storage Tanks[124]

Subtitle I[125], which Congress enacted as a part of the Hazardous and Solid Waste Amendments of 1984 (HSWA), addresses problems associated with regulated substances entering the soil and groundwater due to leaking underground storage tanks (USTs). A UST is defined as any tank (including its connected piping) holding an "accumulation of regulated substances" that has ten percent or more of its volume in the ground.[126] The EPA regulations apply to all USTs containing petroleum or any of the seven hundred plus chemicals designated as hazardous substances under RCRA.

The federal regulations cover the design, construction, and operation or USTs from installation to closure, require the cleanup of leaks and spills, and impose recordkeeping, reporting, and financial responsibility requirements on owners and operators of USTs. Subtitle I also creates a federal program allowing the EPA to

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[122] *See generally*, Berry and Denison, *supra* note 29, at 352-56.
[123] 42 U.S.C. §6941 through 6949.
[124] *See generally*, Berry and Denison, *supra* note 29, at 356-60.
[125] 42 U.S.C. §6991-6991i.
[126] 42 U.S.C. §6991(l); 40 C.F.R. §280.12.

intervene and take corrective action where a UST leak endangers a community's water supply. Corrective actions could include providing alternative household water supplies and even permanently relocating residents.[127]

F. Enforcement and Penalties[128]

The primary enforcement responsibility of RCRA lies with the EPA and the Department of Justice. State agencies may also play a role in enforcement if the EPA has delegated authority to the state to administer their own hazardous and solid waste management programs in lieu of the federal RCRA program. Once the EPA or state agency determine that there has been a violation, the government may pursue two types of proceedings. The government may initiate administrative and civil judicial actions to compel compliance. Or, in the case of a "knowing" violation, the government may take criminal enforcement action against the alleged violator. In addition, under appropriate circumstances, private parties may bring a citizen suit to enforce RCRA in cases where the governmental authorities have failed to act.

In an administrative proceeding, the EPA may issue a compliance order assessing a penalty of up to $25,000 per day without a cap for any past or current violation. In a civil proceeding, in addition to seeking penalties of up to $25,000 per day of violation, the EPA may seek injunctive relief, which is a court order compelling the party to cease all noncompliant activity. In both proceedings, the actual penalty assessed depends on the particular circumstances of the violation, and the EPA must take into account the seriousness of the violation and any good faith efforts of compliance.

A person can face criminal penalties for violating RCRA when the person violates Subtitle C, knowing that the violation places another individual in imminent danger or serious bodily injury. In criminal enforcements, the defendant may be charged with fines of $250,000 per day and/or up to 15 years imprisonment. Organizations can be fined up to $1,000,000.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act

A. Scope and Background

For decades, the nation's commercial, industrial, and governmental enterprises have generated, stored, and disposed of millions of tons of hazardous waste annually. Some of this waste has escaped from its intended place of disposal, permeated into underlying soils, polluted both surface and groundwater sources, and placed human and

[127] 42 U.S.C. §6991(b)(h)(5).
[128] *See generally*, Berry and Denison, *supra* note 29, at 361-66.

environmental health at risk from exposure to hazardous substances. For example, the toxic contamination of Love Canal in upstate New York by an industrial facility resulted in the evacuation of hundreds of families from the surrounding area.

Environmental catastrophes like Love Canal convinced Congress that a system was needed to identify and cleanup contaminated waste sites that resulted from past, unregulated releases of hazardous pollutants into the environment. Thus, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was enacted in 1980 to provide a mechanism to clean up contaminated sites and hold potentially responsible parties accountable for clean up costs.[129] CERCLA differs from other environmental statutes such as the Resource Conservation and Recovery Act (RCRA) because CERLCA deals with contamination that has already occurred whereas other statutes attempt to prevent contamination from happening in the first place.

CERCLA authorizes the EPA to force parties that were responsible for releases of hazardous substances to finance and conduct cleanups. However, such parties are not always identifiable, willing, or able to finance cleanup actions. These parties may, for example, have gone out of business, gone bankrupt, or been taken over by other entities. In addition, poor recordkeeping may make it difficult to trace and identify all the responsible parties. Therefore, CERLCA established a $1.6 billion Hazardous Substances Trust Fund (commonly known as "Superfund") to ensure that funding would be available to finance cleanup of the most contaminated sites.

The Superfund Amendments and Reauthorization Act of 1986 (SARA) added provisions that increased the taxes available to finance the Superfund and authorized an appropriation of $8.5 billion through December 31, 1991. SARA also requires the EPA to use "applicable or appropriate requirements" of other environmental laws when designing remedies at CERCLA sites, adding a preference for permanent cleanup and treatment remedies as opposed to containment remedies.

B. EPA Response Authority

Under CERCLA, the EPA may initiate clean up actions at abandoned hazardous waste sites. This "response authority" is triggered by the release[130], or threatened release of a hazardous substance[131] from a vessel or facility into the environment. The EPA response can take two forms.[132] First, the EPA can conduct a short-term removal action at any site that requires emergency action. Removal actions are designed to reduce immediate threats to the public health or welfare and the environment. Removal actions,

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[129] 42 U.S.C. §§9601 through 9675.

[130] A "release" is defined as any situation that leads to a hazardous substance being freed from its normal container, such as "spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, … or dumping" into the environment. 42 U.S.C. §9601(22).

[131] CERCLA defines "hazardous substance" by referencing other environmental statutes. For example, "hazardous substance" includes the hazardous waste defined in RCRA or the Clean Water Act; and hazardous air pollutants as defined by the Clean Air Act. 42 U.S.C. §9601(14). For additional reference, see Berry and Denison, *supra* note 29, at 377-78. The EPA provides a comprehensive list of hazardous substances at 40 C.F.R. §302 (1994) to avoid confusion and unnecessary complication.

[132] 42 U.S.C. §9604(a)(1).

however, must be capable of being completed within one year and must cost less than $2 million; there are limited exceptions.[133] In stead of removal actions, the EPA can conduct a long-term remedial action at any site on the National Priorities List (NPL).[134] Remedial actions, unlike removal actions, are supposed to permanently effect the cleanup of contaminated sites. The degree to which these sites must be cleaned up is one of the most contentious issues that arises under CERCLA.

C. PRP Liability

There are four broad categories of potentially responsible parties (PRPs) that may be held liable for paying for CERCLA cleanup costs if they contributed any amount of hazardous substance to the contaminated site:[135]

- *Current owners or operators of the site at which hazardous substances were disposed.* The current owner can be liable even if that owner or operator never operated the facility as a hazardous waste disposal site and even if hazardous wastes were not deposited at the facility during under the current ownership. This is termed "current owner/ operator" liability.
- *Past owners or operators of a site at the time hazardous substances were disposed of at the site.* This is termed "past owner/ operator" liability.
- *Anyone, including generators, who arranged for the disposal, transport or treatment of hazardous substances found at the site.* The generator is responsible even if the hazardous substances sent to the site were not disposed of in accordance with the generator's instructions, and even if the transporter disposed of the substances illegally. This is termed "generator" or "arranger" liability.
- *Transporters, or anyone who arranged for transport of hazardous wastes to the facility.* The courts have required that the transporter actually chose the treatment or disposal facility in order to be liable. This is termed "transporter" liability.

The liability imposed by Section 107(a) of CERCLA is strict, joint and several, and retroactive.[136] Strict liability means that liability can be imposed regardless of fault or negligence. Joint and several provides that one party may be held liable for the entire harm caused by the action of others if they cannot pay their portion. Retroactive allows

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[133] 42 U.S.C. §9604(c)(1).

[134] The NPL is the EPA's ranking of hazardous waste sites that are eligible for cleanup using Superfund. To rank the sites, the EPA created the Hazardous Ranking System (HRS) that scores each site based on factors such as the quality and nature of hazardous waste present, the likelihood of contamination, and the proximity of the site to populated areas and sensitive natural environments. By restricting remediation actions to NPL sites, this provision is designed to ensure that the Superfund is used for only the most contaminated sites.

[135] For additional discussion on the categories of potentially responsible parties, see Berry and Denison, *supra* note 29, at 381-84.

[136] *See generally*, Berry and Denison, *supra* note 29, at 378-80 for numerous case examples where courts have held PRP's to be jointly, severally, and retroactively liable under CERLCA.

CERCLA liability to apply to actions that occurred before CERCLA's enactment. The EPA does not have to link a particular PRP's waste to the release or threatened release. The EPA need only prove that there are hazardous substances at the site that are "like" those associated with the PRP's waste management/ disposal activities. Thus, if a PRP sends hazardous waste A to a landfill and this type of waste leaks into the nearby groundwater supplies, the PRP is liable whether or not the waste A in the groundwater originated with the PRP.

Note that the breadth of the categories of PRPs creates an incentive for current owners or operators to investigate what type of activities took place on a site before purchasing it. And, generators have an incentive to make sure that the disposal or treatment facility that they chose will and has been in compliance with regulations.

In order to encourage the purchase of potentially contaminated property, the EPA may enter into prospective purchaser agreements, which are settlement agreements concerning CERCLA liability, including promises not to sue and contribution protection. A June 1, 1995 guidance document on prospective purchaser agreements outlines several criteria that must be met before the EPA will consider entering into one of these agreements: (1) this site must be one where EPA response action is undertaken, ongoing, or anticipated; (2) the agreement must result in some direct benefit to the agency, although indirect benefits to the community bolsters the possibility of an agreement; (3) the site operation by a new owner must not aggravate existing contamination or interfere with the EPA's response action; (4) the site operation must not pose any health risk to the community; and (5) the prospective purchaser must be financially viable and capable of fulfilling obligations under the agreement.[137]

In addition to prospective purchaser agreements, the EPA encourages purchase of brownfields, which are abandoned industrial sites.[138] In 1995 and 1996, the EPA issued grants of up to $200,000 each for 50 brownfield pilot projects in an attempt to demonstrate redevelopment solutions. The goal is to stimulate a national search for innovative ways to overcome the current obstacles to the reuse of contaminated properties. As a part of this encouragement, the EPA issues "comfort/ status" letters for brownfield properties which indicate whether there is any federal Superfund interest in the property so that potential purchasers can assess the risk of buying the property.

D. Private Party Cleanups

In addition to using Superfund to cleanup sites, the EPA can also compel private parties to perform response action when release or threatened release of hazardous substances present an imminent and substantial endangerment to the public health or

[137] *See* Announcement and Publication of Guidance on Agreements With Prospective Purchasers of Contaminated Property and Model Prospective Purchaser Agreement, 60 *Fed. Reg.* 34792 (July 3, 1995). *See also* Berry and Denison, *supra* note 29, at 452-455 for a discussion of this guidance document.
[138] *See* 62 *Fed. Reg.* 4624 (Jan. 30, 1997) (EPA's policy statement designed to assist parties seeking to clean up and reuse brownfield properties).

welfare of the environment.[139] By ordering PRPs to cleanup the site through administrative or judicial actions, the Superfund can be conserved for use when the PRPs cannot be identified or found. A private party cleanup order has been one of the EPA's most powerful enforcement tools because failure to comply with an order can triggers penalties of up to $25,000 per day. A private party can recover its costs from the Superfund only if it can prove that it is not a valid PRP at the site.

E. Defenses

PRPs may escape liability under three CERCLA defenses:[140] (1) an act of God; (2) an act of war; or (3) an act or omission of a third party if the PRP exercised due care and took precautions against foreseeable acts of the third party[141]. These defenses, however, are rarely used.

In addition to the three CERCLA defenses, SARA adds the "innocent landowner" defense. Under this defense, the owner or operator of the Superfund site can avoid liability if the owner or operator did not know or have reason to know that any hazardous substance had been disposed of at the site prior to purchase even after making all appropriate inquiry into previous ownership.[142]

F. Release Reporting

CERCLA requires parties to notify the EPA whenever there has been a release of a hazardous substance that is equal to or greater than the reportable quantity for that substance.[143] There are EPA regulations that list the reportable quantities for various substances.[144] Failing to report releases can result in civil and criminal penalties. The maximum criminal penalty is three years in prison for a first conviction and five years for a subsequent conviction. Civil penalties amounting to more than $25,000 per day may also be imposed.

G. Enforcement

In addition to authorizing actions for cleanup and for response costs, CERCLA also contains a "citizen suit" provision that permits private citizens to initiate civil action against parties that violate CERCLA (this includes suing the agency for failure to perform

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[139] 42 U.S.C. §9606.
[140] 42 U.S.C. §9607(b).
[141] Typically, the third party is someone who acts in a way that could not have been prevented, such as a vandal.
[142] 42 U.S.C. §9601(35).
[143] 42 U.S.C. §9603 et seq.
[144] 40 C.F.R. §302 (1993).

nondiscretionary CERCLA duties, such as enforcing CERCLA's provisions).[145] A citizen suit cannot be commenced, however, if the government is already bringing a prosecution action against the alleged violator.

TSCA: Toxic Substances Control Act

A. Scope and Background

The Toxic Substances Control Act (TSCA), which was passed in 1976, regulates the distribution of existing chemicals and the manufacture of new chemicals.[146] Whether a chemical falls under the control of TSCA depends on the risks that chemical poses to health and the environment. TSCA places the burden on manufacturers to supply the EPA with information on environmental and health effects of chemical substances and mixtures. The EPA then has broad power to regulate the manufacture, use, distribution, and disposal of chemical substances and mixtures. However, the EPA must balance the economic and social benefits of a chemical against the risks when setting forth regulations.

Section 2(b) of TSCA[147] articulates the basic strategy and policy of the Act in three parts:

(1) Adequate data should be developed regarding the effect of chemical substances on health and the environment. Further, the responsibility for developing this data falls on those who manufacture and those who process such chemicals.
(2) The EPA should have the authority necessary to regulate the chemical substances and mixtures that present an "unreasonable risk of injury to health or the environment".
(3) While the EPA should protect against unreasonable risk of injury, the regulation of chemicals under TSCA should not pose an unnecessary economic barrier to technological innovation.

B. New Chemical Review

Under TSCA's Section 5,[148] any person who manufactures or processes new chemicals for commercial purposes must submit a premanufacture notice (PMN) to the EPA at least 90 days before they begin manufacturing or processing. For an identified substance, the PMN lists the uses or intended uses of the substance, the information

[145] 42 U.S.C. §9659.
[146] 15 U.S.C §2601 *et seq.* Its regulations are found at 40 C.F.R. §§700-799. For a more detailed discussion of the requirements of TSCA, see Berry and Denison, *supra* note 29, at 489-505.
[147] 15 U.S.C. §2601(b).
[148] 15 U.S.C. §2604. *See also* Berry and Denison, *supra* note 29, at 491-96 for further discussion of PMN requirements, the contents of the PMN, and exemptions from the PMN requirement.

required to develop test data, and describes the nature of the test data that was developed. If the information in the PMN is insufficient to allow a reasonable conclusion on risks presented to health and environment, or if the chemical might present unreasonable risk, then the EPA may issue an administrative order or seek a court injunction to stop or limit its use.

There are several instances in which a chemical may be exempt from the PMN requirement. If materials are regulated under other statutes, for example, they are exempt from TSCA regulation because such regulation would be redundant. So, any food additive, drug, or cosmetic is exempt because it is already regulated under the Food, Drug, and Cosmetic Act. Similarly, a substance is exempt if a substance is the chemical equivalent of a substance that has already been submitted, such that another PMN would be duplicative.

C. Existing Chemical Testing

Section 4 of TSCA requires manufacturers, importers, and processors of TSCA-related chemical substances to submit data to the EPA on existing chemicals when they may present an unreasonable risk to health and environment or when they are produced in such quantities that there is a potential for a substantial release into the environment or human exposure.[149] If the submitted data is insufficient to resolving safety concerns, the EPA may order requiring further testing.

The Interagency Testing Committee, created in Section 4(e), is responsible for determining which chemicals should be given priority in undergoing TSCA-testing. If a chemical substance is on the Testing Committee's priority list, Section 8 requires manufacturers to submit production and exposure data and health and safety studies to be submitted to the EPA within 90 days of listing.

D. Enforcement

In order to determine TSCA compliance, the EPA may conduct inspections and require entities to disclose materials and documents to aid in making that determination.[150] The inspection may include, files, records, processes, controls, and facilities as long as they bear some relation to TSCA compliance.

When the EPA discovers violations of TSCA, the agency may seek civil and criminal penalties.[151] The civil penalties are determined by weighing the violator's culpability, compliance history, financial position, and "other matters as justice may require". The EPA may also seize products in cases where a penalty is insufficient to protect public health and environment. Civil penalties may also be sought through a citizen suit if the EPA has not already brought an action against the alleged violator. Criminal penalties may be sought for "knowing or willful" violations. These penalties

[149] 15 U.S.C. §2603.
[150] 15 U.S.C. §2610.
[151] 15 U.S.C. §2615.

may be assessed at up to $25,000 per day of violation and/or up to one year imprisonment.

FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

A. Scope and Background[152]

The first commercial pesticides became available in the United States in 1902. Since then, the application of pesticides has been largely responsible for increases in agricultural productivity in this country. Unfortunately, many pesticides have a powerful deleterious effect on nontarget species in the environment. Further, some species that are perceived as "pests" in one situation can be critical parts of the ecosystem in other situations. Awareness of the environmental consequences of pesticides is particularly important because of the persistence of pesticides in the environment, some of them remaining in the environment for decades.

The need for regulatory controls over pesticide use is undeniable given their potency and widespread use – approximately one billion pounds of pesticides have been used every year in the United States since 1980.[153] The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)[154] was originally enacted in 1947 in response to the increase use of synthetic compounds as pesticides. This original legislation focused on ensuring that pesticides were properly labeled. Apparently Congress felt that the health and environmental problems cause by pesticides were due to misuse which could be rectified through labeling requirements. Since 1947, FIFRA has been amended several times, most notably in 1972. The 1972 Amendments continued the consumer protection philosophy espoused by the original Act's labeling requirements but added health-based regulations. The amendments require that the risks and benefits of pesticides be considered at the registration, restricted registration, cancellation, and suspension stages. The major features of FIFRA remain, however, the imposition of registration and labeling requirements on pesticides.

B. Registration Requirements

FIFRA prohibits the distribution or sale of any pesticide that is not registered with the EPA.[155] In fact, FIFRA has been called a "gate-keeping" statute because manufacturers cannot use active ingredients in pesticide formulations until that substance

[152] *See* Berry and Denison, *supra* note 29, at 469-472 for a discussion on the problems of pesticide pollution and the history of pesticide regulation.
[153] *See* Berry and Denison, *supra* note 29, at 470.
[154] 7 U.S.C. §§136 to 136y. The regulations are found at 40 C.F.R. §§162-180 (1993).
[155] 7 U.S.C. §136a. The registration regulations are found at 40 C.F.R. §152 (1993).

has been registered by the EPA. Registration requirements are set forth in Section 3 of FIFRA.[156] The EPA must approve the registration of a pesticide if it meets four criteria:

1) its composition must warrant the proposed claims for it
2) labeling and other materials submitted with the application must meet FIFRA requirements
3) it will perform its intended function without any unreasonable adverse effects on the environment
4) it will not generally cause unreasonable or adverse effects on the environment even when used in accordance with widespread and commonly used practices

The EPA's decision as to whether a pesticide meets the enumerated criteria is based on the data submitted by the manufacturer in its registration application. The data that is submitted is extensive and expensive to develop because it must specify the crops and insects on which the pesticide may be applied.[157] Each use must be supported by research data on safety and efficacy. The EPA then decides whether there are unreasonable adverse effects on the environment by taking into account the economic, social, and environmental costs and benefits of the use of the pesticide.[158]

The criteria prohibiting the pesticide from posing an unreasonable or adverse effect on the environment is a continuing criteria. This means that the EPA may, at any time, pursuant to Section 6 of FIFRA suspend, cancel, or restrict the use of a pesticide that poses unreasonable adverse effects or imminent hazards to the environment.[159] If the EPA needs additional data to maintain registration and that data are not submitted, the EPA may suspend the product's registration.

Before registration can be denied, the manufacturer must be notified of the basis for the EPA's determination and must be given an opportunity to correct the problem. Registration must be renewed every five years.

Pesticides are registered for general or restricted use. Restricted pesticides require additional regulatory restrictions because they are more dangerous to the applicator or the environment.[160] For example, FIFRA requires restricted pesticides must only be applied in the direct supervision of a certified applicator who is competent in terms of handling the registered pesticides. If additional restrictions cannot prevent unreasonable adverse effects, the pesticide cannot be registered.

C. Labeling Requirements

All registered pesticides must be properly labeled for lawful sale.[161] The label must specify the pesticide's active ingredients, how to use the pesticide on particular

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[156] 7 U.S.C. §136a(c)(5).
[157] E. Elliott and E. Thomas., *Chemicals*, in Sustainable Environmental Law §17.2(B), at 1290.
[158] 7 U.S.C. §136(bb).
[159] 7 U.S.C. §136d.
[160] 7 U.S.C. §136a(d)(1)(C).
[161] 7 U.S.C. §§136(p) - (q) and 136j(a)(1)(F). Regulations pertaining to labeling are found at 40 C.F.R. §156 (1993).

crops, and limitations on how or when it may be used.[162] It is a violation of FIFRA to use a pesticide in a manner that is inconsistent with its label instructions. While FIFRA depends heavily on labeling to ensure pesticides are used in a manner that ensures human and environmental safety, several courts have nevertheless emphasized the inability of labeling to offset the effects of misuse.[163]

D. Implications of the Food Quality Protection Act (FQPA)

While the effects of pesticides on animals has been relatively well documented, there remains great uncertainty about the effect of pesticides on humans. In response to studies that focused on the effects of certain "estrogen disruptor" pesticides[164], which were shown to have adverse effects on reproductive patterns in animals, Congress became concerned with the effect of pesticides on humans and passed the Food Quality Protection Act (FQPA) in 1996.[165] This Act amended portions of FIFRA section 25.

Two major mandates of the FQPA effect FIFRA.[166] First, the EPA is required to develop an Estrogenic Substances Screening Program.[167] Therefore, the EPA must screen all pesticides, or any other substance that may have a cumulative effects with the pesticide, for their effect on humans. Pesticides that are determined not to have an effect on humans are exempted from further regulation. The second FQPA mandate requires the EPA to set a tolerance, or maximum residue limit, on each registered pesticide. This is to ensure the safety of the food supply in the United States. In setting the tolerance levels, the EPA considers the toxicity of the pesticide, how much of the pesticide is used and how often, and how much of the pesticide typically remains in food and ensures this level will be safe. The EPA is required to complete tolerance assessments by August of 2006.

E. Enforcement

Pursuant to Section 12, it is unlawful to distribute or sell unregistered pesticides, registered pesticides that are adulterated or misbranded, or registered pesticides whose composition is different than that disclosed during registration.[168] Thus, false data submissions and registration statements constitute FIFRA violations. In addition, FIFRA is violated by detaching, altering, defacing, or destroying any labeling required by FIFRA or by failing to comply with recordkeeping, reporting and inspection requirements.[169]

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[162] 7 U.S.C. §136(q)(2).
[163] *See, e.g.*, Hercules, Inc. v. EPA, 598 F.2d. 91 (D.C. Cir. 1978).
[164] For reviews of the literature regarding estrogen disruptor pesticides, see U.S.E.P.A., Endocrine Disruptor Screening Program (EDSP): Priority Setting Workshop, 63 *Fed. Reg.* 71,541 - 71,570.
[165] 7 U.S.C. §136w.
[166] *See* Berry and Denison, *supra* note 29, at 480-484 for an additional reference on the affects of the Food Quality Protection Act on FIFRA.
[167] 21 U.S.C. §346a(p)(1).
[168] 7 U.S.C. §136j.
[169] 7 U.S.C. §136j.

Where a state has a federally approved pesticide program, the state is the primary enforcement authority.[170] However, ultimate enforcement authority lies with the EPA because the agency can take over state's enforcement authority if the state programs are not adequately enforced.[171]

Any violation of FIFRA is subject to a $5,000 civil fine.[172] Knowing violations are punishable by a criminal fine of up to $50,000 and one year imprisonment.[173] Fraudulent data disclosures can incur up to a $10,000 fine and three years imprisonment.[174]

F. Alternatives to Conventional Pesticide Use

Integrated Pest Management (IPM) is an alternative to conventional pesticide use which is described in FIFRA Section 20-1 as "a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."[175] IPM combines pest management techniques such as crop rotation, timed crop planting and biological controls. FIFRA section 11 requires the EPA to make IPM information available to those who request it through state extension services.[176] The use of IPM techniques are recommended, where practical, to reduce pesticide use and thus reduce the chance of accidents and lawsuits resulting from injury to the health and environment. Further, the IPM techniques can be just as effective as reliance on pesticides alone, but they reduce the amount of money spent on expensive chemicals.[177]

In addition to IPM, biological pesticides ("biopesticides") are an alternative to conventional pesticides. There are derived from natural materials such as animals, plants, bacteria, and certain minerals (e.g., garlic, mint, baking soda). Biopesticides have several advantages: i) they are inherently less harmful than conventional pesticides; ii) they are designed to target a single pest organism, instead targeting a broad spectrum of pests which can incidentally harm non-pests such as birds; and iii) they are often used in smaller quantities and decompose quickly in contrast to the persistence of conventional pesticides.[178] Since biopesticides pose fewer risks than conventional pesticides, they often require less data to become registered, which is less expensive, and also are registered more quickly (compare one year for registration of biopesticides to the more than three year average for registering conventional pesticides).[179]

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[170] 7 U.S.C. §136w-1.
[171] 7 U.S.C. §136w-2.
[172] 7 U.S.C. §136l(a).
[173] 7 U.S.C. §136l(b).
[174] 7 U.S.C. §136l(b)(3).
[175] 7 U.S.C. §136r-1.
[176] 7 U.S.C. §136i(c).
[177] *See* Berry and Denison, *supra* note 29, at 484 *citing* Botrell, *Integrated Pest Management* (Council on Environmental Quality, 1979).
[178] *See* Berry and Denison, *supra* note 29, at 484-86.
[179] *See* Berry and Denison, *supra* note 29, at 484-86.

NEPA: National Environmental Policy Act

A. Scope and Background

The National Environmental Policy Act of 1969[180] was the United States' first significant acknowledgement that legislation is necessary to encourage productive and harmonious relationship between humans and the environment. The lofty goals of NEPA are succinctly articulated in Section 2:

> The Purpose of this Act are: to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.[181]

Despite the lofty policy goals articulated in NEPA, it is important to note that NEPA applies only to federal agency actions. Only under limited circumstances do the requirements extend to private individuals or entities, or to state or local governments. Nevertheless, the federal NEPA statute has inspired similar statutes at the state and local level. It is also important to recognize that unlike most other environmental statutes, NEPA is a short and drafted in general terms. Therefore, most of the detailed requirements of NEPA are either outlined by the Council on Environmental Quality or articulated by courts through common law.

B. Requirements

NEPA contains three core sections. Section 101, often called "substantive NEPA", is a lofty statement of national environmental policy goals.[182] Section 102, "procedural NEPA", requires an environmental impact statement to be prepared for "all major Federal actions significantly affecting the quality of the human environment."[183] Finally, Title II of NEPA[184] establishes the Council of environmental Quality (CEQ), an Executive Office of the President, with responsibility for promulgating regulations to

[180] 42 U.S.C. §4331 *et seq*. For a more detailed and comprehensive discussion of NEPA, see Berry and Denison, *supra* note 29, 39-90.
[181] 42 U.S.C. §4321.
[182] 42 U.S.C. §4331.
[183] 42 U.S.C. §4332.
[184] 42 U.S.C. §4342-4347.

implement NEPA. The CEQ has primary responsibility for interpreting NEPA and courts have generally given deference to the CEQ's interpretations.

1. Substantive

A series of general purposes, goals, and policies of NEPA are set out in Section 101. Because these statements have allowed the argument that NEPA creates substantive responsibilities that federal agencies must meet, this section has become known as a "substantive provision." The duties on federal officials articulated in section include:

- fulfill the responsibilities of each generation as trustee of the environment for succeeding generations
- assure for all Americans safe, healthful, productive and esthetically and culturally pleasing surroundings
- attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences
- preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice
- achieve a balance between population and resource use which will permit high standards of living
- enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources[185]

2. Procedural

Section 102 is called the "procedural provision" of NEPA because it requires federal agencies to prepare a detailed statement for "legislation and other major federal actions significantly affecting the quality of the human environment."[186] This detailed statement, which is called an "environmental impact statement" (EIS), is meant to guarantee that no federal agency will conduct its business without at least considering the adverse environmental consequences of its action. An EIS must contain a discussion of:

- the environmental impact of the proposed action
- any adverse environmental effects which cannot be avoided should the proposal be implemented
- alternatives to the proposed action
- the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity

[185] 42 U.S.C. §4331(b).
[186] 42 U.S.C. §4332(2)(C).

- any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented[187]

The details of the EIS process are contained in CEQ regulations, not in NEPA itself.[188] Even thought the requirements appear to be simple, the EIS process can be very tedious and expensive for large projects. The range of impacts are broad, sometimes including crime, emotional and physical isolation, an esthetic considerations.[189] Sufficient information must be presented so that a well reasoned decision can be made.

An EIS is not required every time a federal agency takes action. Therefore, the CEQ regulations have set out a system to determine whether an EIS is necessary. If an agency is unsure whether or not an EIS is required, it prepares an Environmental Assessment (EA), which is a brief public document that provides sufficient evidence and analysis for determining whether to prepare an EIS.[190] Most EA's are 10-15 pages in length, as opposed to EISs which can be hundreds or thousands of pages long. If, after preparing an EA, the agency determines that no the project will not significantly affect the quality of the environment, the agency makes a "Finding of No Significant Impact" (FONSI).[191] If the EA determines that a full EIS is required, the agency prepares a "notice of intent" that is published in the Federal Register.[192] The notice of intent describes the proposed action and alternatives, describes the scoping process and whether and when a scoping meeting will be held, and states the name and address of a person within the agency who can answer questions of the proposed action and EIS.[193]

The first version of an EIS prepared by an agency is termed a draft EIS (DEIS). Once prepared, this draft is made available through the Federal Register for public comment. The final EIS (FEIS) responds to all comments on the draft. If the final EIS differs substantially from the draft EIS, then the comment process begins again.

C. Remedies under NEPA

Interestingly and importantly, an agency is not bound by NEPA to choose an alternative with the least amount of adverse environmental impact. Instead, NEPA has been interpreted to impose only procedural requirements on an agency. Therefore, so long as an agency has adequately considered alternatives to the proposed project and adequately examined the impacts of each alternative, the agency may choose any of the alternatives regardless of substantive impact.

The most common form of relief in NEPA cases is the preliminary injunction, which temporarily stops the actions by the defendant agency until it complies with its responsibilities under NEPA.[194] Many NEPA plaintiffs also ask the court for declaratory

[187] 42 U.S.C. §4332(2)(C).
[188] The regulations are principally found at 40 C.F.R. §1502.
[189] *See, e.g.,* Maryland Nat'l Cap. Park v. U.S. Postal Serv., 487 F.2d 1029 (D.C. Cir. 1973).
[190] EA's are described by the CEQ regulations at 40 CFR §1508.9(a).
[191] 40 C.F.R. §1508.13.
[192] 40 C.F.R. §1501.7.
[193] 40 C.F.R. §1508.22.
[194] *See* Berry and Denison, *supra* note 29, at 83.

relief in addition to their request for an injunction, which specifies the legal obligations of the defendant agency.[195] Unlike other environmental statutes, there are no monetary penalties because an agency fails to comply with NEPA requirements.

EPCRA: Emergency Planning and Community Right to Know Act

A. Scope and Background

In 1984, more than 2500 people were killed and some 50,000 more were permanently disabled when a Union Carbide facility in Bhopal, India, released methyl isocyanate into the atmosphere. The Bhopal accident triggered concern for accidental chemical releases in the United States and highlighted the need for emergency planning to respond to those releases if they should occur. In addition, communities located near industrial sites became eager to know what substances the facilities in their communities were emitted after the incident.

The Emergency Planning and Community Right to Know Act (EPCRA)[196] of 1986 was a response to the concerns triggered by the Bhopal incident. As its name suggests, EPCRA does two major things: (1) it requires states to create local emergency units that must establish plans for responding to chemical release emergencies and (2) it requires the creation of a national inventory, which is available to the public, that reports the chemical releases from all manufacturing facilities.

B. Emergency Planning

Section 301 of EPCRA[197] requires each state to establish a State Emergency Response Commission (SERC). SERC then designates emergency planning districts within the state to facilitate the preparation and implementation of the emergency plans required under 303. Each district has an appointed local emergency planning committee (LEPC) in each of those districts.

In order for the LEPC to generate a broad perspective of the chemical hazards in the entire community, Section 302 requires any facility that produces, uses or stores any of the substances on the EPA's List of Extremely Hazardous Substances[198] to notify SERC. A facility only has to notify SERC if it produces, uses or stores those substances in quantity greater than the emergency planning quantity that is established for each substance. In addition, the person designated as the facility emergency response coordinator must submit additional information to the LEPC upon request or notify the

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[195] *See* Berry and Denison, *supra* note 29, at 84.

[196] While EPCRA is a separate law, it is contained in Title III of the Superfund Amendments and Reauthorization Act, codified at 42 U.S.C. §11001-11050.

[197] 33 U.S.C. §11001.

[198] A list of the extremely hazardous substances and their threshold notification quantities is contained in the EPA's *Title III List of Lists* in Appendix A or Appendix B to 40 C.F.R. Part 355.

LEPC of any changes occurring at the facility that may be relevant to emergency planning.

