CHAPTER 14

# LEGAL PROTECTION OF GROUND WATER

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The protection of ground water in the United States is accomplished through a set of statutes passed at different times. These statutes are not comprehensive; instead, they cover specific types of problems that cause ground water contamination. These statutes reflect the political issues of the time of their passage and incorporate different relationships between the executive and legislative branches.

This chapter will present: (1) the governmental institutions that address ground water contamination; (2) the major requirements of the various acts; and (3) case studies associated in the various programs. It is the goal of this chapter that both the substance and the process of ground water protection will be addressed and made understandable.

## 14.1 THE PROCESS OF GROUND WATER PROTECTION

Several federal statutes protect ground water: the Safe Drinking Water Act of 1974, the Resource Conservation and Recovery Act of 1976 (RCRA), the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the Hazardous and Solid Waste Amendments of 1984 (HSWA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA).

These federal statutes are implemented under the auspices of the U.S. Environmental Protection Agency (EPA). EPA publishes regulations in the Federal Register through a process known as informal rule-making. Regulations are published as "draft" regulations and are commented upon by the regulated public, environmental groups, and other interested parties. After consideration of these comments, EPA will promulgate "final" regulations in the *Federal Register*. Each year, the rules of the agency are codified in a single document titled *Code of Federal Regulations* (CFR). The final regulations of the EPA are just as binding as are the terms of the statutes.

EPA is part of the executive branch of government that is headed by the President of the United States. A dynamic exists between the executive branch and legislative branch (the House of Representatives and the Senate). In essence, the Congress writes the policy of the United States in the form of statutes, and the executive branch (i.e., EPA) implements that policy through rule-making.

A key issue is the extent of the discretion that is delegated to EPA by Congress. In the early days of ground water regulation, EPA was granted a great degree of discretion by Congress. However, a major disagreement emerged between EPA and Congress in the early days of the Reagan Administration. Conflicts emerged over the implementation of the newly-passed CERCLA/Superfund program as well as RCRA. These conflicts culminated with the criminal indictment of Rita LaVelle for perjury and the exit of Ann Burford as the Administrator of EPA.

Since that time, Congress has taken substantial discretion away from EPA with regard to the implementation of ground water protection. Stated otherwise, Congress has been much more explicit in its policy statement, leaving less policy discretion in EPA headquarters. This dispute between EPA and Congress is important because it was the driving force in the 1984 HSWA amendments that in turn substantially altered U.S. ground water policy. This dispute also will have a bearing on future initiatives by Congress in the ground water arena.

A second institutional issue of importance is the role between the states and EPA. Just as there is a dynamic between Congress and the EPA, there is also a dynamic between the states and EPA. Under the United States Constitution, states are the repository of governmental power whereas the federal government has limited power. Federal environmental control is undertaken pursuant to the commerce clause of the Constitution.

The states have a very strong role in ground water protection. First, all laws about ground water supply and allocation arise under state rather than federal law. Second, each state has property rights and tort concepts that apply to ground water. For example, if your neighbor contaminated your ground water, there may be rights that you as a landowner can assert in state court. These rights are in addition to, and distinct from, federal environmental law. These will not be covered in this chapter.



Every state has one or more administrative agencies that are the state counterpart to EPA. Ground water protection programs of the federal government are implemented in whole or in part by these state agencies. As a general rule, the state program must be as strong as the federal program. It can, however, be more stringent. The state program may be designated through a process called delegation to act on behalf of EPA. If delegation occurs, then a separate regulatory program will not exist at EPA for that state for those matters that have been delegated.

Confusion sometimes exists when some portions of a program have been delegated and some have not. For example, when HSWA was passed in 1984, it substantially changed the RCRA program. Most states had already been delegated the RCRA program. For that reason, the HSWA program was implemented by EPA until the state could pass regulations sufficiently strong to allow delegation of the new HSWA programs. As of 1991, most of the HSWA requirements have been delegated to the states.

In this chapter, ground water law will be presented from the standpoint of the requirements of federal law and EPA regulations. This should define the "bottom line" of ground water protection throughout the United States. It is important to remember that each state may have variations from this "bottom line" and these state requirements should always be consulted to be confident about the status of regulation in any particular state.

Finally, it is important to note that this ground water system is constantly being reviewed, criticized, interpreted, and reinterpreted by EPA, Congress, and the court system. Given that Superfund site clean-ups may cost hundreds of millions of dollars and ground water contamination can paralyze a community with fear, it is inevitable that changes and fine-tuning will occur in this system.

## 14.2 THE SAFE DRINKING WATER ACT OF 1974

The Safe Drinking Water Act (SDWA) of 1974, passed because of concerns regarding the safety of public water supplies, set forth two large initiatives. First, the EPA was empowered to develop drinking water standards throughout the United States for public water supply systems. Second, the EPA was given responsibility for implementing a broad-scale ground water protection program called the Underground Injection Control (UIC) program.

Of the two major programs, only the UIC program protects ground water. The drinking water standards govern the quality of water delivered to the consumer but does not regulate sources of ground water contamination. Stated otherwise, the drinking water program prevents the delivery of contaminated water to the ultimate consumer but does not prevent the occurrence of contamination. That responsibility is vested in the UIC program.

The SDWA was passed before Congress determined that the federal government would directly regulate ground water protection activities. For this reason, the UIC program gives

the states a major role in the implementation of this act. Under the SDWA, EPA was empowered to develop general regulations for underground injection control. Then, each state is required to adopt rules and regulations implementing the UIC program, including the development of a state permit program. EPA is authorized to implement a program in any state that does not have its own program.

The UIC program regulates underground injection of fluids into wells. A well is defined as a hole in the ground that is deeper than it is wide or long. A fluid is defined to include liquids, semi-solid material and other nonliquid substances. According to the SDWA, a state must have a regulatory program to prevent underground injection, that endangers drinking water sources. A drinking water source is considered to be endangered if underground injection results in the placement of any contaminant into an underground source of drinking water and such contaminant results in a violation of the national primary drinking water standards.

Under the regulations promulgated by EPA to implement the SDWA, five classes of underground injection wells have been identified.

- Class I wells inject hazardous waste or industrial or municipal waste below the lowermost underground source of drinking water (USDW).
- Class II wells inject fluids brought to the surface in association with oil and gas production or injected as part of a secondary and tertiary recovery process.
- Class III wells inject fluids for the extraction of minerals, including the Frasch method of mining sulfur.
- Class IV wells inject hazardous waste into or above an underground source of drinking water.
- Class V wells are those that are not included in classes I- IV. Class V wells include air conditioning return flow, community cesspools (not single family), cooling water, drainage wells, dry wells, recharge wells, saltwater barrier wells, backfill wells, community septic system wells (not single family), subsidence control wells, radioactive waste wells, geothermal injection wells, conventional mine solution wells, brine extraction wells, injection wells for experimental technologies and injection wells used for the in situ extraction of lignite, coal, tar sands and oil shale.

As a general premise, all of the above underground injection wells may be permitted by the state except for Class IV wells, that are prohibited (40 CFR 144.13). The state is not required to allow underground injection; however, if it chooses to allow underground injection, this injection must be accomplished in accordance with the EPA regulations appearing at 40 CFR Part 146.

Underground injection of waste is only one part of the activities regulated by the UIC program. Although passed in 1974, the regulations implementing this act were not promulgated by EPA until 1980 at the same time that the RCRA regulations were promulgated.



The definition of hazardous waste used for Class I and Class IV wells is the same for the SDWA as it is for the RCRA program. For a discussion of what a hazardous waste, see the discussion under RCRA.

A substantial amount of controversy has been generated by the oil and gas lobby over the potential effect of the UIC regulations on the extraction of oil and gas, leading to the establishment of a separate Class II well for oil and gas exploration and production. Brine waste is generated in the production of oil and gas, and water often is injected into the ground to "enhance" production in depleted reservoirs. Permits are not necessary for individual wells but can be obtained for entire fields. The oil and gas lobby was so strong that Section 1425 was added to the SDWA in 1980 to allow an optional approach to regulating underground injection associated with oil and gas production.

Underground injection is accomplished by injecting fluids at high pressure into a well. The regulations established by EPA require that these wells be cased and that the casing be cemented into the geologic formation. The space between the well and the casing—called the annulus—must be filled with a fluid and a positive annulus pressure must be maintained such that if a leak occurs, the leak will be from the annulus into the well rather than from the well outward.