Each LEPC reviews the information submitted by facilities and develops a plan to respond to local hazardous chemical emergency releases. The local emergency response plan must:

1. Identify all the facilities subject to the emergency planning requirements within the district.
2. Identify all routes within the district used to transport extremely hazardous substances.
3. Identify all risk-related facilities in the district, such as natural gas facilities, power stations, or schools or hospitals.
4. Describe methods and procedures that emergency response personnel with follow in case of chemical release
5. Identify all facility emergency response coordinators within the district.
6. Describe the procedures used to notify and evacuate the public in case of a release.
7. Specify methods for determining whether a chemical release has occurred and the probable affected area and population.
8. List all community facility emergency equipment or facilities available and their location as well as the persons responsible for them.
9. Describe the training program used to train emergency response personnel.[199]

Not only must facilities submit information that allows the LEPC to formulate an adequate emergency response, but they must also notify SERC and the LEPC if there is a release of a listed substance that is not federally permitted, that exceeds the reportable quantity established for that substance, and that results in exposure to persons off-site. Initial notification can be made by phone, radio, or in person.[200] However, a written follow-up emergency notice must be filed as soon as possible after the release.[201]

C. Community Right to Know Reporting and the Toxic Release Inventory

EPCRA contains several provisions designed to assimilate information for the general public concerning the type of chemicals to which they may be exposed.

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[199] 33 U.S.C. §11003(c).

[200] Initial reporting must name the chemical involved and indicate whether it is extremely hazardous; estimate the amount released, the time and duration; list the environmental media into which the release occurred; warn of the known or anticipated health risks; advise as to the proper precautions to be taken as result of the release; and provide the name and telephone number of the contact person at the facility. See 40 C.F.R. § 355.40(b)(2).

[201] An emergency follow up notice updates the information included in the initial release information, provides the actions taken to respond to and contain the release, lists any known or anticipated acute or chronic health risks associated with the release, and gives advice on medical attention for exposed individuals where appropriate. See 42 U.S.C.A. §11004(c).

- Material Safety Data Sheets[202]: Section 311 requires owners and operators of facilities that are subject to the Occupational Health and Safety Administration's Hazard Communication Standard regulations to submit copies of material safety data sheets (MSDSs) or a list of hazardous substances that they handle to SERC, the LEPC, or the local fire department.
- Tier One/ Tier Two Reporting[203]: Section 312 requires the owner or operator of covered facilities to submit an emergency and hazardous chemical inventory form to SERC, the LEPC, and the local fire department. There are two forms of reporting that are acceptable. The Tier One reporting requires facilities to estimate the amounts of listed chemicals at the facility in the previous year and the general location of the hazardous chemicals. The Tier Two reporting outlines health and physical hazards on a chemical-specific basis and indicates the precise location of those chemicals. While Tier One information must be submitted by every facility on or before March 1st, Tier Two reporting is additional information that is required upon request of an interested public like the SERC, LEPC, or the public.
- Toxic Release Inventory[204]: Section 313 applies to manufacturers with more than 10 employees who either use more than 10,000 pounds or manufacture or process more than 25,000 pounds of one of the listed chemicals or categories of chemicals. This section requires covered facilities to report annually to EPA and the state the maximum amount of listed chemical present at the location during the previous year, the treatment or disposal methods used, and the amount released to the environment or transferred off-site for treatment and/ or disposal. Covered facilities must maintain records that support the TRI submissions for three years. These records are subject to EPA inspection and verification. The data obtained is compiled into the Toxic Release Inventory (known as the TRI), which is a computerized database maintained and published each year by the EPA.

Of the provisions assisting the dissemination of information to the public regarding the chemicals and releases present facilities in their community, the TRI has been the most widely used source of information. It is used by citizens, environmentalists, states, and industry as an environmental "scorecard" to identify facilities that handle and release large amounts of listed chemicals. The public disclosure of facilities' toxic chemical release and transfer information has resulted in many facilities voluntarily reducing their releases and off-site transfers.[205] There are a couple of dangers, however, with the community relying solely on TRI to assess a facility's environmental record. First, TRI reporting is self-submitted so the accuracy of the report is as trustworthy as those submitting reports. Second, assessing the risks posed by a facility requires

[202] 42 U.S.C. §11021.
[203] 42 U.S.C. §11022.
[204] 42 U.S.C. §11023.
[205] In response to TRI, nine major petrochemical manufacturers made public commitments to reduce their emissions of selected toxins into the environment by almost 83 percent by December 1993. *See* E. Elliott and E. Thomas, *supra* note 157, at 1270.

examining the toxicity and persistence of the released chemicals, not only the quantity released. By and large, however, the TRI reporting has been a positive influence on community awareness and industry awareness of public concern.

D. Enforcement

EPCRA contains a complex set of administrative, civil, and criminal penalties for violations of its various provisions.[206] Section 325 and 326 authorize the EPA, SERCs, LEPCs, and citizens to take legal action against owners and operators of facilities who violate requirement of EPCRA. Notably, however, the enforcement authorities vary for each requirement – citizen suits, for example, are allowed for violation of some but not all requirements. Congress intended mainly that implementation be a state and local function with the notable exception of Section 313 pertaining to toxic chemical release inventory reporting.

Citizens can bring suits for violations of Sections 311, 312, and 313, which are the community reporting requirements. Violations of Section 311 are subject to $10,000 fines per day; Section 312 and 313 violations are subject to $25,000 fines per day.

The EPA can order covered facilities to comply with the emergency planning requirements of Sections 302 and 303. Violations are punishable by civil penalties of up to $25,000 per day. Violations of Section 304's emergency notification requirements are punished more severely by fines of up to $25,000 and/or two years imprisonment for a first violation. Second violations are subject to $50,000 and up to 5 years imprisonment.

OSHA: Occupational Health and Safety Act

A. Scope and Background

The Occupational Safety and Health Act[207] (OSH Act) was enacted in 1971 and is driven by a lofty goal – that "no employee will suffer material impairment of health or functional capacity" from a lifetime of occupational exposure.[208] Even though this goal contains the supplementary phrase "to the extent feasible", the legislative history of the Act reveals that the consideration of feasibility was really an afterthought to Congress when enacting the Act. Therefore, there has been much litigation in the courts over the extent to which worker safety should be balanced in a risk-benefit or cost-benefit analysis when regulations are drafted.[209]

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[206] 42 U.S.C. §11045.

[207] 29 U.S.C. §651 et seq. A useful reference for obtaining an overview of the OSH Act can be found in Marshall Lee Miller, *Occupational Safety and Health Act, in* Environmental Law Handbook (14th ed. 1997) (Thomas Sullivan, ed.).

[208] OSH Act §6(b)(5).

[209] The D.C. Circuit Court of Appeals accepted that economic consideration play a role in setting health and safety standards, but only to the extent that "a standard that is prohibitively expensive is not feasible." *See*

The coverage of the OSH Act extends to all employers and their employees in all fifty states.[210] In total, the Act covers approximately 100 million workers in 6 million workplaces.[211] The Act, however, provides some limited exemptions to workplaces employing fewer than ten workers and federal or state employees.

Along with the passage of the OSH Act, Congress created a new federal agency to carry out the mandate of the Act, the Occupational Safety and Health Administration (OSHA). The three main roles of OSHA are (1) setting of safety and health standards, (2) enforcing those standards through federal and state inspectors, and (3) public education and consultation.[212]

B. Standard Setting, the General Duty Clause, and Variances

The OSH Act creates both health and safety standards. Increasingly, health issues like environmental contaminants in the workplace have become the focus of OHSA's concern. Unlike safety hazards, the effects of health hazards may be slow, cumulative, irreversible, and complicated by non-occupational factors (i.e. smoking). Health hazards are therefore more difficult to define and become translated into standards than safety hazards. To be complete, the promulgation of health standards involved complex concepts and detailed information such as medical surveillance, recordkeeping, monitoring, and multiple physical reviews.

Not only is setting health standards a complicated process, but there are also thousands of chemical substances, fire hazards, or other dangerous situations that are prevalent in the workplace for which standards need to be developed. Recognizing the inordinate amount of time that could be spent setting meticulous standards for every toxic chemical found in workplaces, OSHA developed three different standard setting procedures:

- Consensus Standards: Section 6(a) allowed OSHA to develop Consensus Standards until April 1973. These standards were assimilated from standards and guidelines already existing in other federal agencies, industry, or private associations. These standards, however, are problematic because they are only threshold values; they do not set forth requirements for warning labels, monitoring, medical recordkeeping, etc. Also, these generic standards are generated from information that was not necessarily established from scientific evidence and that has been in circulation for a number of years with no urgency to be kept current. OSHA has attempted to deal with some of the problems of Consensus Standards by adding various medical, monitoring, and other requirements to threshold levels.

Industrial Union Department, AFL v. Hodgson, 499 F.2d 467 (D.C. Cir. 1974). Compare the D.C. Circuit's view, however, to the Seventh Circuit Court of Appeals decision that the cost of installing noise abatement equipment should be balanced against the health damage to workers, thus essentially articulating that feasibility requires a cost-benefit analysis. *See* Turner Co. v. Secretary of Labor, 561 F.2d 82 (7th Cir. 1977).

[210] OSH Act §4(a) - 4(b)(2).

[211] *See* Miller, *supra* note 207, at 524, §2.2.

[212] *See* Miller, *supra* note 207, at 523, §2.1.

- Permanent Standards: After April 1973, Section 6(b) requires OSHA to set health standards following a regular standard setting process. Namely, the standard is developed based on scientific health considerations, medical monitoring, labeling and other proscriptions. Once a standard is proposed, it is subjected to public comment and hearing. In practice, this permanent standard setting process takes several years, which may explain why there are only 25 standards promulgated so far. Most standards, therefore, are still Consensus Standards developed pre-1973.
- Emergency Temporary Standards: Under Section 6(c), OSHA may issue emergency standards for substances that place workers in grave danger and that are determined to be toxic or physically harmful or from new hazards. These standards are effective immediately upon publication in the Federal Register and are valid for only six months. When an emergency standard is promulgated, however, there is considerable pressure on OSHA to conduct an expedited rulemaking for a permanent standard before the time limit lapses.

In spite of the tens of thousands of toxic chemicals that are present in the nation's workplaces, OSHA has only listed threshold limits and health standards for less than 500. Therefore, many of the workplace safety hazards and potentially dangerous chemicals present in workplaces are not regulated by specific standards. They are, instead, subject to the "General Duty" clause, under Section 5(a)(1), which imposes a generic duty on employers to keep their workplaces safe.[213] Inspectors have the authority to cite violations of this general duty. Even where specific standards do exist, if those standards are outdated and not sufficient to ensure worker safety, an employer may be cited for violating Section 5(a)(1) in spite of meeting regulations on the books.[214]

Because the ultimate goal of the OSH Act is to ensure workplace safety, the Act does not require inflexible adherence to OSHA standards. An employer may be granted a permanent variance from OSHA standards if he/she can demonstrate that the conditions, practices, means, methods, operations or processes proposed to be used will provide a safe and healthful workplace as effectively as the OHSA standards.[215]

C. Inspections and Violations[216]

OSHA is primarily an enforcement organization. The only way to determine compliance with the Act is inspections. Each year there are 50,000 federal inspections and at least that many state inspections. Inspections are supposed to be surprises. In fact,

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[213] OSH Act §5(a)(1); 29 U.S.C. 654(a)(1).

[214] *See, e.g.*, International Union, UAW v. General Dynamics Land System Division, 815 F.2d 1570 (D.C. Cir. 1988). The D.C. Circuit stated that an employer who knew that the OSHA standard was not adequate to protect worker safety violated the general duty clause in spite of adhering to the outmoded standard.

[215] OSH Act §6(d). *See also* Miller, *supra* note 207, 534-35, §5.0 - 5.2 for a slightly more extended description of permanent and temporary variances.

[216] *See* Miller, *supra* note 207, at 535-537, §6.0 for a more detailed analysis of compliance and inspections under the OSH Act.

there are penalties for anyone alerting the sites beforehand. The inspections may be targeting at random, set by a priority system which targets high-hazard workplaces first, or by events such as a fatality or explosion.

During an inspection, an employer can be fined for serious, willful, or repeat violations. A serious violation is found if there is "substantial probability that death or serious physical harm could result from a condition which exists."[217] A penalty is mandatory for a serious violation and penalties for non-serious violations are discretionary. A willful violation is one where the employer knows that a hazardous condition existed and then took no reasonable steps to eliminate that condition.[218] Citations for repeat violations can be issued if the employer has been cited for a violation, has abated the violation, and has then again violated the same standard or permitted the same hazard to exist in the workplace. If the employer has failed to abate the violation, a penalty may be assessed for each day that the violation continues.[219]

D. Refusal to Work/ Whistleblowing

OSHA has ruled, and the Supreme Court has unanimously upheld, that workers have a right to refuse to work in the face of serious injury or death.[220] If a worker refuses to work because of unsafe conditions, the OSHA regulations protects the worker from discrimination.[221] Also, if a worker is fired or disciplined for complaining to governmental officials about unsafe work conditions, the worker has a legal remedy under the OSH Act for restoration of his job or loss of pay.[222] By providing protection for whistleblowing, the statute recognizes that employees in a given workplace would be best acquainted with the hazards there. Contrary to what Congress might have expected when enacting the OSH Act, however, worker complaints have not been a fruitful source of health and safety information.[223] Perhaps this is because despite the protection that OSHA affords a whistleblower, it is often difficult to determine whether worker was fired for informing OSHA or because of other issues clouding the employer-employee relationship.

E. State OSHA Regulations

The OSH Act requires OSHA to encourage states to develop and operate their own job safety and health programs, which must be at least as effective as the federal program.[224] The federal program is effective until a state program is approved.[225] Even

[217] OSH Act §17(k).
[218] OSH Act §17(d).
[219] OSH Act §17(d).
[220] *See* Whirlpool Corp. v. Marshall, 445 U.S. 1 (1980).
[221] 29 C.F.R. § 1977.12 (1979).
[222] OSH Act §11(c); 29 U.S.C. §660.
[223] *See* Miller, *supra* note 207, at 540-41, §8.2.
[224] OSH Act §§ 2(b)(11) and 18(c)(2).
[225] OSH Act §18(a).

then, the federal enforcement standards fill in the gaps of the state program. Almost half of the states have their own system. Industry, however, dislikes the dual system because multi-state companies are forced to decipher a variety of state laws and regulations instead of a uniform federal plan.[226] Also, state OSHAs are often larger than the local federal force and are therefore capable of conducting more inspections.[227]

F. Hazard Communication Regulations[228]

While OSHA has not developed an impressive volume of health hazard standards, the health hazard communication regulation which was issued in November of 1983 has been noted as one of OSHA's most important rulemaking ever.[229] The Hazard Communication or "Right-to-Know" Standard originally applied to manufacturing industries, but in 1987 by court order it was extended to virtually all employers.[230] The standard requires employees to be provided with information concerning hazardous chemicals through labels, material safety data sheets, training and education, and lists of hazardous chemicals in each work area.

Material safety data sheets (MSDSs) are the primary tool for transmitting detailed information on hazardous chemicals. A MSDS is a technical document that summarizes the known information about a chemical. They are developed by chemical manufacturers or importers and passed along to the purchaser in the first shipment. The employers must keep the MSDSs where employees can have access to them at all times.

Pollution Prevention Act

A. Scope and Background

The previous sections have discussed environmental statutes that serve as this nation's primary pollution control mechanisms. While together these statutes seem comprehensive, the problem with the traditional pollution control scheme is that each statute regulates a particular media – i.e. the Clean Water Act focuses on water, the Clean Air Act regulates air, the Resource Conservation and Recovery Act controls pollutant release on land. Often, however, when a pollutant stream to one media is decreased, the pollutants are merely shifted to another media. For example, removing metals from water creates toxic sludge, which then has to be deposed of in a hazardous landfill. The same amount of metals are discharged into the environment as a whole; the regulations have merely shifted the distribution of those metals in the environment.

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[226] *See* Miller, *supra* note 207, at 542, §10.2.
[227] *See id.*
[228] *See generally* Miller, *supra* note 207, at 548-49, §16.2.
[229] 49 *Fed. Reg.* 52380, Nov. 25, 1983.
[230] 52 *Fed. Reg.* 31852, August 24, 1987.

Recognizing the potential danger in using pollution control as a method for shifted unwanted pollution between environmental media, the Pollution Prevention Act of 1990 establishes pollution prevention as the nation's preferred pollution control strategy.[231] Pollution prevention is defined to mean source reduction and other practices that reduce or eliminate the creation of pollutants through increased efficiency in the use of raw materials, energy, water or other resources.[232] In contrast to the traditional statutes, pollution prevention attempts to reduce the amount of waste that is generated in the first place through more efficient use of resources at the input and production level. Reducing the generation of waste streams, in other words, is more effective than attempting to treat the waste once it is produced.

The Act establishes a hierarchy for preferred waste strategy methods: the ultimate goal is to prevent or reduce pollution at the source when possible; pollution that cannot be prevented should be recycled; pollution that can not be prevented, reduced or recycled should be treated; finally, disposal or other releases into the environment are a last resort.