A substantial amount of site-specific geologic and construction data is required to obtain a permit for underground injection of hazardous waste. First, the injection of hazardous waste must be below the lowermost source of drinking water. Second, the injection must be into a formation that is suitably permeable and confined by impermeable layers. Third, the confining zone must be free from faults, fractures and punctures (wells). Corrective action may be required to plug abandoned wells that could allow the upward migration of hazardous waste (40 CFR 146.7). And fourth, the well must exhibit mechanical integrity. Mechanical integrity means that there is no significant leak in the casing, tubing or packer and there is no significant fluid movement into an underground source of drinking water through vertical movement adjacent to the well (40 CFR 146.8).

One of the major differences between the UIC program and the RCRA program is that ground water monitoring is not required for the UIC program. Instead, the UIC program depends upon remote sensing and integrity analyses to determine whether the fluid is actually staying where it is supposed to stay. In this manner, the UIC program differs substantially in philosophy and in specific regulatory provisions from the RCRA program.

Substantial disagreement exists among experts as to the desirability of underground injection of wastes. Underground injection generally does not require pretreatment and results in the long-term presence of hazardous waste and other wastes in the receiving formation. As such, underground injection is not destruction but simply land disposal and storage. The continuation of the practice of underground injection was in question after the passage of the Hazardous and Solid Waste Amendments of 1984, with the ban on land disposal of hazardous waste. Underground injection is subject to the land ban, but EPA, particularly region 6, has "no migration" of the waste for 10,000 years, thereby triggering an exemption to the land ban. For more on the land ban, see the section on HSWA.

The UIC program covers more than waste disposal. Many economic activities may threaten ground water through mining activities or nonwaste-related activities. To the extent

that they involve injection of fluids through a well, such activities are regulated under the SDWA if underground sources of drinking water are potentially affected.

## 14.3 THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

The Resource Conservation and Recovery Act (RCRA) was passed in 1976. RCRA is the centerpiece of United States efforts to protect ground water and to regulate solid waste and hazardous waste. Although RCRA was passed in 1976, regulations implementing the hazardous waste requirements of RCRA were not promulgated by EPA until November, 1980. Comprehensive regulation of hazardous waste did not exist prior to November of 1980.

A recurring theme of United States hazardous waste laws is to make the generator of hazardous waste responsible for the ultimate fate of that waste. As will be seen, RCRA set in motion a comprehensive system for tracking hazardous waste. The point here, however, is that a uniform system of regulation did not exist prior to late 1980 and many ground water problems were in existence at the time RCRA became effective. In all of these ground water protection statutes and their amendments, Congress is continually trying to bring all ground water contamination sources under either the RCRA or CERCLA programs.

The RCRA forever changed the solid waste disposal practices of the United States and is an extremely powerful piece of legislation. However, it is important to note that it is part of a comprehensive approach to solid waste management with references to solid waste in the definitions and provisions of RCRA. The regulation of municipal solid waste disposal is undertaken pursuant to Subtitle D of RCRA whereas the disposal of hazardous waste is regulated under Subtitle C of RCRA. For purposes of this subpart, the manifest system of RCRA will be discussed first, followed by a discussion of hazardous waste permitting under RCRA and then permitting of sanitary landfills under Subtitle D.

RCRA has been amended several times since its initial passage. The most far-reaching of these amendments have come from the Hazardous and Solid Waste Amendments of 1984 (HSWA). To the extent possible, the HSWA changes will be treated in a separate section because these amendments significantly altered the requirements for hazardous waste disposal in the U.S. In some instances, however, the HSWA changes will be mentioned in the discussion of RCRA. All of these changes have a significant impact upon what is legal at what point in time. Stated otherwise, an act that was legal in 1990 may not be legal in 1991 as new provisions become applicable.

### 14.3.1 Goals and Objectives of RCRA

RCRA is a far-reaching act that does more than control the handling and disposal of hazardous waste. Section 1003(b) states:



> (b) NATIONAL POLICY. The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment.

The objectives of RCRA are set forth in Section 1003(a) and include the following:

> (a) OBJECTIVES. The objectives of this Act are to promote the protection of health and the environment and to conserve valuable material and energy resources by:
>
> (3) prohibiting future open dumping on the land and requiring the conversion of open dumps to facilities which do not pose a danger to the environment or to health;
> (4) assuring that hazardous waste management practices are conducted in a manner which protects human health and the environment;
> (5) requiring that hazardous waste be properly managed in the first instance thereby reducing the need for corrective action at a future date;
> (6) minimizing the generation of hazardous waste and the land disposal of hazardous waste by encouraging process substitution, materials recovery, properly conducted recycling and reuse, and treatment.

Additionally, Congress made specific findings with regard to solid waste, environment and health, materials, and energy in Section 1002 of the Act. The bottom line is that the generation of hazardous waste is to be reduced over time, proper recycling should be encouraged, and destruction and detoxification of hazardous waste should be encouraged. The details of the realization of these lofty goals are contained in the specific requirements of the various programs.

### 14.3.2 The RCRA Manifest Program

Within the RCRA structure, standards are set out for facilities that generate hazardous waste, transporters of hazardous waste, and facilities that store, treat or dispose of hazardous waste. Section 3002(a)(5) of RCRA requires that a manifest system be established "... to assure that all such hazardous waste generated is designated for treatment, storage, or disposal in, and arrives at treatment, storage and disposal facilities ... for which a permit has been issued..." In other words, the manifest program is to track the hazardous waste from the generator through the transporter to the treatment, storage and disposal (TSD) facility.

Essentially, the manifest is a set of papers. The intent of the manifest program is to create a "paper trail" to follow the waste from "cradle to grave." The generator initiates the manifest and gives the manifest to a transporter who must follow the manifest's instructions on the delivery of the hazardous waste to a TSD facility. The generator retains a copy of the

manifest when the waste is picked up and gives the manifest to the transporter. The transporter delivers the waste to the site identified on the manifest and passes on the manifest, retaining a copy for her records. The TSD facility must be permitted to receive the waste. Upon receipt of the waste, the TSD facility retains a copy and returns the manifest to the generator, thereby completing the cycle. If the manifest is not returned within 35 days, the generator is responsible for finding the missing hazardous waste and must submit an exception report to EPA if the waste is not found within 45 days.

RCRA and the manifest program have divided the world of hazardous waste into parts. There are generators, transporters, and TSD facilities. Each generator and transporter have an identification number and each TSD facility must be permitted. RCRA is clear that the generator is responsible for determining where the waste is sent, thereby removing transporters and disposers from their pre-1980 "turn-key" role. Today, a prudent generator will perform an extensive investigation of the disposal company taking the waste in order that clean-up liability and environmental damage liability will not be realized under other statutes, such as CERCLA.

### 14.3.3 Generator Responsibility

It is the responsibility of the generator to determine whether its waste is hazardous. The definition of hazardous waste under RCRA is very complex and full of loopholes. A hazardous waste is a solid waste that can cause or increase mortality or serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed (RCRA section 1004(5)).

As a practical matter, many wastes can be excluded as being hazardous by definition, including waste from oil and gas exploration and production. If a waste is not excluded, it may be listed as a hazardous waste by source or by name. If a waste is not excluded but not listed, it must be tested to determine if it is (1) ignitable; (2) reactive; (3) corrosive, and (4) toxic. If the waste meets any one of those four tests, it is a RCRA hazardous waste.

A manifest is not required for all hazardous waste disposal. If a generator is disposing of hazardous waste on-site, no manifest is required. If fewer than 100 kilograms of hazardous waste are generated per month and that waste is not acutely hazardous, no manifest is required and that waste may be disposed of in facilities not permitted for hazardous waste disposal. Similarly, in some situations, hazardous wastes that are being recycled may be excluded from the manifest requirements. Otherwise, the generator is required to initiate a manifest. In addition to manifesting, the generator must prepare the hazardous waste for shipment. The waste must be packaged, labeled, marked, and/or placarded prior to shipment in order that the hazardous waste will be properly identified. A generator must not accumulate hazardous waste on-site awaiting shipment for too long a time or in too great a quantity. Otherwise, the generator may be deemed to be a storage facility subject to permitting requirements. A generator normally is not required to obtain a hazardous waste permit. Finally, extensive record-keeping is required of the generator and a biennial report must be submitted to the EPA.



Throughout the requirements applicable to generators, provisions of the regulations inquire as to the waste reduction accomplished by the generator. For example, the biennial report requests a comparison of the volume of hazardous waste generated in the prior reporting period to the volume generated this reporting period. This and many other provisions press the generator to reduce the volume of hazardous waste.