Unlike the environmental statutes discussed previously, the Pollution Prevention Act does not place affirmative requirements on industry. The provisions are designed to educate facilities about the benefits of pollution prevention control strategy and formulate a working relationship between the government, industry, and the community to move facilities beyond compliance on a voluntary basis. The only affirmative requirement is an amendment to the toxic release inventory reporting requirements under the Emergency Planning and Community Right to Know Act (EPCRA).[233] This amendment requires facilities subject to EPCRA's reporting requirements to also report information on the pollution prevention and recycling activities at the facility for each toxic chemical. This information, like the other toxic release information, is available to the public.

Other than the effect that the Pollution Prevention Act has through EPCRA, the EPA has also initiated several programs to develop and implement pollution prevention strategies in industry: the Environmental Leadership Program, the Common Sense Initiative, and the Regulatory Reinvention Program. These programs are discussed below.

B. EPA Environmental Leadership Program

The Environmental Leadership Program (ELP) aims at encouraging companies to develop and implement pollution prevention management practices and to set environmental goals beyond regulatory compliance. Participants in the program would be subject to national risk reduction goals set by the EPA. The basis for measuring a participant's progress in meeting the national goals is the Toxic Release Inventory (TRI) published in accord with requirements under the Emergency Community Planning and

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[231] 42 U.S.C. §13101 et seq. A more in depth review of the Pollution Prevention Act is provided by John M. Scagnelli, *Pollution Prevention Act*, *in* Environmental Law Handbook (14th ed. 1997) (Thomas Sullivan, ed.).

[232] 42 U.S.C. §13102(5)(A).

[233] *See* Berry and Denison, *supra* note 29, at 519 for more details as to how EPCRA was amended by the Pollution Prevention Act.

Right to Know Act (EPCRA). In addition, the EPA will develop environmental principles with the industry and corporations to govern the way that corporations design, manufacture, market, and distribute products. These Corporate Statements of Environmental Principles would be maintained in a public docket to allow the public to access and examine the contents.

The third component of ELP is the Model Facilities Program , which publicly recognizes facilities that meet strict environmental criteria. Aside from public recognition, other incentives for corporations to become model facilities include a commitment by the EPA to accelerate the permit and product registration process, reduce monitoring and reporting requirements, issue multi-media permits and allow companies to off-set voluntary actions against future regulatory requirements.

C. Common Sense Initiative

The Common Sense Initiative is a program that alters the EPA's approach to environmental policy. The Initiative uses an industry-by-industry approach to environmental protection instead of the traditionally favored pollutant-by-pollutant strategy. The EPA works with all levels of government officials, environmentalists and industry leaders to create strategies and a blueprint for achieving real environmental protection. The first phase of industries that are the focus of this Initiative are auto manufacturing, computers and electronics, iron and steel, metal plating and finishing, oil refining, and printing.

Such an industry-by-industry approach is expected to generate cheaper, but more efficient, pollution control strategies because facilities will have more opportunity to invoke flexibility and innovation when trying to reduce waste streams generally instead of focusing efforts on one particular pollutant. The Initiative moves beyond media-specific regulations to viewing an industry as a whole.

D. EPA's Regulatory Reinvention (XL) Program

The EXcellence in Leadership (XL) program is part of President Clinton's "Reinventing Environmental Regulation" initiative, announced by the President in March, 1995. The XL Program goes beyond command and control regulatory systems by granting industrial participants flexibility in meeting regulatory requirements in exchange for an enforceable commitment by the participants to attain greater environmental results than what would have been achieved through compliance. Participants in the program could implement technologically innovative and cost-effective alternatives to regulatory requirements.

Program participants must meet specific criteria: applicants must gain the support of parties that a stake in the environmental impacts of the project, the project must test innovative alternatives against several regulatory requirements and more than one environmental medium, and pilots should be amenable to implementation in other

industries.[234] The EPA intends to learn from pilot projects and promote cooperation among regulators and the regulated community. The goal is to establish at least fifty partnerships with XL participants.

Common-law principles:[235]

A. General Definition

In addition to federal and state laws, there are several common law theories that may be asserted as a basis for environmental liability claims. Common law is the creation of general principles and rules relating to persons and property from court decisions that have recognized customs and usages over time. While statutory law pertains to all federal and state laws specifically enacted by legislatures, the common law refers to all the remaining rules, principles, and customs not derived form express legislative authority.

Common law claims are discussed here because they have begun playing an increasing role in environmental law. Liability may stem from personal injuries and property damage caused by environmental conditions under common law theories of trespass, nuisance, negligence, and strict liability for abnormally dangerous activities. The remedies available to injured parties and the burdens of proof necessary to generate liability may be different under common law actions than statutory actions. Therefore, engineers or owners/operators of facilities need to be aware of common law duties in addition to statutory requirements in order to avoid liability.

Keep in mind, however, that common law is not synonymous with uniform law. Because common law theories are developed through court decisions, the reach of the common law theories discussed below into environmental disputes may vary greatly between jurisdictions.

B. Trespass

A common law action for trespass is brought for an unauthorized invasion of a person's right to exclusive possession of the land. Trespass is a strict liability claim, which means that the plaintiff may succeed even in the absence of proof of actual harm or injury. In an environmental context, a trespass claim been successful when sludge from defendant's industrial waste dump entered plaintiff's land. The defendant was liable because defendant was notified that the sludge was entering the plaintiff's land and yet did nothing to stop it.[236]

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[234] *See* 60 *Fed. Reg.* 27282 (May 15, 1995).

[235] A more extensive discussion of common-law principles at work in environmental cases is found at Berry and Denison, *supra* note 29, at 15-37.

[236] *See, e.g.*, Regan v. Cherry Corp., 706 F. Supp. 145 (R.I. 1985) (knowing deposit of toxic waste on another's property is a continuing trespass).

C. Strict Liability for Ultra Hazardous Activities

Under the common law theory of strict liability for ultra hazardous activities, liability can be imposed regardless of fault if injuries are caused from ultrahazardous activity. There are several factors that courts rely on when determining whether an activity is abnormally dangerous: high degree of risk of some harm, likelihood that resulting harm would be severe, inability to eliminate risk in spite of reasonable care, inappropriateness of activity in the place where it is carried out, and extent to which the value of the activity to the community outweighs the danger.[237]

Although the vast majority of cases involving injury caused by hazardous substances are litigated under federal statutes like the Comprehensive Environmental Recovery Compliance Liability Act (CERLCA) or the Toxic Substances Control Act (TSCA), the common law action for ultrahazardous activities can be invoked in some situations. For example, in New Jersey, the owners of land used as dump for toxic wastes were held strictly liable for harm caused to others, including the cost of cleanup.[238] In what looked liked a CERLCA remedy, some 625 corporations that deposited their waste at the site were also found strictly liable and had to contribute to cleanup costs.

D. Nuisance

Nuisance is an action brought against someone for unreasonably interfering with one's use and enjoyment of property. In other words, if the way Mr. X uses his land unreasonably disturbs the way that Mrs. Y can use her land, Mrs. Y can bring a nuisance action against Mr. X. The relief afforded Mrs. Y can be in the form of monetary damages or injunctive relief.[239] In determining whether a challenged activity is a nuisance, the courts typically weigh the usefulness and the public acceptability of the activity with the extent of harm or cost of compensation for the injury. A court may then choose to deny injunctions with the resulting losses to the polluter would greatly exceed the benefits to their victims.

A nuisance action can either be raised as a public nuisance claim or a private nuisance claim. Public nuisance claims arise when their is an unreasonable interference with a property right that is common to the general public. For instance, an improperly managed public landfill violates the public's right to a safe environment.[240] Public nuisance claims can be difficult to bring because the private person bringing suit must show that the injury suffered is unique as compared to the injury suffered by other members of the general public.

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[237] Restatement (Second) of Torts §520.
[238] State of New Jersey v. Ventron, 468 A.2d 150 (N.J. 1983).
[239] Injunctive relief means that the court can order the person conducting an illegal activity to stop or alter the behavior so as not to violate law.
[240] *See, e.g.*, Blair v. Anderson, 570 N.E.2d 1337 (Ind. App. 1991).

In contrast to a public nuisance claim, a private nuisance claim is brought when the unreasonable, unusual, or unnatural use of someone's property substantially impairs the ability of another to peacefully enjoy his property. Typically, the activity has to be intentional. In a Florida case, the court ruled that an oil company unreasonably interfered with the neighboring landowners ability to peacefully occupy their land because of noise, vibrations, and emissions from the plant.[241] Specifically, the vibrations and noise caused severe structural damage to neighboring homes which rendered them unsafe for human habitation. The neighboring landowner was awarded $304,750, which was the full market value of the house that would have existed if there was no nuisance.

Whether the claimed nuisance is characterized as permanent or temporary by the court is a major factor affecting how the court awards damages. The measure of damages in for a temporary nuisance is the decrease in the value of the land during the time of injury, as well as any special costs. For permanent nuisance cases, however, the measure of damages is the difference in market value of the land before and after the nuisance damage occurred.

E. Negligence

Negligence is the common law doctrine that requires people to act in a reasonably careful manner to avoid causing foreseeable harm to someone else.[242] For instance, a homeowner that fails to shovel and salt her sidewalk may be found negligent and be responsible for damages when a pedestrian slips on the homeowner's property if it was foreseeable that the pedestrian would slip and if the homeowner failed to exercise reasonable care in preventing such an accident.

There are four elements that a plaintiff must prove when brining a negligence claim: 1) duty of care; 2) breach of that duty; 3) causation; and 4) actual harm to the plaintiff. The duty of care element requires showing that the injury was foreseeable. In determining what is the proper standard of care, courts will consider what a reasonably prudent person should have done or what the applicable standard of care is for a particular industry. After establishing what the standard of care should have been, the plaintiff must show that the defendant failed to adhere to that standard and that in doing so the defendant caused actual harm to be suffered by the plaintiff.

In environmental cases, the causation element can be difficult to prove. For example, suppose someone buys property that was formerly owned by a gas station and subsequently discovers that the land is contaminated with petroleum.[243] If the buyer brings a negligence action against the former owner, the buyer will have to prove that the contamination was caused by negligence by the former owner. This is a difficult task considering that the contamination could have several potential causes like system leaks, customer overfills, and accidents at the pump island. In addition, experts would have a difficult time pinpointing when the contamination occurred.

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[241] Exxon Corp. v. Dunn, 474 So.2d 1269 (Fla. App. 1985).
[242] Restatement (Second) of Torts §282.
[243] This example is based on facts in Gerst v. Marshall, 1996 WL 333149 (Iowa, June 19, 1996).

F. Toxic Torts

An environmental toxic tort is a claim for damages arising from exposure to a harmful chemical or substance. Environmental torts are increasingly related to injuries caused by exposure to a variety of substances like polychlorinated biphenyls (PCBs), pesticides, benzene, heavy metals, and other contaminants in the soil, air or water. A plaintiff that brings a toxic tort suit must prove that she has been exposed to a toxic substance; that there was sufficient exposure to cause a harmful effect; and that the exposure was caused by the defendant's wrongful conduct and did not occur from exposure to a substance that occur naturally in the environment.

International Treaties and Protocols

National industries and engineering design are not only constrained by United States federal environmental statutes; they are also subject to limitations created by international treaties and protocols. This section will review some of the major international treaties like the Montreal and Kyoto Protocols, their potential affect on regulations in the United States, and the process by which international treaties become binding in the United States.

The international environmental law typically generates obligations through the form of a bilateral or multilateral agreement. These agreements can take place between countries or between countries and non-governmental organizations like the World Trade Organization (WTO) or the International Organization of Standards (ISO). When an international issue is identified, one or more countries call for a "convention" to discuss the issue or issues. The convention is attended by representatives of interested or invited countries who negotiate the details of the agreement. This agreement is followed by a formal proposal called a "protocol". The protocol becomes binding when it is ratified by every nation that wishes to be included. In the United States, the President can sign the protocol to symbolize approval of the agreement, but the protocol only becomes technically binding on the nation after the protocol receives the consent of the Senate and meets it own standards for ratification (i.e. the protocol may specify a certain number of states that must ratify the treaty before it has binding international effect).

One of the major problems facing international environmental agreements is the issue of enforcement. A country or an international body has a difficult time enforcing environmental agreements in another country because most countries are wary about involving foreign nations in their domestic affairs. Therefore, most enforcement of international agreements is "soft", which means most disputes are not litigated but are resolved by cooperation and consultation. Furthermore, the complaining country generally has the burden of showing that the other country's environmental measures are not consistent with the agreement.

A. Great Lakes Water Quality Agreement of 1978

In 1978, the United States and Canada entered into the Great Lakes Water Quality Agreement (GLWQA) in order to restore and maintain the chemical, physical, and biological integrity of the great lakes. Because the Great Lakes system contains over 90% of the freshwater in North America, international cooperation became critically important to prevent further degradation of the Great Lakes system. The GLWQA created an International Joint Commission made up of representatives of each country which drafts regulations and makes recommendations on all actions affecting the Great Lakes, their tributaries, and adjacent riparian areas. The GLWQA has been successful in substantially reducing the pollutants entering the Great Lakes and in improving the water quality of the Great Lakes.

B. The Kyoto Protocol[244]

The Kyoto Protocol is an agreement that was negotiated as a means of implementing the United Nations Framework Convention on Climate Change. The Convention set an objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent global warming. The Kyoto Protocol negotiated that objective and set binding targets for the reduction of emissions of greenhouse gases by developed nations. Under the Protocol the United States would be obligated to reduce its greenhouse gas emission 7% below the 1990 levels for carbon dioxide, nitrous oxide, and methane. For the three man-made greenhouse gases – HCFC, CFC, HFC – the United States would have to meet a 7% reduction below the 1995 levels averaged over the period of 2008 to 2012. Based on projections of growth of emissions using current technologies and processes, the reduction in greenhouse gas emissions required of the United States would probably be between 20% and 30% below where they would otherwise be during that time period.

This reduction in emissions does not account for the offset credit that the United States could receive under the Protocol for activities that absorb carbon such as planting trees. The United States, in fact, insisted that nations receive credit for carbon reducing activities to encourage activities such as afforestation and reforestation. Joint implementation is another mechanism under the Protocol that allows a nation to decrease its own commitment for reducing greenhouse gas emissions. Joint implementation is a project-based activity in which one country can receive emission reduction credits when it funds a project in another country where the emissions are actually reduced. This joint implementation was another aspect of the Protocol that was highly favored by the United States.

One of the controversial issues concerning the Protocol is the United States insistence that developing countries meaningfully participate in the commitments of the Protocol. In

[244] The information on the Kyoto Protocol that forms that basis of this section can be found in Berry and Denison, *supra* note 29, at 718-19, § 16 and Congressional Research Service Report for Congress, *Global Climate Change Treaty: The Kyoto Protocol*, Update March 6, 2000 <http://www.cnie.org/nle/cli-3.html>

fact, the Administration has stated that without such participation, the President will not submit the Kyoto Protocol to the Senate for consent to ratification.

The Kyoto Protocol was signed by the President of the United States in 1998, but the protocol has not yet been ratified by the United States or even submitted to the Senate for its consent. Ratification in the United State requires the President to submit the treaty to the Senate for advice and consent with a two-thirds majority vote in the Senate required for approval. Even if the protocol had been ratified by the United States, it would not be binding internationally until it is ratified by at least 55 countries that account for at least 55% of the total carbon dioxide emissions as of 1990. Even though the President's signature does not legally bind the United States to the terms of the Kyoto Protocol, the signature does authenticate the text of the agreement, thereby acknowledging that the terms of the protocol express the intent of the negotiating nations. Also, by signing the protocol, the United States is bound to refrain from acts that would defeat the object and purpose of the agreement and creates at least a moral obligation on the United States to seek ratification.

If the Kyoto Protocol is ratified by the United State and meets its own ratification requirements by achieving participation of 55 countries, additional legislation would likely have to be proposed and passed in the United State legislature to implement the Protocol's objectives. Otherwise, the objectives would have to be met on the initiative of the EPA for example in issuing permits under the Clean Air Act, for example. Permits issued under the Clean Air Act could, for example, decrease the allowable amounts of carbon dioxide, methane or nitrous oxide emitted into the air. Currently, the Protocol is not binding and does not impose any direct obligations on facilities in the United States.

C. The Montreal Protocol[245]

The issues addressed in the Kyoto Protocol, namely global climate change, are related to the concerns addressed by the Montreal Protocol, namely the depletion of the ozone layer. Changes in the ozone affect the Earth's climate, and change in climate and meteorological conditions affect the ozone layer because the ozone depletion and climate change phenomena share a number of common physical and chemical processes. Decisions taken, or not taken, under one Protocol therefore have an impact on the objectives of the other Protocol.

The issue of dangerous stratospheric ozone depletion was first addressed by the United Nations in 1981 which resulted in the Vienna Convention for the Protection of the Ozone Layer. The Vienna Convention was signed in 1985 by 20 of the leading CFC-producing and consuming nations. The Vienna Convention, however, did not establish specific controls or reduction targets because of disagreements between countries like the United States which favored a worldwide ban on CFC's and other groups like the European Union that would only support a freeze on CFC production. Several

[245] The information forming the basis of this section is found in Berry and Denison, *supra* note 29, at 718-719, §16.4.6. *See also* World Meteorological Organization Global Ozone Research and Monitoring Project – Report No. 44, *Scientific Assessment of Ozone Depletion: 1998*, available at <http://www.al.noaa.gov/wwwhd/pubdocs/Assessment98/executive-summary.html.>

negotiations, therefore, followed the Vienna Convention and resulted in the Montreal Protocol, which was signed by 24 countries in September of 1987.

Under the Montreal Protocol, CFC production levels of 1986 was supposed to be reduced by 50% by 1999, starting with a freeze in production and consumption within one year of adoption of the Protocol. In the case of halons, the Montreal Protocol did not seek to reduce 1986 production levels; rather, it only froze production and consumption levels at the 1986 levels. No other ozone depleting substances have been included under the control measures of the Protocol.

The Montreal Protocol has twice been amended since coming into effect in 1989. The London Amendment of 1990 provided that CFCs should be completely phased out by the year 2000. In addition, a financial mechanism was provided so that industrialized countries could pay for incremental costs of acquiring and developing alternative technologies for developing countries. In 1992, the signatory countries adopted further amendments to accelerate the timetable for reduction of ozone depleting substances.

Title VI of the 1990 Amendments was essentially intended to implement the *Montreal Protocol* as it relates to U.S. emissions. Basically, the production of all substances listed as Class I substances (CFCs, halons, carbon tetrachloride, methyl chloroform) must be phased out by the year 2000. Methyl chloride production must be phased out by 2002. Class II substances (HCFCs), which are less significant ozone depleters, must be phased out by 2030. The EPA can add substances to this list. The EPA must also assign ozone depletion and global warming potential values to each listed substance. In addition, the 1990 Amendments establish requirements for warning labels for products containing ozone depleting substances, for the federal procurement of ozone depleting substances, and recycling of such substances.

Since the passage of the 1990 amendments, new evidence has become available supporting an accelerated schedule for phasing out various ozone-depleting substances. This evidence has spurred adjustments to the *Protocol* but have not necessarily been accounted for in Title IV yet. This may be an area where industry can expect more strict future standards.

D. The International Organization for Standards (ISO)[246]

The International Organization for Standards (ISO) is a private sector non-governmental organization founded in 1947 in Geneva, Switzerland. The primary purpose of ISO is to promote international harmonization and development of manufacturing, product, and communications standards. More than 120 countries belong to ISO as full voting members, including the Unites States. ISO standards represent an international consensus on the state of the art in the technology concerned and supposed to make the development, manufacture, and supply of products and services more efficient, safer, and cleaner. The quality of goods and services are also safeguarded for consumers.

To date, ISO has been successful in promulgating more than 8,000 internationally accepted standards for everything from paper sizes to film speeds. ISO standards and

[246] *See* Berry and Denison, *supra* note 29, at 719-724, §16.4.7.

enforcement are administered by experts from the affected industrial, technical, and business sectors as well as selected individuals with relevant knowledge, such as representatives of government agencies and testing laboratories.

The two most recognized standards are the ISO 9000 series, which are quality management standards, and the ISO 14000 series, which are environmental management standards. Specifically, the environmental management standards are a series of voluntary standards and guideline reference documents which include environmental management systems, eco-labeling, environmental auditing, life cycle assessment, environmental performance evaluation, and environmental aspects in product standards. The ISO 14000 series does not set requirements for environmental compliance. Rather, it calls for environmental policies that demonstrate a commitment to environmental compliance and pollution prevention. For example, one element of the ISO 14000 series is an environmental performance evaluation guide which is a guide to measuring, analyzing, assessing, and describing the organization's environmental performance against agreed targets based on the entity's environmental policy objectives.

Section III: The Influence of Environmental Laws on Design

A. A Life Cycle Analysis of Environmental Laws

A lifecycle framework is a useful tool for analyzing and organizing the numerous environmental laws that potentially govern a single product. The life cycle of a product can be broken down into several stages: resource extraction, manufacturing, distribution, use, and disposal. A single sheet of paper, for example, generally involves harvesting timber; transporting timber to a pulp manufacturing plant; processing the timber into pulp and the pulp into paper; packaging and shipping the paper; using the paper; and disposing of the paper after use through recycling, incineration, or landfill disposal.

Aside from providing a framework for organizing the environmental laws that may be applicable to a given product, the life cycle framework is also a useful concept for considering how engineers can influence which environmental laws govern a product over its life cycle. For example, when a design engineers choose which materials to use in a product, that choice effects what environmental laws will be applicable during the materials extraction stage of the lifecycle. In addition, the materials chosen can effect whether manufacturing by-products could be hazardous or non-hazardous wastes. This in turn effects whether the wastes will be subject to environmental laws such as the federal Resource Conservation and Recovery Act. Similarly, the mechanical, industrial, and chemical engineers that are responsible for designing the manufacturing processes influence how much of the waste is discarded and how much is internally recycled. The internal recycling of waste streams then effects how much waste the facility has to treat, transfer and dispose. Waste generation is an important consideration because as more waste is generated there is generally more risk that the waste will be treated, transferred or disposed of improperly. Therefore, the risk of liability increases with the amount of waste that is generated.

These are just a few examples of how engineers can effect the environmental obligations and risks that a company faces through design decisions. If an engineer is able to envision the life cycle of a product or activity and recognize the ways that decisions made at one point in the life cycle effect decisions both upstream and downstream from that point, then that engineer is better able to make decisions that optimize the use of resources and minimize the legal obligations and potential liability that the company incurs.

Because of the usefulness of the life cycle framework for organizing the environmental laws that can effect a product or activity, this section will first generally describe the life cycle categories that environmental laws fall into. Those categories will then be used to analyze the wealth of environmental laws that effect the petroleum industry at each stage of the life cycle. During this analysis, consider how engineers could alter the course of the applicable environmental laws through creative design and decision-making.

1. Explanation of Environmental Laws in a Life Cycle Framework

The environmental laws govern the life cycle of a product at four basic stages: resource extraction, manufacturing, use, and disposal. Examples of what types of laws may be applicable at each stage are described below.

(a) Resource Extraction

The laws that govern resource extraction can be subdivided into two major parts: laws that govern whether resources can be extracted from the land and laws that govern the actual extraction process. In general, because the United States federal government is a government of limited powers, whenever the federal government seeks to regulate private activity it must link the regulation to a federal interest. Therefore, federal laws that govern the extraction of resources typically do not regulate private lands. Most of the private land use regulation is left to state and local governments. Some of the exceptions to this general rule are discussed below.

Laws that Restrict the Extraction of Resources from Land. Both federal and state laws protect certain areas from extraction of resources. Federal laws, such as the Wilderness Act, may set aside areas as wilderness areas, wildlife refuges, or national parks and thereby restrict the commercial activity that can take place on that land.[247] Another example of land-use restriction is the Clean Water Act, which places restrictions on the use of wetlands by requiring private landowners to obtain a permit from the U.S. Army Corps of Engineers before they would be able to fill in a wetland on their property.[248] On the state and local level, one of the most important tools available for regulating resource extraction is zoning because it determines how certain parcels of land may be used (e.g. for residential use, for commercial activity, etc.).

Laws that Govern the Process of Extraction. Another category of laws that govern the extraction of resources are those laws that effect the extraction process rather than effecting land use outright. Such laws specify how to extract resources and how to keep the extraction from being too destructive. In some cases, federal laws may reach the extraction processes on private lands. Operators of copper and iron mines, for example, may be subject to requirements of the Clean Water Act because mine dewatering can lead to the unintentional creation of wetlands, which requires a §404 permit under the Clean Water Act.[249] In addition, the Surface Mining Control and Reclamation Act (SMCRA) regulates surface strip mining of coal and the surface effects of underground coal mining.[250] Permits issued to coal mines under SMCRA require a reclamation plan to restore the land to a condition capable of supporting existing or higher uses when the mine is finished.[251] Because it regulates a private industry in stead of a particular resource, however, SMCRA is unique among federal extraction laws.

(b) Manufacturing

[247] 16 U.S.C. §§1131-1136.
[248] 33 U.S.C. §1344.
[249] *See* Celia Campbell-Mohn, *supra* note 9, at §16.2(A)(3)(b).
[250] 30 U.S.C. §1201-1328.
[251] 30 U.S.C. §§ 1258, 1265.

While federal resource extraction laws tend not to regulate private entities, there are numerous federal laws that regulate private entities regarding how resources are manufactured into products, e.g. the Clean Water Act and the Clean Air Act. Collectively, these laws are usually termed pollution abatement laws because they focus on treating or abating pollution at the end of the manufacturing processes. Consider why environmental laws do not generally focus on using resources more efficiently to prevent pollution before the end of the manufacturing process, with the exception of the Pollution Prevention Act which is discussed *infra* Section II. Generally, these pollution abatement laws can fall into three categories: those that govern the manufacturing process, those that regulate the products that are manufactured, and those that regulate information disclosed about the manufacturing process and the products.

Laws that govern the manufacturing process. Laws that govern manufacturing processes are probably the most well known environmental laws. The Clean Air Act regulates the emission of pollutants into the air. The Clean Water Act regulates pollutant discharges into the water. And, the Resource Conservation Recovery Act regulates how wastes generated in the course of manufacturing are treated, transported, and disposed of. All of these examples set minimum national standards. Through the Clean Air Act, for example, the EPA has set national ambient air quality standards for lead, ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide and particulates.[252] States must then develop implementation plans to ensure the air will meet the EPA standards of "clean". States, however, are free to establish standards that are more stringent than the nationally established standards.

Laws that govern the manufactured products. The two primary examples of federal product regulation statutes are the Toxic Substances Control Act (TSCA) and the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). The approaches that each of these two statutes take to product regulation makes for an interesting comparison.

TSCA provides the EPA with the authority to ban or restrict the manufacture of certain chemicals, but the burden of going forward with the ban is on the EPA. Before chemical manufacturers begin manufacturing a new chemical, they must inform the EPA.[253] If the EPA does not act, the manufacturer is free to make and market the chemical – no affirmative permission from the EPA is required. But, if the EPA wants to require a manufacturer to test its chemicals for harmful side effects, it can not simply order the manufacturer to do so. The EPA would first have to go through a notice and comment rulemaking procedure[254] which can be unwieldy and take at least 18 months.[255]

FIFRA, unlike TSCA, requires manufacturers to obtain a license from the EPA before manufacturing or marketing any pesticide. The EPA still does not have broad authority to deny licenses to pesticides that may still be harmful to humans and the environment. If the manufacturer demonstrates to the EPA that the pesticide is fairly and fully labeled, and that it "will perform its intended function without unreasonable adverse effects on the

[252] The Clean Air Act is discusses *infra*, section II.
[253] 15 U.S.C. §2604(a).
[254] 15 U.S.C. §2603.
[255] *See* Campbell-Mohn, *supra* note 9, at 79, §2.3(B).

environment", the EPA must register the pesticide.[256] If two pesticides technically meet the registration criteria, the EPA does not have the discretion to register one pesticide and not the other even if one pesticide is safer and superior to other.[257]

Laws that Regulate Information About the Product. Several environmental laws require the manufacturing facilities to publicly disclose information regarding the environmental consequences of the activity. The Emergency Planning and Community Right to Know Act (EPCRA) requires firms to submit an annual report to the EPA that inventories their hazardous chemicals and summarizes all toxic releases made into the environment in that year.[258] This information is then entered into a database that is available to the public. Because of EPCRA, people can find out what chemicals the facilities in their communities are releasing into the air, water, or landfills. This can generate a tremendous amount of pressure on companies to answer questions about what steps are being taken to substitute benign chemicals for dangerous ones and what ultimately happens to the chemicals released in the environment.

(c) Laws Governing Disposal and Damage to the Environment

After resources are extracted and manufactured into products, they eventually are reintroduced into the environment at the end of their life cycle. Some of this reintroduction occurs during the manufacturing process. The laws that govern manufacturing processes focus on regulating wastes that are generated and discharged during the manufacturing stage of the life cycle. The Resource Conservation and Recovery Act (RCRA) is an example of a statute that regulates wastes that are byproducts of manufacturing.[259] However, RCRA is also one of the most important statutes that regulates the intentional disposal of products at the end of the life cycle. RCRA tightly regulates hazardous waste. Therefore, products that are hazardous by design, e.g. paint thinner, are also hazardous when discarded and are subject to RCRA regulation.[260]

In addition to federal requirements under statutes like RCRA, common law can also impose liability on companies or individuals for failing to take proper care in disposing of environmental contaminants. Toxic tort law is a branch of state common law that provides monetary compensation for injuries to people or damage to property that was caused by environmental contaminants. The threat of multimillion dollar lawsuits can be a powerful motivation for companies to look for safer business practices.

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[256] *See* 7 U.S.C. §136a(c)(5).
[257] *See* 7 U.S.C. §136a(c)(5).
[258] The requirements of EPCRA are discussed *supra* Section II.
[259] The requirements of RCRA are discussed *supra* Section II.
[260] One curious feature of RCRA, however, is that it does not regulate household wastes. Therefore, paint thinner that is disposed of from a factory must be incinerated or buried in a hazardous waste landfill; but, under federal law, the paint thinner is someone's home basement can be thrown out in the trash. Even though household waste disposal is not governed by TSCA, it may be governed by local or state ordinances.

2. Case Example: A Cradle to Grave Legal Analysis of the Petroleum Industry[261]

In order to illustrate how many different environmental laws can govern the production of a single product, this section outlines the environmental laws that regulate the life cycle of petroleum, from defining areas where drilling is prohibited to disposal of petroleum wastes. The life cycle of petroleum production is discussed three stages: extraction, refining and use, and disposal of waste oil and wastes from the recycling process.

(a) Extraction

The laws governing the extraction process serve three functions: they define areas where drilling is permitted; they articulate how to obtain permission to extract; and they regulate the extraction, storage and transportation process. Because the statutes that govern onshore and offshore petroleum extraction differ significantly, extraction onshore and offshore are discussed separately.

(i) Onshore petroleum extraction

Restrictions on where petroleum extraction is permissible range from outright bans, to permit requirements, to land use planning controls:

- *National Park System Mining Regulation Act* – bans petroleum extraction in most wilderness areas and national parks.[262]
- *Federal Land Policy and Management Act* – bans petroleum extraction in most national monuments, national rivers, and areas of critical environmental concern.[263]
- *National Wildlife Refuge System Act* -- in national wildlife refuges, like the Alaska National Wildlife Refuge, petroleum extraction is permitted only if the Secretary of Interior determines that the drilling is compatible with the major purposes of the refuge.[264]
- *Wild and Scenic Rivers Act* – prohibits petroleum extraction within a quarter-mile of the bank of a wild and scenic river. [265]
- *Clean Water Act* – anyone wishing to explore or drill for petroleum on a wetland must first obtain a special permit under §404 of the Clean Water

[261] This example is adapted from a more detailed discussion of the environmental laws that affect each stage of the petroleum industry which is provided by Campbell-Mohn, *Petroleum*, *supra* note 9, at 1095-1183, §15.
[262] *See* National Park System Mining Regulation Act, 16 U.S.C. §§1901-1912
[263] Federal Land Policy and Management Act, 43 U.S.C. §1712(c)(3).
[264] National Wildlife Refuge System Act, 16 U.S.C. §668dd(d)(1)(A). The petroleum extraction in the Alaska National Wildlife Refuge is specifically governed by the Alaska National Interest Lands Conservation Act. 43 U.S.C. §§3101-3233. *See also*, Campbell-Mohn, *supra* note 9, at §15.2(A)(1).
[265] *See* 16 U.S.C. §§1271-1287.

Act.[266] This is one example of how in some areas petroleum extraction requires a permit.

- *State and local regulations* – local land use restrictions may also set aside areas from petroleum extraction, although these restrictions cannot deprive a land owner from all use and value of minerals on the property without compensation.

Even when petroleum extraction is technically permissible on a given tract of land, there are still laws that govern how to obtain permission, usually through a lease, to engage in extraction activities. The extent of restrictions on the allocation of the petroleum depends on whether the extraction is proposed for public, private, or tribal lands.

Private companies that seek to extract petroleum from public lands must typically obtain a lease from the federal agency that owns the land. Several statutes govern the leasing process:

- *Federal Land Policy Management Act*[267]– before the Department of Interior issues a lease for petroleum extraction, this Act requires the Department of Interior to prepare planning reports to evaluate the environmental consequences of the extraction.[268] In the course of these planning processes, mineral specialists determine previous petroleum exploration and production on the land, the potential for finding petroleum, the amount of petroleum, the facilities necessary to produce the petroleum, and the potential impacts of development on other resources.[269]
- *National Forest Management Act*[270] – this Act is similar to the land use and planning requirements of the Federal Land Policy Management Act but it applies to the Department of Agriculture.
- *National Environmental Policy Act*[271] – if the lease is a major federal action with the potential for significantly affecting the quality of the human environment, the agency has to prepare an Environmental Impact Statement in accordance with NEPA even after federal agencies develop plans to identify where exploration is permissible.
- *Federal Onshore Oil and Gas Leasing Reform Act*[272] – provides for the audits, inspections, and enforcement of petroleum operations.