On the other hand, regulatory changes may substantially increase the amount of hazardous waste. For example, EPA adopted a new procedure for testing for the toxicity requirement in 1990. The toxicity characteristic leaching procedure (TCLP) increased substantially the volume of hazardous waste generated in the United States and made many facilities RCRA hazardous waste generators overnight.

### 14.3.4 Transporter Requirements

The requirements applicable to transporters are very straightforward. Transporters must have an EPA identification number and must follow the Department of Transportation regulations for transporting hazardous materials as set forth in 49 CFR Subchapter C. Transporters must sign for the hazardous waste when they pick it up and must follow the instructions of the manifest. It is illegal for a transporter to pick up hazardous waste without a manifest unless the generator generates fewer than 100 kilograms per month. Under the RCRA scheme, the transporter simply provides a service of transportation and is removed from major decision-making with regard to the place and type of disposal activity.

### 14.3.5 TSD Facility Requirements

All TSD facilities must be permitted in order to receive manifested hazardous wastes. The receiving facility must verify that the amount and type of waste received matches the amount and type of waste manifested. The receiving facility must sign the manifest, leaving a signed copy with the transporter, retaining a signed copy for its own records and sending the original back to the generator within 30 days. The owner or operator of a TSD facility must retain manifests for three years and must keep an operating record identifying the disposition of each waste shipment. Each TSD facility is required to submit a biennial report.

A waste analysis plan must be developed by TSD facilities to insure that the waste delivered indeed matches that which was manifested (40 CFR 265.13(b)). An attempt must be made to reconcile manifest discrepancies. If the discrepancy is not resolved within 15 days, then the TSD facility must report the discrepancy to the Regional Administrator of the EPA and identify the manifest at issue and attempts to resolve the discrepancy.

The manifest program was intended to make illegal disposal of hazardous waste very difficult. As will be seen in the next section, RCRA imposed very strict standards on facilities that treat, store, and dispose of hazardous waste. However, if hazardous waste is simply thrown in an abandoned pit or upon the side of the road, the most stringent permitting program will fail to protect ground water. Therefore, the manifest was viewed as Step 1 in the national strategy under RCRA to protect ground water.

### 14.3.6 The RCRA Hazardous Waste Permitting Program

Subtitle C of RCRA created a program for the permitting of facilities that treat, store, or dispose of hazardous waste in Section 3005(a). Under this section, facilities in existence on November 19, 1980, were to be treated differently from facilities constructed after that date. Facilities in existence as of November 19, 1980, were eligible for "interim status," which allowed these facilities to continue operation until a permit application could be filed and a final permit issued. Therefore, a distinction exists between interim status facilities and final permitted facilities or new facility permits.

The rationale for this distinction is valid and created one of the most interesting of all permitting systems in federal environmental law. Unlike air and water pollution, hazardous waste deposited into the ground is not going to disappear if the dumping activity ceases. Indeed, the United States is full of sites that continue to contaminate ground water decades after the disposal activity ceased. On the other hand, EPA had no records of the location of hazardous waste disposal activities around the country in the late 1970s. For these two reasons, existing facilities that were storing, treating or disposing of hazardous waste were given "interim status" if they would identify themselves and adhere to minimal regulations.

Essentially, interim status allowed existing sites to continue operation until the magnitude of the contamination problem was assessed and the safety the operations evaluated. Interim status also gave the United States time to develop other technologies for hazardous waste disposal. In the sections that follow, interim status is described first, followed by final permitting.

### 14.3.7 Interim Status

The RCRA permitting concept essentially turned the traditional permitting concepts around. Instead of environmental controls being required when the permit is issued, "interim status" simply brings the industry into the permitting program. The important environmental controls occur when the "interim status" facility moves to final permitted status after several years of ground water data collection. Stated otherwise, the controls are on the back end of the RCRA interim status program, not the front end.

All interim status facilities had to file a Part B application to matriculate from interim status to final permitted status. Most of these Part B applications were filed between 1985 and 1987. In order to receive a final permit, very stringent environmental performance standards have to be met. A large number of interim status facilities, perhaps up to 75%, are not safe enough to be granted final permits. These facilities must undertake "closure" activities. A significant amount of environmental clean-up occurs at the "closure" stage.

Once a TSD facility qualifies for interim status, the EPA regulations at 40 CFR Part 265 become applicable. These regulations apply to treatment, storage, and disposal facilities, and contain specific requirements with regard to activities such as tanks, surface impoundments, waste piles, land treatment, landfills, incinerators, thermal treatment and chemical, physical and biological treatment. However, there are number of requirements that apply to all TSD facilities.



### 14.3.8 Ground Water Requirements

If land disposal alternatives such as surface impoundments, landfills or land treatment facilities were used to manage hazardous waste and were granted interim status, then ground water monitoring was required to be implemented within one year. This ground water monitoring program must be carried out during the life of the facility and during the post-closure care period for these disposal facilities. The ground water monitoring regulations are found at 40 CFR 265.90-94.

An upgradient well is required to test the uppermost aquifer for background levels that will be used for comparison purposes with downgradient wells. With downgradient, at least three wells are required although more may be necessary to immediately detect any statistically significant concentrations of hazardous waste or hazardous waste constituents in the uppermost aquifer (40 CFR 265.91). The number, location, and depths will vary to reflect the geometric and geologic complexity of the site.

If there are multiple land disposal units on site, then the "waste management area" must be adequately monitored. The boundaries of the waste management area will be determined on a case-by-case basis, but once determined, at least one upgradient and at least three downgradient wells must be present at the boundaries of the waste management area to immediately detect leakage of contaminants. All ground water monitoring wells must be cased to maintain the integrity of the monitoring well bore hole.

Once these ground water monitoring wells are located and completed, the owner or operator must develop and follow a ground water sampling plan. This plan will identify how samples are collected, preserved and shipped, as well as how the samples are analyzed and chain of custody of the samples (40 CFR 265.92). These wells must be sampled for EPA interim drinking water standards in Appendix III as well as parameters for ground water quality such as chloride, iron, manganese, phenols, sodium and sulfate. Further, monitoring is required of ground water contamination indicators such as pH, specific conductance, total organic carbon (TOC) and total organic halogen (TOH). Background levels must be established for each of these parameters. The sampling frequency is more intense in the first year, with quality parameters being measured annually thereafter and contamination indicators being measured at least semi-annually thereafter. The ground water elevation must be determined each time the well is sampled.

Further, the owner or operator must prepare a ground water quality assessment program that includes a more comprehensive ground water monitoring program. This ground water quality assessment program must be capable of determining whether hazardous constituents have entered the ground water, the rate and extent of contaminant migration, and the concentrations of hazardous waste or hazardous waste constituents in the ground water. For the ground water contaminants, pH, specific conductance, TOC and TOH, the Students t-test must be utilized to determine whether statistically significant increases have occurred over the monitored background (upgradient) concentrations.

Within 15 days of notifying EPA, the facility must develop a plan certified by a qualified geologist or geotechnical engineer for a ground water assessment program. This assessment plan must include number, location, and depth of wells, including the development of

new wells. Sampling must be increased to include all hazardous waste and hazardous waste constituents at the facility. Further, evaluation procedures must be specified and schedules set forth identifying the implementation of the program over time.

The importance of ground water monitoring to the RCRA scheme cannot be overemphasized. Interim status facilities were allowed to continue in operation but only long enough to determine the ground water problems and issues associated with the facility. If the facility has no major ground water problems, then the facility may be granted final permitted status. If, however, the ground water contamination is severe enough, the owner or operator may have to close the facility and undertake corrective action to remediate the ground water contamination.

It should be noted, however, that the EPA regulations do not require immediate clean-up or corrective action in the case where contamination of the ground water is found. As long as the facility is active, ground water contamination can be identified, studied, and evaluated for a substantial amount of time. Indeed, a shortcoming of the RCRA structure is that the ground water analysis may take an extremely long time to be completed, with substantial discretionary authority being given to the agency to allow continued study prior to action.

### 14.3.9 Closure and Post-Closure Care Requirements

Perhaps no provisions distinguish RCRA from other statutes as do the requirements for closure, post-closure care and corrective action. These requirements reflect the fact that contamination of soil and ground water is not dissipated as are air and water pollution. Even though the hazardous waste storage, treatment, and disposal may be completed, the impacts of that activity remain after cessation of the TSD activity.

Closure plans are required of all facilities having interim status. A performance standard is established for closure that has three parts. First, all facilities must be closed in a manner that minimizes the need for further maintenance. Second, facilities must be closed in a manner that controls, minimizes or eliminates—to the extent to protect human health and the environment—post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products into the ground or surface waters or into the air. And third, the closure must meet requirements specific to various types of facilities. As can be seen, the key terms are: controls, minimizes or eliminates. The closure requirement, therefore, will vary upon the facts of a particular situation.

A closure plan must be prepared that identifies how long the facility will continue to operate and how the waste on site will be handled after closure. Obviously, waste will have to be removed from treatment and storage facilities and the closure plan requires an identification of how such removal is to be accomplished. In the case of land disposal facilities, waste may be left on-site and contained or removed from the site. These plans are to be maintained during the life of the interim status facility and shown to the Regional Administrator upon request. If changes occur in the operation of the facility, then the closure plan must be amended.



### 14.3.10 Permitted Facility Requirements

Interim status facilities matriculate to final permitted status over time. Initially, the time for submitting a Part B application for final permitted status was unclear. However, the Hazardous and Solid Waste Amendments of 1984 specified that interim status would expire for land disposal facilities that failed to submit part B applications within 12 months of the passage of HSWA. In addition to submitting a Part B application, the land disposal facilities had to certify that they were in compliance with the ground water monitoring and financial responsibility requirements of interim status regulations.

Once the Part B application has been submitted, the agency conducts a review to determine whether the final RCRA permit should be issued or denied. If the determination is made that the permit should be issued, then a detailed permit will be issued that identifies the terms and conditions under which that facility must operate. This permit review process includes substantial detail as well as steps where the agency staff reviewing an application will send notices of deficiency (NODs) to the applicant. There are different types of deficiencies, including administrative and technical ones. Administrative completeness is first determined to insure that the applicant has answered all of the questions and blanks in the application. The second NOD is a technical one concerned with the substance of the permit application. Here, the applicant is told of problems in the application as submitted and the need for new or reviewed information to support a determination to issue the permit.

An important part of the permit process is the RCRA facility assessment (RFA). The RFA is a study of existing (e.g., interim status) facilities to determine the status of their RCRA compliance including the results of their ground water monitoring and evaluation. If substantial ground water contamination exists, then a major hurdle will exist in moving to final permitted status.

General standards exist that are applicable to facilities that have been permitted to store, treat, and dispose of hazardous waste. These regulations are found at 40 CFR Part 264. The facility must comply with these regulations as well as the requirements of the permit. These standards include requirements for good housekeeping to minimize the potential for ground water contamination as well as specific aspects associated with closure and post-closure care. Specific standards are identified for various types of disposal activities, including incinerators (40 CFR Part 264, Subpart O) and landfills (40 CFR Part 264, Subpart N) as well as several other storage or disposal alternatives.

These standards include design requirements as well as operating requirements. For example, in the landfill section, elements associated with landfill design are specified to protect the ground water. Here, a liner is required that has been designed to prevent migration of the waste from the landfill to the surrounding soil, ground water, and surface water. This liner system is required to contain a top liner, a composite bottom liner, a leachate collection, and removal system and a leak detection system (40 CFR 264.301). The permit will contain sufficient provisions to implement these and other requirements.

As will be shown in the section discussing the Hazardous and Solid Waste Amendments of 1984, many disposal options have been eliminated or substantially restricted by the ban on the land disposal of hazardous wastes. Therefore, a significant portion of the interim

status facilities never received final permitted status and instead went straight to closure and post-closure care. Also, many interim status disposal facilities identified ground water contamination and went to closure, post-closure care, and remediation.

These facility standards have been adopted by most states in the United States. In such a situation, RCRA provides that the federal program may be delegated to the state for implementation if the state program is "consistent" with the federal program (40 CFR 271.4). Therefore, as a practical matter, much of actual business of protecting ground water under RCRA is undertaken by state agencies implementing a state program that is consistent with the RCRA requirements and EPA guidelines rather than by the Environmental Protection Agency itself.

## 14.4 THE HAZARDOUS AND SOLID WASTE AMENDMENT OF 1984 (HSWA)

RCRA was amended in 1984 by a Congress that was unhappy with EPA's early implementation of the act. The head of EPA during the early days of RCRA and CERCLA implementation substantially reduced EPA's budget and cut its personnel from 11,000 to 6,000.

Congress was upset over the EPA's decision to allow the disposal of free liquid hazardous waste in land disposal facilities. This was not a result Congress intended in the initial passage of RCRA and Congress no longer trusted the EPA to implement general policy directives. With the passage of the Hazardous and Solid Waste Amendments of 1984 (HSWA), Congress signaled a major change of national environmental policy. No longer was Congress willing to let EPA be in charge of hazardous waste policy. Congress took policy control over hazardous waste back from the executive branch.

The changes of HSWA were swift and far-reaching. First, a ban on the land disposal of hazardous waste was implemented. Second, the small generator exemption was substantially reduced. Third, underground storage tanks became regulated. And fourth, an overlooked area of hazardous waste disposal—solid waste management units or SWMUs ("smoos")—became regulated.

### 14.4.1 The Land Ban

Section 101(a)(7) of HSWA created a new section 1002(b)(7) of RCRA that states:

> (b) ENVIRONMENT AND HEALTH.—The Congress finds with respect to the environment and health, that:
>
> (7) certain classes of land disposal facilities are not capable of assuring long-term containment of certain hazardous wastes, and to avoid substantial risk to human health and the environment, reliance on land disposal should be minimized or eliminated, and land disposal, particularly landfill and surface impoundment, should be the least favored method for managing hazardous wastes.



In order to implement this Congressional finding, Congress enacted certain prohibitions on land disposal. Over time, successive prohibitions would apply. Land disposal was defined for purposes of the land ban in a new subsection 3004(k) to include "... any placement of such hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation or underground mine or cave."

Initially, the disposal of free liquids into salt domes was prohibited. Six months after the date of enactment of HSWA, a prohibition against the disposal of bulk or noncontainerized liquid hazardous waste into landfills took effect. More generally, the placement of any noncontainerized liquids into a hazardous waste landfill was prohibited in Section 3004(c)(3), as amended.

The prohibition against the land disposal of liquids was a priority of Congress due to the high potential for ground water contamination associated with free liquid hazardous waste. However, Congress went much further in HSWA than simply banning the disposal of free liquid hazardous waste in landfills. The HSWA land ban also included a prohibition of varying types of land disposal activities at varying time increments.

For example, the land disposal of certain types of solvents and dioxin-containing material was banned 24 months after the passage of HSWA (except for deep well injection). The land disposal of certain heavy metals, liquid hazardous waste with a very low pH, liquid hazardous waste containing polychlorinated biphenyls greater than 50 ppm and organic halogenated compounds greater than 1000 mg/kg was banned within 32 months after passage of HSWA.

All other types of hazardous waste proposed for land disposal were to be analyzed and evaluated by the Administrator, with certain of the wastes to be analyzed within 48 months of the passage of HSWA and all wastes to be analyzed within 66 months of the passage of HSWA. This requirement came to be divided into thirds, with the first third of EPA hazardous wastes evaluated in 48 months, the second third evaluated within 55 months and the third evaluated within 66 months.

The goal of this evaluation was to determine whether one or more types of land disposal should be banned. If EPA failed to act within a specified time frame, then the ban was automatically imposed. This is the so-called "hammer provision," a self enforcing provision. If EPA failed to act (which was common during the Reagan Administration), then the prohibition would automatically take place.

This land ban was not absolute. In many cases, treatment could be undertaken that would alter the hazardous waste to such an extent that land disposal was allowed. The goal of this new Section 3004(m) was to either substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration to drinking water sources. Subsequent EPA rules have identified some treatment standards that allow land disposal, but these requirements can be rather difficult and expensive in certain situations and unavailable in other

situations. Rules concerning each waste type must be consulted to determine the exact situation with regard to treatment prior to land disposal.

By the adopting the land ban, Congress rejected land disposal and endorsed virtually all other concepts of waste disposal. Land disposal without pretreatment is only permitted if a "no migration" petition was granted. This petition must show that the disposal concept will be "... protective of human health and the environment for as long as the waste remains hazardous." The Petitioner therefore must demonstrate to the Administrator with a reasonable degree of certainty that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the waste remains hazardous (e.g., 10,000 years). Although such a finding may seem to be impossible, EPA has granted several no-migration petitions for underground injection, although no other disposal concepts have been allowed to take advantage of this exemption from the land.