In addition to the statutes that govern the leasing process, the lease itself can be a tool for federal agencies to impose environmental restrictions. For example, the Bureau of

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[266] 33 U.S.C. §1344.
[267] 43 U.S.C. §1701 *et seq.*
[268] The Forest Service and the Bureau of Land Management also undergo resource management plans to determine which lands are suitable for extraction. *See* Campbell-Mohn, *supra* note 9, at 1125, §15.2(A)(1).
[269] Unfortunately, the General Accounting Office has found that 75 of 82 land use plans and related Environmental Impacts Statements reviewed did not fully address one or more of the five key elements. *See* Campbell-Mohn, *supra* note 9, at 1126, §15.2(A)(1).
[270] 16 U.S.C. §§1600-1614.
[271] The National Environmental Policy Act is discussed *supra* Section II.
[272] 30 U.S.C. §§181 *et seq.*

Land Management may modify siting or design of operations, limit the timing of operations, and requires reclamation measures through a lease.[273] Leases can then be cancelled for failure to comply with provisions.[274]

In contrast to the range of statutes that require consideration of environmental impacts before leasing public lands for petroleum extraction, there is little federal control over the allocation of petroleum on private lands. State statutory and common laws govern the distribution of petroleum on private lands. Most states implement conservation laws to regulate overdrilling and to prevent waste.[275] On tribal lands, tribes control the standards and procedures for leasing lands for petroleum extraction and dictate the terms of the lease.[276] In addition, the Bureau of Land Management and the Bureau of Indian Affairs are responsible for NEPA compliance and oversee petroleum exploration on tribal lands.[277]

The final category of laws that govern petroleum extraction are those that regulate the actual extraction process, which includes exploration and exploratory drilling, development of drilling, storage of the extracted petroleum, and transportation to the refinery.

During the course of extracting petroleum, certain residual wastes are produced which then must be disposed. The primary residual from onshore drilling is wastewater from deck drainage[278], sanitary wastes[279], produced water[280], and drilling fluids[281]. Examples of statutes that may govern the extraction process include:

- *Clean Water Act* – if the petroleum rigs discharge any of these waters into navigable streams, the operators must first obtain a national pollution discharge elimination permit under the Clean Water Act.
- *Safe Drinking Water Act*[282] – if operators inject produced waters into the ground, which they generally do, they must obtain a permit under the Safe Drinking Water Act. Before a permit is issued, the permit applicant must show that underground injection will not harm drinking water sources.
- *Resource Conservation Recovery Act* – underground injection wells are considered land disposal facilities under the Resource Conservation and

[273] 43 C.F.R §3101.1-2.
[274] 30 U.S.C. §188.
[275] *See* Campbell-Mohn, *supra* note ****, at §15.2(A)(1)(c)(iii), p1128-29.
[276] *See id.*
[277] *See id.*
[278] Deck drainage is water that washes off the drilling platform carrying oil and dirt.
[279] Sanitary wastes are created from kitchens and service facilities on the extraction site.
[280] Produced waters are waters that percolate through the rock formation with the petroleum and are extracted through bore holes. These waters may contain radioactive materials from underground rock formations. *See* Campbell-Mohn, *supra* note 9, at 1132, §15.2(A)(1).
[281] Drilling fluids are required in rotary drilling for petroleum exploration and development to remove cuttings from beneath the bit, to cool and lubricate the drill string, and to seal the well. Operators sometimes add materials that the EPA considers toxic to the drilling fluids to improve the cutting efficiency. *See* Campbell-Mohn, *supra* note 9, at §15.2(A)(1).
[282] 42 U.S.C. § 300f *et seq.*

Recovery Act (RCRA) which requires operators to obtain a permit to manage the "facility".[283]

- *Federal Onshore Oil and Gas Leasing Reform Act*[284] – establishes a process for controlling drilling operations.
- *Endangered Species Act*[285] – plays a potential role in extraction processes on public lands because the Act requires the Department of Interior to consult with the Fish and Wildlife Service to ensure that issuance of a lease or drilling permit will not jeopardize the continued existence of an endangered or threatened species or its habitat.
- *National Environmental Policy Act* – issuance of permits to drill must also be preceded by compliance with NEPA and the possible development of an Environmental Impact Assessment.

Once petroleum is extracted, it is stored in a temporary holding tank and then transported to the refinery. The storage of the extracted petroleum is subject to EPA regulations governing substantive performance standards, record-keeping and reporting obligations, release response requirements, closure requirements, and financial responsibility requirements.[286]

The transportation of petroleum, either by pipeline or rail, is governed by another set of environmental laws:

- *Federal Onshore Oil and Gas Leasing Reform Act* – governs the siting of pipelines. The Act requires siting applicants to submit a plan of construction, operation and rehabilitation for each right-of-way permit to the appropriate agency before the agency can issue a permit.
- *Federal Land Planning and Management Act* – govern siting of pipelines in tandem with the Federal Onshore Oil and Gas Leasing Reform Act.
- *Comprehensive Environmental Response Compensation and Liability Act* – leaks from pipelines may eventually accumulate to the point where they are considered spills. Onshore spills are cleanup up under the National Contingency Plan in the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).
- *Resource Conservation Recovery Act* – whenever the pipelines are cleaned, the PCBs that are typically removed from the pipelines are regulated as the generation of hazardous waste under RCRA.
- *Department of Transportation regulations* – the design, construction, testing, operation, and maintenance of petroleum pipelines is regulated by the Department of Transportation.[287]

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[283] Safe Drinking Water Act permits satisfy this requirement. Note also that RCRA's hazardous waste provisions exempt drilling fluids, produced waters, and other wastes associated with exploration, development, or production of petroleum. 42 U.S.C. §6921(b)(2)(A).
[284] 30 U.S.C. § 226.
[285] 16 U.S.C. §1531-1544.
[286] *See* 40 C.F.R. pt. 280A-280G.
[287] 49 C.F.R. §§195.0 - 195.440.

(ii) Offshore petroleum extraction

Like onshore petroleum extraction, offshore extraction applies principles such as planning and leasing but through different statutes. And, like onshore petroleum extraction, the types of laws that govern the extraction process include those that define areas off-limits to extraction, those that allocation the extraction of petroleum, and those that regulate the extraction process itself.

Several statutes prohibit offshore extraction in an effort to preserve marine areas:

- *Marine Mammal Protection Act*[288] – prohibits "taking" certain species of marine life. Therefore, the presence of marine mammals or threatened or endangered species may limit the siting of offshore rigs and therefore effectively create preserved areas.
- *Endangered Species Act* – prohibits "taking" certain species of marine life.
- *Marine Protection, Research, and Sanctuaries Act*[289] – controls offshore extraction by allowing the Secretary of Commerce to designate certain areas as marine sanctuaries. Once an area is designated as a marine sanctuary, the Secretary of Commerce has the authority to veto any federal lease that conflicts with that designation.
- *Fishery Conservation and Management Act*[290] – uses land-use planning restriction to limit the placement of rigs by creating a 197-mile wide fishery conservation zone in the oceanic continental shelf.

In addition to federal statutes restricting petroleum extraction through the protection of certain species or marine areas, the placement of rigs may also be limited by the state common law public trust doctrine. The public trust doctrine rests on the notion that the certain public lands that are owned by the state are to be managed for the benefit of the people of the state. The doctrine typically applies navigable and nonnavigable waters that are influenced by the ebb and flow of the tide. Because a state is supposed to manage these lands like a trust fund for the public, the state cannot relinquish all of its power over such an area – the state can not lease its offshore land to the extent that it gives up all of the state's power to govern that area.

In the areas of the outer continental shelf where petroleum extraction is permitted, the control of the outer continental shelf is divided up among different countries, the federal government, and state governments. Therefore, international, federal, and state law all apply to petroleum extraction on the outer continental shelf:

- *International Law* – under international law, coastal countries have the power to control the resources in the seabed and subsoil. Therefore, the United States controls those portions of the outer continental shelf that are off of the borders of the United States through federal law. The surrounding waters are high seas and are subject to admiralty law. International law creates an affirmative duty on the countries using high seas to respect the rights of other users and to avoid marine pollution.

[288] 16 U.S.C. §§ 1361-1407.
[289] 33 U.S.C. §§ 1401-1444.
[290] 16 U.S.C. §§ 1802(4), 1802(6).

- *Outer Continental Shelf Land Act* – under federal law, the allocation of petroleum extraction rights is governed by the leasing process under the Outer Continental Shelf Land Act (OCSLA).[291] It establishes procedures for leasing the area and then governs the many steps in the exploration and drilling process that require permits and consideration of environmental impacts. For example, after the Department of Interior issues a lease under OCSLA, the lessee must submit an exploration and development plan that contains information relevant to determining the environmental impact of production (e.g. a list of proposed drilling fluids and additives and the method of disposal; a description of the onshore facilities, including pollutants that they may emit; a list of onsite flora and fauna including endangered and threatened species; a list of environmentally sensitive areas; an assessment of direct and cumulative environmental impacts; and an explanation of projected air emissions). [292] This plans is then distributed for comment and approval from the Secretary of the Mineral Management Service (MMS).[293] Next, the lessee must apply for and receive a permit to drill which may contain stipulations and requirements in itself.
- *National Environmental Policy Act (NEPA)* – if the lease is considered a major federal action taken by a federal agency, the agency may have to develop an environmental impact assessment before issuing the lease.
- *Coastal Zone Management Act (CZMA)* – applicants for exploration or development must also show that their activities will be consistent with the state's coastal zone management program.[294]

The final type of laws that govern the extraction of offshore petroleum are those laws that regulate the drilling process itself and the transportation of petroleum to the shore for processing after drilling. Like onshore drilling, offshore drilling produces waste waters in the form of drilling fluids, additives, and produced waters. While these waste waters could be barged ashore or to other sites for disposal, the waste is generally discharged into the ocean after being processed to extract petroleum. In addition to wastewater regulation, air pollutants generated from the extraction process are subject to regulation. The following statutes and regulations are examples of some of the sources of law that regulate the petroleum extraction process:

- *Mineral Management Service (MMS) regulations* – because of the impacts that wastewaters can have on the receiving waters[295], the Mineral Management

[291] 43 U.S.C. § 1333(a)(1). *See also* Campbell-Mohn, *supra* note 9, at 1145-46, §15.2(A)(2), for a more detailed description of the leasing process.
[292] 30 C.F.R. § 250.33(b).
[293] 30 C.F.R. § 250.33(f), 250.33(n).
[294] *See* Campbell-Mohn, *supra* note 9, at 1148, §15.2(A)(2).
[295] Drilling rigs discharged over 1.5 million barrels of wastewater into the Gulf of Mexico in 1986. Consequently, an EPA study of the wastewater discharges into the Gulf of Mexico indicated that napthalene concentrations were 1.5 ppm, which is one hundred times the level determined to be toxic to fish eggs and benthic organisms by the Fish and Wildlife Service. Wastewaters suffocate benthic organisms and lower the amount of oxygen available to organisms in the water column. *See* Campbell-Mohn, *supra* note 9, at 1150, §15.2(A)(2)(c)(i).

Service (MMS) requires operators to use the best available and safest technologies that are economically feasible

- *National Environmental Policy Act* – if upon inspection of the offshore rigs, the Director of the MMS finds there is a threat of serious, irreparable, or immediate harm or damage to life or to the environment, the Director can suspend production and require submission of new Environmental Impact Statements under the National Environmental Policy Act. The lease can also be cancelled if the threat of harm is not likely to decrease within a reasonable period of time.
- *Clean Water Act* – the discharge of the waste waters is specifically regulated under the Clean Water Act which requires a national pollution discharge elimination system (NPDES) permit for all discharges into the Gulf of Mexico.[296]
- *Marine Protection, Research, and Sanctuaries Act* – the operators must also apply to the EPA for a permit under the Marine Protection, Research, and Sanctuaries Act,[297] which has similar criteria as the Clean Water Act for issuance of a permit.
- *Shore Protection Act*[298] – governs waste wasters by requiring operators to provide adequate control measures to clean up wastes discharged into coastal waters.
- *Mineral Management Service's air quality standards*[299] – main source of air pollution control of offshore rigs in the Gulf of Mexico
- *Clean Air Act 1990 Amendments* – the Clean Air Act only provides the EPA with the authority to regulate air pollution for offshore rigs in the Pacific, Atlantic, and Arctic Oceans and off the West coast of Florida.[300] The Amendments exempt areas adjacent to Alabama, Louisiana, Mississippi, and Texas. Because 98.8 percent of the total offshore rigs are located in the Gulf of Mexico[301], the old Mineral Management Service standards are the main source of air pollution control of offshore rigs, not the Clean Air Act. The Clean Air Act, however, may apply to other activities related to drilling such as platform and drill ship exploration, construction, development, production, processing, and transportation.[302]

Another area where environmental controls are necessary to control potential pollution is in the storage of petroleum after extraction and the transportation of petroleum from the offshore rigs to the shore for processing. The storage of petroleum in tanks prior to transport creates a risk of petroleum leakage. In addition, storage tanks

[296] However, even though the waste water may be considered hazardous waste, drilling fluids and produced waters, however, are not regulated under RCRA.
[297] 33 U.S.C. § 1412(a).
[298] 33 U.S.C. § 2601-2623.
[299] 30 C.F.R. § 250.44.
[300] 42 U.S.C. § 7627.
[301] *See* Campbell-Mohn, *supra* note 9, at 1155, §15.2(A)(2).
[302] *See id.* at 1156.

release fugitive nitrogen oxide emissions from their valves and pipes. In spite of their environmental risks, storage tanks are not regulated by underground storage tank provision under the Resource Conservation and Recovery Act (RCRA).

Once the stored petroleum is ready to be transported ashore, it is brought to shore either through pipeline or by ship. Offshore pipeline are primarily regulated by the Mineral Management Service which regulates the design, installation, testing, repair, and abandonment of the pipeline.[303] The siting of pipeline delivery systems and ports are regulated by the Deepwater Port Act.[304] Siting requires an environmental assessment in compliance with the National Environmental Policy Act. Tankers that ship petroleum back to shore are regulated under the International Convention for the Prevention of Pollution From Ships[305] and the 1990 Oil Pollution Act.[306] The transport of wastes from offshore rigs is also regulated – the operator must obtain a permit from the Secretary of Transportation under the Shore Protection Act.

Shipped petroleum is transferred twice in the course of shipping it ashore: once from the storage tanks to the supertanker and then to a lightening tanker. Each transfer increases the risk of an oil spill. The Oil Pollution Act regulates oil spills. Removal costs under the Oil Pollution Act, however, only apply to oil; the removal costs for hazardous substances are covered under the Comprehensive Environmental Response and Liability Act (CERLCA).[307]

(b) Refining

After petroleum is taken from the ground, either onshore or offshore, the petroleum undergoes a refining process which separates the petroleum into its constituents and introduces additives to create a final product. Three types of laws govern this refining stage: those that regulate the actual refining process; those that regulate the petroleum products; and those that regulate the information.

The first step in refining petroleum is to find a place to locate the refinery, which typically are located close to the onshore terminals that receive petroleum from offshore rigs. This siting process is regulated mainly by the Deepwater Port Act[308] and requires environmental assessment in compliance with the National Environmental Policy Act. Other federal statutes such as the Endangered Species Act, the Wild and Scenic Rivers Act[309], the Migratory Bird Treaty Act[310], the Historic Preservation Act[311], and the Clean Air Act may influence where the facility is located.

[303] 30 C.F.R. §§ 250.150-250.169.
[304] 33 U.S.C. §§ 1501-1524.
[305] Int'l Env't Rep. (BNA) 21:2301 (1991).
[306] 33 U.S.C. §§ 2701-2761.
[307] *See* Campbell-Mohn, *supra* note 9, at 1158, §15.2(A)(2).
[308] 33 U.S.C. §§ 1501-1524.
[309] 16 U.S.C. §§ 1271 *et seq.*
[310] 16 U.S.C. §§ 703-711.
[311] 16 U.S.C. §§ 470-470w-6.

The primary externalities from the refining process are air emissions[312] and wastewater[313]. Air emissions are regulated by the Clean Air Act and its amendments. The wastewater is subject to the requirements of the Clean Water Act which require the refinery to obtain a National Pollution Discharge Elimination System (NPDES) permit to discharge waters into navigable waters. Refineries are also subject to regulation by the Occupational Safety and Health Administration (OSHA). Among other things, OSHA regulates benzene in the workplace.

Environmental laws not only regulate the refining process, but they also govern the petroleum products themselves.