The net result of the imposition of the land ban was to shift the United States disposal preferences to other technologies from land disposal. Almost immediately upon passage, many generators and disposers prepared applications for incinerators. Indeed, incineration appeared to be technology favored by Congress in passing HSWA. Unfortunately, cost considerations kept more innovative treatment and disposal concepts from coming to the forefront. In many respects, HSWA, by implementing the land ban, transferred our hazardous waste disposal problems from the ground water to the air.

### 14.4.2 Small Quantity Generators

Since the inception of the RCRA program, a distinction was made between generators of hazardous waste on the basis of volume. Utilizing discretionary authority, EPA's initial RCRA regulations separated generators of over 1000 kg of hazardous waste a month from those generating fewer than 1000 kg/mo. This division regulated 60,000 generators accounting for a large majority of the volume of hazardous waste in the country.

Small quantity generators are not required to manifest their waste and are not required to dispose of their hazardous waste in permitted hazardous waste disposal facilities. Instead, this waste may be deposited in municipal landfills that are not designed to contain hazardous waste. This small quantity generator provision has been controversial because it allows hazardous waste to be disposed of into facilities where ground water contamination may very likely result. In the 1984 HSWA, Congress changed the small quantity generator exemption to lower the volume requirements. By March, 1986, EPA was mandated to promulgate regulations for facilities generating more than 100 kg/mo but fewer than 1000 kg/mo. These regulations could vary from those required for generators of 1000 kg/mo, but at the least had to include manifesting and disposal in permitted hazardous waste facilities. With a few minor differences, the regulations for the approximately 130,000 generators of from 100 to 1000 kg/mo of hazardous waste are the same as those from the greater than 1000 kg/mo generators.



### 14.4.3 Solid Waste Management Units

A major loophole was closed by HSWA through the incorporation of provisions addressing "solid waste management units" or SWMUs. SWMUs are currently inactive but formerly used hazardous waste disposal sites that are within the boundaries of a RCRA-permitted facility.

HSWA changed this loophole by adding Section 3004(u) of RCRA. This section requires that any permit issued after the date of HSWA enactment establish a requirement for undertaking corrective action for all release of hazardous waste or constituents from solid waste management units at a storage treatment or disposal facility regardless of when that release occurred. Further, Section 3004(v) extends the requirement for corrective action outside of the boundaries of the storage, treatment, or disposal facility unless the owner/operator can demonstrate that permission to take corrective action on adjacent property was sought and denied.

The inclusion of SWMUs within the RCRA regulatory program substantially expands the scope of the RCRA program. The program's focus changed dramatically from manifesting and permitting to include remediation of old disposal sites. Further, the SWMU concept goes far beyond disposal to include sites where hazardous waste or hazardous constituents have been released to the land surface. In a major industrial facility, it would not be uncommon to have one RCRA land disposal site, a RCRA incinerator, several RCRA storage facilities, and 40 to 80 solid waste management units.

From a regulatory standpoint, the major requirement for SWMUs is that they be identified and evaluated to determine the type of waste contained therein. Further, a determination must be made as to whether the waste has contaminated the ground water. These efforts require testing and ground water monitoring. Once the leakage has been detected, then the extent of the leakage must be characterized and a corrective action plan developed. Then, corrective action must be undertaken, ultimately resulting in a clean-up of the SWMU.

### 14.4.4 Leaking Underground Storage Tanks

The last major program initiated by HSWA involved the regulation of leaking underground storage tanks. It is important to note that this program regulates hazardous product, not waste, thereby differentiating it from other RCRA programs.

Underground storage tanks containing hazardous waste were subject to regulation under RCRA. However, the estimated 2.8 to 5 million underground storage tanks containing hazardous products such as gasoline were not. Of these, as many as 450,000 were estimated to be leaking by 1989. For this reason, Congress included in HSWA the requirement that EPA regulate underground storage tanks.

This regulatory program unfolded between 1984 and 1986 when EPA promulgated implementing regulations. First, each state had to designate an agency to implement this program. Secondly, each tank owner had to identify the existence of these existing, new or old tanks removed from operation after 1973 to the state agency by May 8, 1986. Then, EPA promulgated regulations that set forth several steps to be followed for storage tanks.

These EPA regulations required that regulated tank owners test the integrity of these tanks. The existence of any releases had to be reported and corrective action had to be undertaken in response to releases. In some cases, the sites had to be closed in accordance with general closure requirements.

In essence, the site of an underground storage tank became regulated in a manner similar to SWMU or even an existing disposal site. The leakage of contaminants had to be identified, the extent of the damage to soil and ground water had to be assessed, and the problem remediated.

Further, EPA was required to promulgate standards for new underground storage tank construction under Section 9003(e) of RCRA. These "New Tank Performance Standards" shall include requirements for the "design, construction, installation, release detection, and compatibility standards." In the resulting regulations, EPA opted for noncorroding tank shells and/or leachate collection systems, making the design of underground storage tanks similar in many ways to landfill design requirements.

### 14.4.5 HSWA Impacts

HSWA forever changed the relationship of Congress and EPA. Not only did Congress reassert control of the nation's hazardous waste program, it did so decisively. EPA was forced into responding to a series of HSWA deadlines. When EPA failed to meet statutory deadlines, the regulatory hammer fell, eliminating the activity. If a mistake was to be made, Congress had decided the mistake would be in regulating too much rather than too little.

HSWA also marked a new, get-tough attitude on underground contamination. Leak-prone land disposal methods were banned and old hazardous waste disposal sites were brought into the corrective action/remediation program. Underground storage tanks were regulated, analyzed, and remediated. Congress had declared a national war on ground water contamination with the passage of HSWA.

## 14.5 CERCLA

The Comprehensive Environmental Response, Compensation and Liability Act of 1980, known as CERCLA, was passed to provide the legal and regulatory basis to clean-up releases of hazardous substances as well as to introduce a concept of hazardous substance reporting. During the decades preceding the passage of RCRA and CERCLA, hazardous substances had been dumped around the United States in thousands of places. No permits were required in many cases. When permits were required, the state of the art was simply not sufficient to contain the waste and protect ground water. By the time CERCLA was passed, Congress knew that a major problem existed in the United States with regard to past disposal practices and ongoing releases.

The concept of clean-up that Congress adopted consisted of several parts. First, CERCLA had a companion piece of legislation called the Superfund Tax Act, which created



an excise tax on oil and certain hazardous substances. This tax was paid into a fund, which was initially bankrolled by Congress. This fund was called "the Superfund" and was to be used to study and clean up non-RCRA sites where hazardous substance releases were occurring. As the companion to the Superfund Tax Act, CERCLA provided controls on the use of Superfund monies. CERCLA required EPA to establish rules for the expenditure of Superfund money and established liability provisions to insure that the parties responsible for the release ultimately paid for the clean-up. CERCLA also created a reporting requirement for past disposal operations and for current releases.

From a conceptual standpoint, CERCLA is quite different than RCRA and HSWA. CERCLA is not a true regulatory act. Instead, CERCLA created a process for identifying releases and cleaning up sites that pose a hazard to health and the environment. No permits are required. No application is made. Instead, the EPA identifies the site and prepares a clean up plan. Then, after the clean-up takes place, the potentially responsible parties (PRPs) are sued by the federal government to reimburse the Superfund for the money spent to cleanup the problem they created. In this respect, CERCLA is unique among environmental laws.

CERCLA is a harsh statute. CERCLA imposes statutory strict liability for clean-up costs upon generators, transporters, and owners responsible for releases. Conceptually, CERCLA can be viewed in three parts. The first part concerns the identification, analysis, and remediation of releases. The second part concerns the rules of liability associated with the remediation of these releases. And the third part addresses the more general reporting requirements that are created by CERCLA.

The common thread through all parts of CERCLA is the focus upon releases. Releases are to be reported and releases are to be remediated. As will be seen, the concept of release is very broad, covering an extremely wide range of actions. In virtually all cases, these releases either have affected or have the potential to affect ground water. For the most part, the release of concern will involve the leaching of chemicals from an old disposal site into the ground water. For the student of ground water, knowledge of the CERCLA process is essential.

The Superfund process and its harsh liability provisions have forever changed the real estate industry in the United States. Because an owner may be liable for the clean-up of a release under CERCLA, prospective property owners have become concerned about purchasing clean-up liability. Banks, savings and loans, and large institutional real estate investors are now on notice that the purchase of real estate may be accompanied by liability. The owners of shopping centers and commercial buildings are now on notice that they may be liable for the release of hazardous substances by their tenants.

This liability was initiated by the CERCLA provisions and enhanced and amplified by the Superfund Amendment and Reauthorization Act of 1986 (SARA), which reauthorized CERCLA. SARA created a defense for real estate purchasers if they have "no reason to know" about hazardous substances on the property. This "no reason to know" defense can be perfected by conducting an environmental audit of property prior to purchase. These environmental audits are now routinely required throughout the United States for property transactions and represent a major consulting practice for engineers and scientists around the country.

Finally, the 1986 SARA amendments created a new reporting requirement under the Title III provisions. The so-called SARA Title III program required that certain industries report all of their releases of hazardous substances, both permitted and unpermitted, to EPA. This SARA Title III report would include an inventory of hazardous substances in the wastewater, air emissions, underground injection, and land disposal. Never before had such a compilation been required. No legal provision stands for the power of information more than does SARA Title III.

Because of the concise reporting format, the SARA Title III information can be accessed and compared across industrial sectors and across the United States. Lists of the "Toxic 500" companies or of the most toxic counties in the United States could be compiled from the data sets and become public. No other act created information more readily accessible for media use than did SARA Title III. And the results have been phenomenal. Substantial competition exists today among industries **not** to be number one, or even in the top fifty, of the "Toxic 500" companies. As a result, substantial waste reduction has occurred in many industries originally identified as the most toxic in the United States.

CERCLA and SARA have left an incredible legacy in the decade of the 1980s. Extensive liability has been brought to generators and owners. Remediation of releases will continue well into the twenty-first century. Reporting of hazardous substance releases is pervasive. And the public is more concerned than ever about ground water contamination, Superfund site clean-up and their safety. Bankers are worried about chemicals compromising their real estate loans and companies are scrambling to escape the Toxic 500 list. CERCLA and SARA are worth a little time.

### 14.5.1 The National Contingency Plan

The overall process for identifying and cleaning up Superfund sites is contained in a set of regulations titled the "National Contingency Plan." These regulations are found at 40 CFR Part 300. Essentially, there are criteria for placing sites on the Superfund list. Then, there are criteria for studying and evaluating the site. And then there are criteria for cleaning up the site. No action may qualify for the use of Superfund monies unless the procedures outlined in the National Contingency Plan are followed.

**The National Priority List.** 40 CFR 300.425 sets forth the process for establishing remedial priorities. The structure of CERCLA is such that the focus of the statute is upon the reporting and remediation of "releases" of hazardous substances. Section 101(22) of CERCLA defines release as:

> ... any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant)... [with certain exceptions].



As a practical matter, there are hundreds of thousands of releases of hazardous substances throughout the United States that are theoretically in competition for the Superfund remediation money and agency priority action. Congress needed a manner to discriminate among these candidate sites to insure that the Superfund money was spent properly. Therefore, Congress directed EPA to create a National Priorities List to guide the expenditure of these Superfund monies.

Under Section 105(a)(8)(B) of CERCLA, Congress stated that the President of the United States ". . . shall list as part of the [national contingency] plan national priorities among the known releases or threatened releases throughout the United States and shall revise the list no less often than annually." In Section 105(a)(8)(A) of CERCLA, Congress states:

> Criteria and priorities under this paragraph shall be based upon relative risk or danger to the public health or welfare or the environment ... taking into account ... the population at risk, the hazard potential of the hazardous substances at such facilities, the potential for contamination of drinking water supplies, the potential for direct human contact, the potential for destruction of sensitive ecosystems, the damage to natural resources which may affect the human food chain and which is associated with any release or threatened release, the contamination or potential contamination of the ambient air which is associated with the release or threatened release, State preparedness to assume State costs and responsibilities, and other appropriate factors.

Under the directive of this section, EPA has established a so-called National Priorities List (NPL). Only the releases included on the NPL shall be eligible for Superfund-financed remedial activities. On the other hand, removal actions that are not financed by the fund are not limited to NPL sites.

EPA has developed a methodology for determining eligibility for the NPL. This methodology is extremely complex, taking up more than 100 pages in the *Code of Federal Regulations*. This Hazard Ranking System (HRS) is found in Appendix A to 40 CFR Part 300 and has resulted in the listing of NPL sites plus NPL federal facility sites. These are the so-called Superfund sites.

Releases are added to the NPL by action of the so-called lead agency, which is usually the EPA or the state agency working with EPA. It is the responsibility of the lead agency to apply the HRS methodology to a particular release and to submit the results of this analysis to EPA. If EPA concurs in the HRS scoring and if the HRS score is sufficiently high (e.g., greater than 28.5), then a site shall be added to the NPL. The NPL shall be updated annually and new sites must be published in the Federal Register for public comment prior to being added to the NPL. Releases may be deleted from the NPL where no further response is appropriate. A release may be deleted if (a) responsible parties have undertaken appropriate response action, (b) fund-financed response under CERCLA has been implemented and no addition action by responsible parties is appropriate, or (c) investigations indicate the release

poses no significant threat to public health or the environment and remedial responses are not appropriate. Notices of intent to delete must also be published in the Federal Register.

### 14.5.2 The RI/FS Process

A tremendous amount of time and effort goes into the analysis of a Superfund site and the selection of a clean-up remedy. The EPA regulations set out procedures that must be followed to move forward with the clean-up. There are two distinct steps in the process. First, there are the remedial investigations (RI) where data is compiled and site characterization is achieved. Then there is the feasibility study (FS) where various clean-up alternatives are evaluated to determine whether they meet the goals of EPA and the needs of the public. Within this process, interaction with the affected community must occur and ultimately a remedy must be selected. All of this must be undertaken under the umbrella of the ultimate goal of adequately protecting the public and the environment.

The importance of this RI/FS process cannot be overstated. Remedies for various Superfund sites can be extremely costly, ranging well into the tens if not hundreds of millions of dollars. The future of the citizens living next to a facility may hinge on remedy selection as well. To what level will clean-up occur? Will there be air pollution residuals? Will ground water will be cleaned up or contained or left contaminated in place? All of these issues and many more are decided in the RI/FS process leading to remedy selection.

### 14.5.3 EPA Program Goals

The purpose of the remedy selection process is to implement remedies that eliminate, reduce or control risks to human health and the environment (40 CFR 300.430(a)(1). It is important to note at the outset that risk analysis is a major aspect of the remedy selection process. The purpose of this process is not only to eliminate risks but also to reduce and control risks. Therefore, the role of risk assessment and risk management is extremely important. The EPA has a program goal that shapes the overall direction of the remedy selection process:

> The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time and that minimize untreated waste. 40 CFR 300.430(a)(i).

To implement this program goal, EPA has identified a number of expectations, which shall be considered in developing the appropriate response alternatives. These are:

1. Treatment is expected to be used to address the principle threats of a site where practicable, including particular liquids, high concentration toxic areas, and for highly mobile compounds.
2. Engineering controls such as containment are expected to be used for waste that poses a relatively low long-term threat or where treatment is impracticable.
3. Combinations of clean-up controls are expected to be used where principle threats may be addressed by treatment and lesser threats addressed by containment or institutional controls.
4. Institutional controls such as water use limitations and deed restrictions limiting property use are expected to be used in association with engineering controls and not as the sole remedy unless active measures are determined not to be feasible in the remedy selection process.
5. Innovative technology (such as bioremediation) is expected to be used when it can be shown that it will result in equal or superior treatment, performs better from an environmental impact standpoint, or costs less for the same level of performance as other alternatives.
6. Ground water is expected to return to beneficial uses wherever practicable within site-specific reasonable time frames. When beneficial use restoration is not practicable, EPA expects to prevent plume migration and exposure to the contaminated ground water and to evaluate further risk reduction.

From the foregoing goals and expectations, it is clear that absolute clean-up and zero risk are not requirements of the national contingency plan. Instead, the analysis and management of the risk are the critical elements. A clear bias exists for treatment rather than containment, although containment is acceptable in certain situations, as are land use and water use controls. Therefore, the choice of remedies is highly dependent upon the specifics of the site and the analysis of the risk.

### 14.5.4 Scoping

The first step in the RI/FS process is to determine how to proceed with the study. This step is called scoping and sets the protocol for site investigation.