- *Clean Air Act* – subjects petroleum products to volatility requirements. Title II of the Clean Air Act also prohibits misfueling, establishes a diesel fuel sulfur content limit, and bans lead for highway use. Areas that considered in nonattainment under the Clean Air Act must also meet minimum requirements for nitrogen oxide emissions, oxygen content, benzene content, and heavy metals content. Therefore, the Clean Air Act requirements influence the formulation of the petroleum products. States outside the nonattainment areas may voluntarily use this reformulated gasoline.
- *Powerplant and Industrial Fuel Use Act*[314] – the Department of Energy can control the use of fuels by industrial customers and electric utilities in an emergency under the.
- *Environmental taxes* – effect the use of petroleum products (e.g. a motor fuels excise tax for highway vehicles, a fuel tax for inland waterways trust fund, a gas guzzler excise tax, etc).
- *Transportation controls* – e.g., fuel efficiency standards also impact petroleum consumption.[315]

The last type of law that governs the refining process relates to the information that refineries are required to furnish the government and the public regarding the process:

- *Toxic Substances Control Act* -- requires operators to notify the EPA before manufacturing new chemicals
- *Emergency Planning and Community Right to Know Act (EPCRA)* – requires facilities, including refineries, to notify regulators and the public of the production of or release of extremely hazardous substances. Petroleum operations must also furnish information to the EPA for inclusion in the Toxic Release Inventory, which is a public database listing the toxic chemicals that

[312] Air emissions produced during the refining process include hydrogen sulfide, carbon monoxide, hydrocarbon gases, nitrogen oxides, and catalyst dust. In addition, hydrocarbon vapors escape from tanks containing gasoline or crude oil; compressor stations release nitrogen oxide and sulfur dioxide; improperly sealed storage tanks or leaky valves emit hydrocarbons; and the combustion of crude oil releases sulfur oxides, nitrogen oxides, and carbon monoxide.

[313] Wastewater includes surface drainage, domestic sewage, cooling water, and water from production processes.

[314] 42 U.S.C. § 8301 *et seq.*

[315] These standards are termed CAFE standards and are discussed *infra* Section II.B.

are manufactured, the amount of chemical present at the operation, the waste treatment or disposal method for the chemicals, and the annual quantity of chemicals estimated to enter each of the environmental media.

- *Occupational Safety and Health Act* – the plants must produce material safety data sheets[316] for all chemicals that are produced pursuant to the Occupational Safety and Health Act and provide public access to those sheets under EPCRA.
- *Comprehensive Environmental Response Compensation and Liability Act* – requires operators to report the production of petroleum primary treatment sludge.
- *Petroleum Marketing Practices Act*[317] – regulates octane disclosure.

(c) Disposal

Eventually all resources find their way back to the environment in one form or another. The laws that govern this reintegration of resources into the environment fall into four basic categories: solid waste land disposal, incineration, injection, and resource recovery.

Solid waste land disposal is mainly governed by the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The refining process produces many solid waste including sludge that contain sodium silicate, lead, metals, and oils. Tank cleaning sludge, furnace coke, combustion ash, and wastewater flocs are other types of solid wastes that are by-products of petroleum refining processes. Land disposal of hazardous solid wastes is regulated by RCRA, with some exceptions for wastes generated by the natural gas industry. CERCLA would govern much of the solid wastes derived from petroleum if it did not exempt regulation of petroleum. The exemption, however, applies to petroleum products only, however, and not to waste products like sludge from petroleum tanks.[318]

As expected, the incineration of wastes such as acid sludge is governed by the Clean Air Act. The disposal of wastes through underground injection is regulated by the states under the Safe Drinking Water Act, which requires a permit to inject wastes into a well. The permit is issued only if the applicant ensures the waste will not endanger water supplies.[319]

Many of the wastes generated by the refining process can be recycled or reused. For example, sulfur can be removed from the petroleum and sold before it is burned. This prevents the formation of sulfur oxides, which are precursors to acid rain. Similarly, hydrocarbon gases can be recovered and used as refinery fuel or sold. Release into the atmosphere would contribute to formation of photochemical smog. Carbon monoxide can be recovered and used in boilers to produce steam to power the refinery. Generally, cost effectiveness of reuse verses direct regulation determines whether chemicals are recycled.

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[316] Material Safety Data Sheets are discussed *infra* Section II.
[317] 15 U.S.C. §§ 2821-2824.
[318] 42 U.S.C. § 9601(14).
[319] 42 U.S.C. § 300h.

B. Performance Standards Derived from Environmental Laws

This subsection provides examples of some design standards that have been established by federal agencies to meet congressional statutory directives: the corporate average fuel economy, appliance energy standards, and light trucks emissions standards. These examples not only demonstrate that statutes are eventually translated into directed standards, but they also illustrate the challenges that federal agencies can face when establishing these standards.

The promulgation of performance standards typically meets with some industry opposition and can generate both political and fiscal concerns. In the following examples, notice that some companies support more stringent performance standards because they have already anticipated new standards and incorporated these progressive standards in their designs. These companies would therefore have a competitive advantage if new standards were mandated because they would already have a product that could be sold on the market. Other companies, however, focus their energies on opposing new standards rather than on proactively creating designs to meet anticipated standards. The companies that challenge standards rather than focus their energies on innovative design would not be ready to take advantage of market demands if lobbying efforts failed and new standards were promulgated.

1. Corporate Average Fuel Economy (CAFE)

Federal agencies that are charged with the task of implementing federal statutes must promulgate regulations that translate broad statutory objectives into specific, directed, and enforceable standards. In the process of translating statutory mandates into performance standards, however, the federal agency can face numerous challenges and resistance. The challenges faced by the National Highway Traffic Safety Administration (NHTSA) when attempting to promulgate more stringent corporate average fuel economy (CAFE) standards for sports utility vehicles is a good example of the difficulties faced when implementing the objectives of a statute.[320]

When the Energy Policy and Conservation Act of 1975 was passed, one of the least controversial provisions was the one that established CAFE standards for new passenger cars. The CAFE standards impose requirements on the fuel efficiency of a car manufacturer's product line. The average fuel economy is calculated using the sales-weighted mean of the fuel economies in a product line. For example, if a car manufacturer sold fifty cars with a fuel economy of 10 miles per gallon (mpg) and fifty cars with a fuel economy of 30 mpg, the sales weighted average fuel economy for that product line (assuming there are only two cars in the product line) would be 20 mpg. Essentially, the CAFE standards require car manufacturers to produce and sell enough

[320] The information used to generate this case example is provided by Robert Bamberger with The National Council for Science and the Environment, Congressional Research Service Issue Brief for Congress, *IB90122: Automobile and Light Truck Fuel Economy: Is CAFE Up to Standards* (Sept. 22, 2000) *also available at* <http://www.cnie.org/nle/air-10.html>.

fuel efficient cars to compensate for producing and selling cars or trucks that have poor gas mileages.

When the Energy Policy and Conservation Act was passed, there was a large demand for fuel efficient cars because oil prices were high. Therefore, the CAFE provision was not controversial because manufacturers did not anticipate that it would be difficult to sell enough fuel efficient cars to meet those standards. In the early 1990s, however, the NHTSA attempted to significantly raise the CAFE standards (in other words, they attempted to require greater fuel efficiency). The proposal to raise the standards for sports utility vehicles (SUVs) and other light trucks was partially a response to a renewed sense of urgency regarding the United States' growing dependency on imported oil and partially a response to the United States' role in drafting the Kyoto Protocol, which would require the United States to achieve a 7% reduction in 1990 levels of carbon dioxide emissions.[321]

The proposal was met with tremendous opposition from automobile manufacturers, especially because the trend in automobile purchases was moving away from passenger cars and increasingly towards SUVs. In spite of the statutory mandate provided by the Energy Policy and Conservation Act to increase fuel efficiency through CAFE standards and despite the trends indicating decrease in fuel efficiency due to increasing popularity of SUVs, the NHTSA has been unsuccessful in promulgating regulations to raise the standards for light trucks and SUVs. The NHTSA has little hope of passing more stringent CAFE standards because since the 1996 fiscal year, the Department of Transportation Appropriations committee has included language in the appropriations spending bills prohibiting expenditure of funds for any rulemaking that would make any adjustments to the CAFE standards. The NHTSA, therefore, does not even have the funding to investigate whether passing more stringent CAFE standards for SUVs would improve the fuel economy.

2. Appliance Energy Standards[322]

Like the CAFE case example, the delay of the Department of Energy in setting national energy efficiency standards for appliances also illustrates that translating congressional mandates into design criteria can be a slow process in the face of industry opposition. In addition, however, appliance energy standards are a good example of how industries that focus their efforts and resources to anticipate federal design criteria not only are taking a proactive stance in creating environmentally sound design but they are

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[321] The Kyoto Protocol was signed by the President of the United States in 1998, but the protocol has not yet been ratified by the United States or even submitted to the Senate for its consent. Ratification in the United State requires the President to submit the treaty to the Senate for advice and consent with a two-thirds majority vote in the Senate required for approval. See the discussion of the Kyoto Protocol in Section II *supra*.

[322] The information presented in this case example is provided by Environmental Media Services, *New Appliance Standards Would Slash Energy Use, Saving Consumers $14 Billion a Year, available at* <http://www.ems.org/appliance_standards?zz.ems.00.03.28.htm>. In addition, *see* Appliance Standards Awareness Project, *Facts About Appliance Standards, available at* <http://www.standardsasap.org/facts.htm>.

also gaining stronger economic positioning in the market than manufacturers who focus on opposing efficiency requirements.

In 1987, Congress adopted the National Appliance Energy Conservation Act, which established minimum energy efficiency standards for a dozen appliances. The Act further required the Department of Energy to upgrade the energy standards to the maximum level of energy efficiency that is technically feasible and economically justified. Initially, manufacturers of appliances supported national standards because as more states had begun adopting their own individual standards, the industry had to adjust appliance production to meet different standards in different states.

This initial unified support among the manufacturers and efficiency advocates broke down in 1995 when some manufacturers such as General Electric attacked the national standards program and successfully lobbied for a one-year moratorium on setting new standards. Other manufacturers such as Whirlpool, however, opposed the moratorium. Therefore, while some manufacturers invest in developing new technologies, others invest in lobbyists to oppose national standards. Eventually, when new standards are adopted by the Department of Energy, those manufacturers who have already developed new technologies will be able to gain a foothold in the economy immediately while other manufacturers are scrambling to meet new design criteria. For example, even though some manufacturers successfully lobbied for a moratorium in 1995, the Department of Energy has since resumed the standard setting process and has successfully upgraded two standards – one for refrigerators and freezers (effective July 1, 2001) and one for room air conditioners (effective October 1, 2000).

In spite of the recent progress made by the Department of Energy, the Department has long since missed legal deadlines – rules for water heaters and fluorescent ballasts were due in 1992, rules for central air conditioners were due in 1994, and rules for washers were due in 1995. Such delay is unfortunate considering the environmental benefit and consumer savings that could result from more efficient energy appliance standards. The Appliance Standards Awareness Project (ASAP), a nonprofit organization, estimates that the swift adoption of appliance efficiency standards would decrease United States energy demand resulting in consumer savings of $14 billion per year by 2020.[323] In addition to saving on energy costs, the ASAP estimates that electricity savings due to more energy efficient appliances would eliminate the need for 64 large power plants by 2010, and 180 by 2020.[324] Improved efficiency would eliminate 31 million metric tons of carbon pollution each year, along with 90,000 metric tons of nitrogen oxide, and 350,000 metric tons of sulfur dioxide.[325] A new washing machine standard could reduce household water use by 10 percent.[326] Given these estimates, manufacturers that decide to forge ahead with new innovative designs would not only have an advantage over the firms that did not take a proactive approach to energy standards, but they would bring about these energy savings and environmental benefits sooner.

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[323] *See* Appliance Standards Awareness Project, *Facts about Appliance Standards*, available at <http:\\www.standardsasap.org/facts.htm>.
[324] *See id.*
[325] *See id.*
[326] *See id.*

3. Vehicle Emissions Standards and Fuel Sulfur Content Regulations[327]

While the previous case examples emphasize the challenges that a federal agency can face in promulgating specific performance standards, the progress that the Environmental Protection Agency is making with respect to reducing mobile source air pollution emissions illustrates that congressional mandates do set the stage for important environmental regulations. The EPA's commitment to reduce air emissions from mobile sources is most recently evidenced by the regulations that will require tailpipe emissions reductions on all light duty trucks, including sports utility vehicles (SUVs). In addition, by promulgating regulations to reduce the sulfur content in gasoline, the EPA decision-making demonstrates how emissions can be more effectively reduced if the inputs to the automotive system are considered. Finally, the EPA rulemaking with respect to SUVs and gasoline demonstrates that new regulations continually challenge automobile manufacturers to improve vehicle design. Those manufacturers that proactively design more "eco-friendly" vehicles will be better able to capitalize on the new regulations, as other manufacturers struggle to meet regulations.

Stemming from the mandates of the Clean Air Act of 1970, today's cars typically emit 70 to 90 percent less pollution over their lifetimes than their 1970 counterparts.[328] In spite of this progress, however, air pollution problems persist in most major cities in the United States.[329] This is largely because development and urban sprawl have created new pollution sources and have contributed to a doubling of vehicle travel since 1970. Furthermore, scientists and now the public have become concerned about previously unrecognized environmental threats such as global warming, acid rain and air toxics. With these issues in mind, Congress amended the Clean Air Act in 1990 to include provisions to further control ground-level ozone (urban smog), carbon monoxide, and particulate emissions from diesel engines and to address air toxics and acid rain.[330] Motor vehicles contribute to all these problems.

Among other things, the Clean Air Act required the EPA to consider the need, feasibility, and cost-effectiveness of stronger tailpipe emissions standards beginning in 2004. In 1998, EPA reported to Congress that America faced significant air quality challenges in the future relating to vehicles, including:

- Total vehicle miles traveled yearly grew from one trillion in 1970 to 2.5 trillion in 1997 and is expected to continue increasing at the rate of two to three percent each year.
- Almost half of the passenger vehicles sold today are higher-polluting light-duty trucks, such as SUVs, and continued sales growth is expected.

EPA concluded that tighter tailpipe emission standards are necessary to maintain the nation's progress in providing Americans with cleaner, healthier air. The Agency also

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[327] The information presented in this case example is excerpted from a regulatory announcement made by the Environmental Protection Agency in February, 2000. *See* Environmental Protection Agency, Office of Transportation and Air Quality, EPA420-F-99-051, *available at* http://www.epa.gov/otaq/regs/ld-hwy/tier-2/frm/f99051.htm <last updated February 14, 2000>. *See also*, 60 Fed Reg. 6697-6870 (Feb. 10, 2000).

[328] *See id.*

[329] *See id.*

[330] For a detailed discussion of the Clean Air Act, see *supra* Section II.

concluded that new emission standards could be achieved cost-effectively with available technology, and that current levels of sulfur in gasoline must be reduced (because sulfur impedes the performance of catalytic converters). In addition, motor vehicles generate about 30 percent of all emissions of nitrogen oxides and volatile organic compounds--the pollution that causes smog.

Therefore, in February, 2000, the U.S. Environmental Protection Agency (EPA) decided to announce more protective tailpipe emissions standards for all passenger vehicles, including sport utility vehicles (SUVs), minivans, vans and pick-up trucks. The regulation marked the first time that SUVs and other light-duty trucks are subject to the same national pollution standards as cars. And, for the first time, the EPA treats vehicles and fuels as a system. Therefore, the EPA simultaneously announced lower standards for sulfur content in gasoline, which will ensure the effectiveness of low emission-control technologies in vehicles and reduce harmful air pollution.

When the new tailpipe and sulfur standards are implemented, Americans will benefit from the clean-air equivalent of removing 164 million cars from the road. These new standards require passenger vehicles to be 77 to 95 percent cleaner than those on the road today and they reduce the sulfur content of gasoline by up to 90 percent.

The new tailpipe standards are set at an average standard of 0.07 grams per mile for nitrogen oxides for all classes of passenger vehicles beginning in 2004. This includes all light-duty trucks, as well as the largest SUVs. Vehicles weighing less than 6000 pounds will be phased-in to this standard between 2004 and 2007.

For the heaviest light-duty trucks, the program provides a three step approach to reducing emissions. First, in 2004, we will implement standards not to exceed 0.6 grams per mile (gpm)--a more than 60 percent reduction from current standards. Second, to ensure further progress, these vehicles are required to achieve an interim standard of 0.2 gpm to be phased-in between 2004-2007, an 80 percent reduction from current standards. Third, in the final step, half of these vehicles will meet the 0.07 standard in 2008, and the remaining will comply in 2009. Vehicles weighing between 8,500 and 10,000 pounds will have the option to take advantage of additional flexibility during the 2004 to 2008 interim period.

Because the EPA considers the vehicle exhaust and fuel as a single system, the EPA has required that beginning in 2004, the nation's refiners and importers of gasoline will have the flexibility to manufacture gasoline with a range of sulfur levels as long as all of their production is capped at 300 parts per million (ppm) and their annual corporate average sulfur levels are 120 ppm. In 2005, the refinery average will be set at 30 ppm, with a corporate average of 90 ppm and a cap of 300 ppm. Both of the average standards can be met with the use of credits generated by other refiners who reduce sulfur levels early. Finally, in 2006, refiners will meet a 30 ppm average sulfur level with a maximum cap of 80 ppm. Gasoline produced for sale in parts of the Western U.S. will be allowed to meet a 150 ppm refinery average and a 300 ppm cap through 2006 but will have to meet the 30 ppm average/80 ppm cap by 2007.