Existing information is evaluated in the scoping step to determine the extent to which additional data must be collected. Of primary importance is the determination of future data collection efforts to be undertaken in the RI step. The type of data collection, the quality, and the quantity of data must all be determined in advance of the RI. This process is expected to result in a sampling and analysis plan with both field protocols and quality assurance/quality control (QA/QC) components. Also, the type of protective equipment necessary for workers needs to be determined at this juncture.

During scoping, a preliminary assessment is made of the range of potential clean-up alternatives to guide future deliberations. If natural resource damage has been identified or is anticipated, preliminary contact must be made with the state and federal resource agencies that are authorized to act as natural resource trustees to insure protection of the natural environment in the remedy selection process. And finally, applicable or relevant and appropriate

requirements (ARARs) must be determined. ARARs are regulatory requirements from other federal or state laws that apply to a particular site cleanup. ARARs have a major role in determining the acceptability of a particular remedial alternative. If no ARAR exists (or if the ARAR allows relative risk assessment), then risk analysis is used to determine appropriate clean-up levels.

### 14.5.5 Community Relations

Interface with the affected community is initiated prior to undertaking any field work. Interviews should be conducted with public officials, community residents and public interest groups to discover their concerns and to set up a system for informing them of the progress of the RI/FS process. A community relations plan (CRP) is to be developed that identifies opportunities for citizens to participate in the decision-making process, and a local information repository must be set up so that the local affected public may review the documents utilized by EPA.

### 14.5.6 Remedial Investigation (RI)

The purpose of the RI is to collect data to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives. Information regarding the risk to the public and the environment posed by a particular site will be generated by the RI. That is the central focus of the RI.

The nature and character of the threat posed by the hazardous substances and the particular conditions of the release at the site will be determined in the RI. The data collection effort of the RI should generate information relevant to the following concerns:

1. physical characteristics of the site (soils, geology, hydrogeology, meteorology, ecology)
2. characteristics of the surface and ground water
3. characteristics of the waste, including quantities, state, concentration, toxicity, bioaccumulation tendencies, persistence and mobility
4. extent to which the source can be identified and characterized
5. actual and potential exposure pathways through environmental media
6. actual and potential exposure pathways to the body
7. other factors such as sensitive populations

### 14.5.7 Source Control Actions

Source control actions are to be evaluated by the lead agency. Source control actions include first and foremost a range of alternatives that utilize treatment to reduce the toxicity, mobility or volume of hazardous substances. Here the goal is removal and/or destruction of



the hazardous substance, thereby eliminating or minimizing the long-term need for management. The lead agency is authorized to vary from total treatment to partial treatment. Alternatives other than treatment are also developed, such as containment or land use controls, including evacuation, to achieve protection of human health and the environment.

Where ground water response actions are required, a number of alternatives that produce site specific remediation levels over different periods of time shall be developed. Further, the agency is required to develop one or more innovative alternatives if such alternatives can generate comparable or better results than other alternatives.

The detailed analysis of alternatives is accomplished in a comparative manner by utilizing nine evaluation criteria:

1. overall protection of human health and the environment
2. compliance with ARARs (or with criteria for waiver)
3. long-term effectiveness and permanence, including consideration of residual risk resulting from remaining, untreated waste and adequacy and reliability of controls
4. reduction of toxicity, mobility, or volume through treatment or recycling including the type of waste remaining after the clean-up
5. short-term effectiveness, focusing upon risks to the community, to workers, and to the environment during the clean-up including the length of such exposures
6. implementability (i.e., the technical and administrative feasibility of implementing the alternative as well as the availability of off-site treatment, storage and disposal sites)
7. cost, including capital costs, annual operation and maintenance, and net present value of capital
8. state acceptance, including state's preferred alternative and state ARARs
9. community acceptance, including a determination of community concerns with alternatives and preferences

### 14.5.8 Remedy Selection

The decision-maker must select a remedy based upon the above nine factors. However, each of these factors is not equally weighted. To be eligible for selection, each alternative must achieve overall protection of human health, and the environment and must comply with applicable ARARs unless they are waived. These are the two threshold requirements. An alternative cannot be considered if it does not meet these two requirements.

All alternatives meeting the threshold requirements are then reviewed against the five primary balancing requirements. These five balancing requirements are long-term effectiveness and permanence, reduction of toxicity, mobility and volume through treatment, short-

term effectiveness, implementability, and cost. The final two criteria—state and community acceptance—are modifying criteria.

Remedy selection is a two-step process. First, a proposed plan is put forth. Here, the agency identifies the alternative that best meets the evaluation criteria and proposes this alternative to the public for review and comment. The selected alternative must be protective of human health and the environment, meet ARARs, be cost-effective, and utilize permanent solutions to the maximum extent practicable.

This proposed plan is then circulated to the public for review and comment. The availability of the plan and a summary must be published in a newspaper of general circulation. An administrative record of all pertinent documents, studies, and analyses, including those developed during the RI/FS process, must be made available to the public for review and inspection. Then, the public must be given time to submit comments in writing. The agency must provide the opportunity for a public meeting during the public comment period, and a transcript must be made of the public meeting. A written summary – called a responsiveness summary – must be prepared by the agency and carried forward to the final decision. If significant new information is identified during this public comment process, then the lead agency must evaluate it and incorporate it into the analysis.

The second step in remedy selection is to reconsider the proposed plan, factoring in additional information provided by the state and the public. These comments may prompt the lead agency to modify its proposed plan. The final remedy selection shall be made and documented in a record of decision (ROD). This ROD shall document all facts, analysis of facts, and site specific policy determinations considered in the course of carrying out the alternative selection. Specific findings of how the evaluation criteria are met must be included in the agency ROD.

### 14.5.9 The Remedial Design/Remedial Action (RD/RA) Stage

After the remedy is selected, the clean-up occurs. The selected alternative must be designed in sufficient detail to be implemented, and then the actual clean-up must take place. The RD/RA process must follow the ROD. Specifically, the attainment of specific clean-up levels and/or ARARs must be monitored to determine that the alternative has performed to the extent specified in the ROD. Specific attention must be focused upon the QA/QC process as was the case in the RI/FS stage. If the need arises to alter the clean-up alternative adopted in the ROD, the ROD must be amended through formal procedures. Such procedures involve public notice and formal amendment, including formal review and comment and potentially public meetings. A strong preference exists to maintain the integrity of the ROD.

When the RA is completed, a determination is made that the remedy is operational and functional. At that time, the site enters the operation and maintenance (O&M) phase. A site is operational and functional either one year after the completion of the construction or when the remedy is determined to be properly functioning. When ground water remediation is involved, the operation of the treatment for a period of up to ten years is considered to be part of the remedial action.



### 14.5.10 Liability Under CERCLA

The concept of liability under CERCLA is one of the harshest ever adopted by the United States Congress. Strict liability exists under CERCLA for clean-up costs incurred by the federal government acting pursuant to the national contingency plan. Strict liability also exists for damages to the environment occurring as a result of the release. Section 107 of CERCLA contains the liability provisions. Section 107(a) states:

> (a) Notwithstanding any other provision or rule of law, and subject only to the defenses set forth in subsection (b) of this section:
>
> 1. the owner and operator of a vessel or a facility,
> 2. any person who at the time of disposal of any hazardous substance owned or operated any facility at which such hazardous substances were disposed of,
> 3. any person who by contract, agreement or otherwise arranged for disposal or treatment or arranged with a transporter for transport for disposal or treatment, of hazardous substances owned or possessed by such person, by any other party or entity, at any facility or incineration vessel owned or operated by another party or entity and containing such substances, and
> 4. any person who accepts or accepted any hazardous substances for transport to disposal or treatment facilities, incineration vessels or site selected by such person, from which there is a release or threatened release which causes the incurrence of response costs, of a hazardous substance, shall be liable for:
>
> (A) all costs of removal or remedial action incurred by the United States Government or a state or an Indian tribe not inconsistent with the national contingency plan,
> (B) any other necessary costs of response incurred by any other person consistent with the national contingency plan,
> (C) damages for injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing such injury, destruction, or loss resulting from such release; and
> (D) the costs of any health assessment or health effects study carried out under section 104(i).

This Section 107(a) creates liability in the current owner and operator of the facility that is the site of the release, the past owner and operator of the facility that was associated with the release, the generator of the hazardous substance that is being released and the transporter delivering the hazardous substance to the release site. It should be noted that any of these parties are liable for *all* costs identified in (A)-(D) above. This liability is known as joint and several. In this manner, a single generator can be liable for an entire clean-up even

though that generator may not have generated all of the hazardous substances being released from a site.