The significant environmental benefits of this program would cost consumers less than $100 for cars, $200 for light-duty trucks and less than two cents per gallon of gas. The EPA estimates the program will cost industry about $5.3 billion. In contrast, health and environmental benefits are estimated to be $25.2 billion.

When fully implemented, this program would be the equivalent of removing 164 million cars from the road. EPA calculates that the final rule will prevent as many as 4,300 deaths, more than 10,000 cases of chronic and acute bronchitis, and tens of thousands respiratory problems a year.

As newer, cleaner cars enter the national fleet, the new tailpipe standards will significantly reduce emissions of nitrogen oxides from vehicles by about 74 percent by 2030. The standards also will reduce emissions by more than 2 million tons per year by 2020 and nearly 3 million tons annually by 2030.

EPA worked extensively with the auto industry, the petroleum industry, states, and environmental and health experts in developing the program to reduce tailpipe emissions in light duty trucks and reduce the sulfur content in gasoline. EPA included several measures in the rule that will ensure flexibility and cost-effectiveness for the automobile and petroleum industries. This flexibility includes:

- establishing a market-based credit system for both the auto and oil industries which will reward those companies who lead the way in reducing pollution sooner than required
- allowing industries to use an averaging program to meet both the car-emission and gasoline-sulfur standards;
- allowing auto manufacturers and refiners to meet strong interim standards while they work towards full compliance of the new standards; and providing small refiners with extra time to meet the sulfur standards.

Section IV: Beyond Compliance

A. Introduction

The previous sections of this report focus on the multiple levels of environmental statutes and regulations that a design engineer must be aware of in order to comply with the law. While compliance with environmental laws is undoubtedly important, compliance should be a starting point, not the end goal, in reducing the environmental impacts of design. This section uses case examples to illustrate the importance of designing beyond compliance.

Designing beyond compliance benefits companies by reducing the risk that they will be forced to react quickly to changing regulations and by generating positive benefits like cost savings or improved reputation with the community. In addition to the benefits that a company may derive from designing beyond compliance, however, is the possibility that designing beyond compliance is necessary to protect human health and the environment. To the extent that design or processes may be within the confines of the law and yet pose dangers to human health and the environment, design engineers have moral or ethical obligations to consider all the consequences of their designs.

B. The Corporate Risks of Resting on Regulatory Minimums

Because environmental regulations are in a perpetual state of flux due to the continual emergence of information regarding environmental impacts, companies that anticipate more stringent regulations and voluntarily design beyond compliance can minimize future risks and liabilities. In addition, these companies can avoid the costly retrofits necessary to reduce emissions standards or to meet new design criteria. Companies that do not act voluntarily to prepare for future regulations eventually may be forced to change their technology in a relatively short time frame. This may result in a less favorable economic outcome than if they had planned and budgeted for the changes over a longer period. The threat of changing regulations, therefore, motivates some companies to design beyond compliance.[331]

The reaction of TransAlta Utilities company to the threat of changing environmental regulations illustrates the point that some companies take a proactive stance on design to sustain their business in the face of new regulations.[332] TransAlta Utilities operated in the province of Alberta, Canada where it provided nearly 70 percent of the area's electricity.[333] Almost 90 percent of this electricity was generated from coal-

[331] Smart, Bruce, ed., Beyond Compliance, (1992) 3.
[332] *See id.* at 93.
[333] *See id.*

fired generating plants.[334] Because the power plants were located in close proximity to surface mines, the company felt little pressure to look beyond coal-generated electricity technology. In addition, because the company saw itself as operating solely within a limited geographic area, the company self-admittedly did not consider the impacts of coal-fired generating plants on the environment as a whole.

The public concern with global warming due to greenhouse gases such as carbon dioxide, however, awakened TransAlta Utilities to the naivete of their assumptions. The company committed itself to reach the goal of becoming a generative, verses reactionary, company.[335] The commitment to this change was shaped in part by the threat of more stringent environmental controls with respect to greenhouses gases.[336] The company was concerned with the quickening pace of environmental legislation after the enactment of the Canadian Environmental Protection Act in 1988.[337] In particular, the company was threatened by the provincial governments that began reviewing their environmental legislation and making a commitment to more stringent standards for industrial use of air, land, and water.[338]

C. The Corporate Benefits of Beyond Compliance Design

The threat of more stringent environmental regulations is not the only factor that should or does motivate companies to design beyond compliance. Companies have also recognized several benefits that flow from taking a proactive stance on environmental issues:[339]

- preventing pollution at the source can save money in materials and in end-of-pipe remediation
- new "green" products and processes can increase consumer appeal and open up new business opportunities
- a reputation for being environmentally progressive improves recruitment, employee morale, investor support, host community acceptance, and the management's self-respect

In practice, for example, Du Pont Corporation reduced both cost and emissions by altering the manufacture of fluorelastomers in New Jersey.[340] Originally, the production unit proposed the installation of an incinerator to reduce air emissions by 200,000 pounds annually.[341] Instead of investing in technology to dispose of emissions after generation, the engineers made changes to the manufacturing process which reduced the generation

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[334] *See id.*
[335] *See id* at 94.
[336] *See id.*
[337] *See id.*
[338] *See id.*
[339] Smart, ed., Beyond Compliance, *supra* 331, at 3.
[340] *See id.*, at 191.
[341] *See id.*

of air emissions by 50 percent at a mere cost of $3,000.[342] After a second phase of process changes, the overall result was an 80 percent reduction in emissions for an investment of $250,000 and an annual savings of $400,000.[343] Compare this to the cost of the initially proposed incinerator, which would have been approximately $2 million dollars to purchase and $1 million per year to operate.[344]

The benefits of pollution prevention initiatives to both the environment and the company is perhaps best illustrated by the cooperative effort between Dow Chemical Company and the Natural Resources Defense Council to reduce pollution generated at Dow's Midland Facility in Midland, Michigan.

Dow - NRDC Pollution Prevention Case Example[345]

In 1996, the Natural Resources Defense Council, Dow Chemical, and a group of five community activists and environmentalists initiated the Michigan Source Reduction Initiative (MSRI). The initiative sought to reduce the waste and emissions of twenty-six priority chemicals at Dow's Midland site by 35 percent by April 30, 1999 using only pollution prevention techniques.

Pollution prevention increases the efficiencies of manufacturing operations and reduces reliance on toxic chemicals while often saving money. Unlike traditional techniques used to control industrial pollution in the United States like incinerators or wastewater treatment plants, pollution prevention improves processes by decreasing the waste at its source before it is even generated. When manufacturing processes are engineered for maximum efficiency, the system requires less raw materials to produce the same amount of output and less waste is generated at the end of the process. Costs savings are realized by the reduced purchase of raw materials and the reduced amount of waste that has to be treated after generation.

Home to eight of Dow's fifteen global businesses, the Dow Midland site occupies more than 1900 acres, employs 4200 people, and manufactures more than 500 products, including pharmaceuticals, plastics, and pesticides. Wastes and emissions are generated during manufacturing from: raw materials that are not consumed in the reaction, solvents used to dissolve the ingredients, unwanted by-products of the reactions designed to manufacture the products, and the products themselves that do not meet specifications. Before the MSRI project began, the Midland facility ranked the eighth largest emitter in the United States of publicly reported toxic releases in the Toxic Release Inventory (TRI) reports.

Over two years, the MSRI project reduced emissions and wastes at the Midland facility by 7 million pounds and saved the company over 5 million dollars annually. These reductions exceeded the aggressive 35% percent reduction goals set by the project

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[342] *See id.*
[343] *See id.*
[344] *See id.*
[345] The content of this example is derived from a report by the Natural Resources Defense Council, *Preventing Industrial Pollution at its Source: A Final Report of the Michigan Source Reduction Initiative*, 1999 *available at* http://www.nrdc.org/cities/manufacturing/msri/msriinx.asp. *See also* Dow Chemical, *1999 Dow Public Report: Michigan Region*, 1999, *available at* http://www.dow.com/environment/99rep/index.html.

participants at the onset of the initiative. Targeted emissions were reduced by 43%, from 1 million to 593,000 pounds. Similarly, targeted wastes were reduced by 37%, from 17.5 million to 11 million pounds. Some chemical wastes like formaldehyde were almost completely eliminated. The types of waste reductions are particularly significant because approximately two-thirds of the wastes (4 million pounds) were chlorinated. These chlorinated wastes were a priority because they generate dioxins and furans when they are incinerated under some conditions. Considering that the Environmental Protection Agency does not consider there to be any safe level of dioxin exposure, the waste reductions achieved through the MSRI project was important.

One of the seventeen pollution prevention projects initiated through the MSRI project sought to completely eliminate the reject product sent to incineration in the production of DURSBAN insecticides.[346] The project has already reduced waste from 1.2 million pounds to 0.7 pounds. The project team currently intends to make all previously rejected product saleable in the future.

In a post-project analysis, a report by the NRDC attributed part of the project's success to the direct interaction of Dow business leaders with activists and environmental participants. While ordinarily only the environmental professionals within a company like Dow interact with outside activists, this project also involved business leaders within the company. Activists learned about how decisions get made, and the Dow management staff learned of the environmental priorities of the world outside of Dow.

Not only was the participation of Dow's business leaders critical to the success of the project, but the project also required the participation of lower level managers to implement what the business leaders agreed to pursue. In combination, the requirement of these two participatory components illustrate that the success of environmental innovation within a company hinges on the commitment and participation of professionals and engineers on all levels, not only the environmental, health and safety personnel. Environmental stewardship must be a company-wide commitment if it is to generate benefits within a corporation.

In spite of the success of the MSRI project, the project also revealed some important limitations of relying on financial incentives to motivate companies to design beyond compliance. First, businesses typically seek out locations for reduction projects where the investments in pollution prevention improvements would lead to the greatest reductions in pounds – where they could get the "biggest bang for the buck." Therefore, had the MSRI project not been initiated by outside activists at the Midland facility, Midland would probably not have been a top candidate for reduction goals because Midland represents relatively small production volumes for most of the businesses within Dow. Global companies may therefore need an external incentive to initiate pollution prevention projects at certain facilities.

In addition, business value alone may not drive pollution prevention within a company because of the small size of many pollution prevention projects. Projects involving small amounts of capital are often overlooked by the engineering staff of large companies even though they can lead to large and significant reduction in wastes and releases. On the other hand, large pollution prevention projects may also be disregarded

[346] Dow Chemical, *1999 Dow Public Report: Michigan Region*, 1999.

because they have to compete with other capital priorities within the company and individual businesses. Given the barriers that inhibit companies from spontaneously initiating pollution prevention projects, it is important for the new generation of engineers to be educated in the benefits derived from pollution prevention projects and cognizant of reduction opportunities in the workplace.

D. The Environmental and Ethical Necessity of Designing Beyond Compliance

Aside from the benefits that a company may derive from designing beyond compliance, designing beyond compliance is necessary on an ethical level because compliance alone does not equate to sustainable design. While such altruism may not really exist in industry independent of the benefits that a company may reap from proactive environmental policies, some companies have at least recognized the importance of taking a "precautionary approach" to designs that impact the environment.

For example, Samuel C. Johnson, the former Chairman of S.C. Johnson Wax, noted that "when we set aside the obvious benefits of being an environmentally responsible company, we are left with the simple human truth that we cannot lead lives of dignity and worth when the natural resources that sustain use are threatened or destroyed. We must act responsibly and we must act now."[347] Signifying that these were not hollow words, S.C. Johnson company began manufacturing aerosols without fluorocarbons three years before the United States government banned CFC propellant usage for aerosols in 1978 and twelve years before the Montreal Protocol's global call to action in 1987.[348] The foresight of the S.C. Johnson company, in fact, was instrumental in convincing Congress that aerosols could be manufactured without CFCs, thus setting a new industry standard.

In spite of the proactive environmental policies exhibited by some companies with regard to some of their products or processes, there is undoubtedly many environmental issues that require attention – problems that exist despite regulatory compliance. The following examples regarding the problems of pesticide use in the United States and the impact of methyl tertiary butyl ether (MTBE) illustrate the risks to human health and the environment that exist despite compliance. While some would argue that the government bears the responsibility for protecting human health and the environment, consider whether the gaps in regulatory protection are best filled by the companies that are more closely connected to the impacts, intricacies, and alternatives of their designs.

The Pesticide Problem Despite Technical Compliance[349]

Sometimes environmental compliance does not adequately protect human health or the environment. In the pesticide chemical industry, for example, the consequences of

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[347] *See* Smart, *supra* note 331, at 87.
[348] *See id.*
[349] *See generally*, David Pimentel and Hugh Lehman, eds., The Pesticide Question: Environment, Economics, and Ethics, (1993) for a collection of essays outlining the pesticide problem in the United States.

using a particular pesticide are not necessarily known in spite of the pesticide's widespread use and registration with the EPA. In fact, as long ago as 1969, the Secretary of Health, Education and Welfare's Commission on Pesticides and Their Relationship to Environmental Health emphasized the problems of the widespread contamination of air, water, soil, food, and human bodies by persistent insecticides.[350] Further, he pointed out the "absurdity of a situation in which 200 million Americans are undergoing lifelong exposure, yet our knowledge of what is happening is at best fragmentary."[351]

The unpredictable reach of the effects of pesticides is illustrated by the use of heptachlor on pineapples in Hawaii. In 1978, the EPA cancelled all the uses of heptachlor, except one. The EPA continued to allow heptachlor use on pineapples in the Hawaiian Islands to control pineapple mealybugs.[352] As a result, when the pineapple tops were fed to dairy cattle as "green chop", the heptachlor residues were concentrated in milk as a more toxicand more persistent carcinogen, heptachlor epoxide. The heptachlor epoxide residues were transferred to virtually all the inhabitants of the Islands. Mother's milk was found to be contaminated with residues of heptachlor epoxide and infants were ingesting several times the "acceptable daily intake" as determined by the Food and Agriculture Organization and the World Health Organization.[353] The results of this regulatory omission was telling of the consequences of uninformed pesticide use and telling of the how human health and the environment can be adversely impacted despite compliance. .

The Problem with MTBE[354]

Methyl tertiary-butyl ether (MTBE) is part of a group of chemical compounds known as "oxygenates". MTBE is used as a fuel additive in motor gasoline. By raising the oxygen content of gasoline, these oxygenates help gasoline burn more completely, thus reducing the harmful tailpipe emissions from motor vehicles. Since 1992, MTBE has been used to fulfill oxygenate requirements set by Congress in the 1990 Clean Air Act Amendments. The use of MTBE in gasoline has resulted in the annual reductions of smog-forming pollutants (e.g. volatile organic compounds and nitrogen oxides) and toxics (e.g. benzene). Most refiners choose MTBE over other oxygenates, such as ethanol, primarily for its blending characteristics and for economic reasons. In fact, about 30 percent of the country's gasoline is reformulated, of which about 87 percent contains MTBE.

Ironically, even though the use of MTBE affords air quality benefits, MTBE has been found to contaminate surface and groundwater supplies. MTBE contaminates the environment through leaks and overflows in underground petroleum storage tank systems

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[350] *See id.* at 429.
[351] *See id*. at 429.
[352] *See* Robert L. Metcalf, *An Increasing Public Concern*, in The Pesticide Question, 1993, at 427.
[353] *See id*.
[354] The information provided in this example is derived mainly from the Environmental Protection Agency, *Methyl Tertiary Butyl Ether (MTBE): Overview*, 2000, *available at* http://www.epa.gov/mtbe/faq.htm. *See also*, James E. McCarthy and Mary Tiemann, Congressional Research Service Report to Congress, Environment and Natural Resources Policy Division, *MTBE in Gasoline: Clean Air and Drinking Water Issues*, 1998, *available at* http://www.csa.com/hottopics/ern/99may/air-26.htm.

or from spills on land, emissions to water from motorized watercraft, and atmospheric deposition. Because of its volatile, flammable, and highly soluble nature, MTBE is volatilized to the atmosphere from gasoline production, refueling activities, and from incomplete combustion in automobile engines. After dissolving into atmospheric moisture, MTBE returns to the land through precipitation. Since MTBE does not sorb strongly to organic matter in soils, it is easily washed or leached away. In surface waters, MTBE quickly volatilizes back into the air. Once dissolved in groundwater, however, MTBE moves quickly and freely, thus persisting much longer than other petroleum constituents.

MTBE's appearance in surface and ground waters has recently raised concerns about health risks associated with its inhalation and ingestion. Fortunately, the unpleasant taste and odor make its presence in drinking water obvious to most people. Unfortunately, public water supply reservoirs is still one of the top three water quality concerns associated with the use of MTBE in gasoline. As the EPA continues to investigate the health risks associated with MTBE contamination, refiners may face new regulations and be forced to consider more expensive alternative oxygenates such as ethanol.

MTBE is a telling example of how meeting regulatory requirements for one media, e.g. air, does not guarantee that other media, e.g. water, will benefit in kind. The challenge facing design engineers is therefore to consider the impacts of a chemical, product, or process in areas or media outside of that for which the chemical or product is designed. Thinking about the holistic impacts of design not only helps to generate a design that mitigates potential environmental impacts, but it also avoids choosing design alternatives that may be the subject of regulation once those impacts become apparent.