If a party did not generate or transport hazardous substances to a particular release site, a defense exists. If the hazardous substance that is present at the release site could not be the defendants', then a defense exists. If a person is sued for owning a site and never owned it, a defense exists. However, for someone correctly identified as a generator, transporter or owner/operator contributing to a release at a facility, the defenses are limited.

The defenses to liability under subsection (a) are very few and very narrow. If the release of hazardous substance and the damages relating therefrom were caused by either (1) an act of God or (2) an act of war, then no liability will exist. An act of God is defined to include severe natural disasters, the effects of which could not have been prevented or avoided by the exercise of due care or foresight. As a practical matter, the defenses of acts of God and war are of very limited utility.

Because the defenses are so limited, the liability concept is considered to be statutory strict liability. Reasonable care is not a defense except in very specific situations such as third party liability or in the utilization of the act of God defense. By and large, if a defendant generated the waste, transported the waste, currently owns and/or operates the facility and formerly owned and/or operated the facility, liability exists.

A third aspect exists to the liability under CERCLA. Under Section 107(c)(3), a potentially responsible party (PRP) may be liable for punitive damages in the amount of three times the costs actually incurred by the Fund. Punitive damages become applicable if that PRP is requested by the President (e.g., EPA) to provide removal or remedial actions under Sections 104 and 106 of CERCLA and fails to do so. In this manner, a PRP may be liable for the costs of cleanup and for three times that amount. The clear intention of this punitive damages section was to force PRPs to cooperate with the government at an early stage in CERCLA process.

As a practical matter, PRPs are contacted in writing by the EPA at a relatively early stage in the process and asked to cooperate with the various investigations, including the provision of documents and access. The President, acting through the Regional Administrator of EPA, has the authority to request individual PRPs to undertake certain removal and remedial actions under either Section 104 or 106 of CERCLA. If the PRP lacks just cause for refusing such a request (e.g., lacks a defense), then the punitive damages apply. As a practical matter, most PRP's are very hesitant to refuse voluntary cooperation and risk the imposition of punitive damages.

PRP's take a very active role in site clean-up selection by undertaking their own RI/FS process under EPA supervision. In this manner, the PRPs have control of the national contingency plan process while at the same time avoiding the potential punitive damage assessment. All of the PRP studies are undertaken with EPA oversight and ultimate control.



## 14.6 SUPERFUND AMENDMENT AND REAUTHORIZATION ACT OF 1986 (SARA)

The Superfund Amendment and Reauthorization Act of 1986 (SARA) is notable for several provisions. First, Congress left the major liability requirements of CERCLA unchanged, meaning that the relatively harsh clean-up liability was acceptable from a congressional point of view. Second, additional monies were placed into the Superfund to aid in the cleanup of the ever increasing number of abandoned hazardous waste disposal sites. However, the two most important requirements related to the liability for innocent purchasers and the disclosure of annual releases of hazardous substances.

### 14.6.1 Limited CERCLA Liability Through Environmental Audits

Under CERCLA, the current landowner may be liable for the clean-up of hazardous substances even if that landowner did not cause the contamination. This liability provision is particularly important to banks and lending institutions because these institutions lend money and use property as collateral for those loans. If the borrower does not pay back the money and the bank or savings and loan takes over the property used as collateral, the bank or savings and loan becomes the current property owner. In this manner, both new owners and foreclosing owners may be liable under CERCLA.

Although SARA generally left the CERCLA liability provisions unchanged, a provision was added that allows "innocent" purchasers to limit their liability under CERCLA. Under the SARA amendment, a so-called due diligence defense was added to allow new purchasers to limit their liability. If, when the property was purchased, the buyer had "no reason to know" about the contamination of the property, then a defense to liability exists.

SARA sets out the considerations that a judge should take into account in determining whether or not the buyer had "no reason to know" about the contamination (CERCLA Section 9601 (35) (A)). According to §9601 (35) (B), in order to establish "no reason to know," the defendant must establish that an inquiry was undertaken into previous ownership and uses of the property in an attempt to determine whether there might be a reason to anticipate contamination. Further, this section states that the court shall consider any specialized knowledge of the purchaser, the purchase price, commonly known or easily obtained information about the contamination, the obviousness of the problem, and the ability to detect the problem by inspection.

This provision has totally changed the commercial real estate market. After the passage of SARA, virtually all lenders and smart buyers began requiring studies of proposed land purchases to determine whether there was "reason to know" about contamination. These studies have evolved into a nationwide consulting practice called Phase I, II, and III environmental audits.

Phase I audits typically entail a visual inspection of the property, a review of the prior ownership and use, a review of agency records and known contamination sites, a review of

aerial photographs, and perhaps interviews with neighbors and/or past employees. The purpose of this initial review is to determine whether or not the purchaser has reason to know that contamination exists on the property. If no problems are detected, the audit is concluded and the land purchase goes forward with the written documentation of the Phase I audit ready to be used as a defense.

If problems are detected, then a Phase II study is initiated to determine the extent of the problem. Phase II typically involves soil testing and ground water monitoring to determine the extent of soil and ground water contamination. Phase II will include a detailed analysis of the extent of contamination, including plumes of contamination and delineation of affected soils.

Phase III is the remediation effort. Depending upon how the audit is conducted, the design of the remediation effort may be included in either the Phase II or Phase III analysis. Generally, a buyer would require the information on the cost of remediation in order to make an informed decision about the extent of the risk that she will be encountering if she goes ahead and purchases the property.

Oftentimes, the detection of soil or ground water contamination will stop the transaction from occurring. Many buyers and lenders require full clean-up and certification of closure prior to even considering lending money on contaminated property. More sophisticated lenders and buyers have developed criteria to assist them in understanding these risks and working with them. However, the important point is that ground water monitoring, soil contamination, and remediation are now common issues in the real estate community. Such was not the case prior to the passage of CERCLA and SARA.

### 14.6.2 SARA Title III

The other major change introduced by SARA is the reporting requirement under Title III. Here, facilities that exceeded certain size thresholds in the handling and release of hazardous substances must submit an annual report to EPA identifying the total poundage of releases of hazardous substances, both permitted and unpermitted, into the environment.

The hazardous substance releases required to be submitted include permitted and accidental wastewater discharges, permitted RCRA land disposal., permitted underground injection allowed under the Safe Drinking Water Act, and permitted stack and fugitive air emissions. These submissions are on a facility by facility basis and covered virtually all major industrial facilities in the United States.

## SUMMARY

The changes that occurred in ground water protection in the 1980s were staggering. RCRA and the Safe Drinking Water Act became effective in November of 1980, CERCLA was passed in 1980, HSWA was passed in 1984 and SARA was passed in 1986. The United States went from a country that had no uniform hazardous waste requirements to one with a comprehensive system of ground water protection. The 1990s has been a period of reflection and evaluation of the changes that were initiated in the 1980s.



One area of change during the 1990s involves the generation of hazardous wastes and the release of hazardous substances. Simply stated, the costs of waste generation and disposal are extremely high and the negative publicity associated with hazardous wastes and substances is great. For many good reasons, the trend of the 1990s has been to minimize the production of hazardous wastes and to reduce substantially the release of hazardous substances into the environment. Ground water protection of the future will certainly entail the reduction of the contamination potential by reducing the volume of waste generated.

In thinking about the future of ground water protection, it is important to keep in mind that Congress has continually revised and expanded its view of the scope of environmental law and ground water protection. The federal law has expanded from RCRA manifesting and permitting and CERCLA clean-up litigation to land bans under HSWA and environmental audits and Title III reporting under SARA. Ground water protection practices include monitoring, modeling, and permitting but are much broader than hydrogeology. Full disclosure of contamination may ultimately prove to be one of the most important ground water protection and waste minimization tools. Therefore, while it is important to understand the site specific requirements, it is also important not to lose sight of the larger societal goals of ultimately eliminating the source of the contamination.

On the other hand, the costs of remediation of existing contamination are extremely high. It is reasonable to question the overall cost to society of the gains to public health associated with many of these clean-up activities and to assess the risks associated with leaving contaminants in the ground. In many respects, the major ground water protection debate of the 1990s may be between proponents of extensive remediation and proponents of encapsulation and monitoring. The use of risk assessment concepts and techniques will likely become more prevalent as clean-up negotiations concentrate upon relative benefits associated with extensive clean-up costs.

The use of risk assessment will raise ethical and professional questions. Who is competent to assess the risk to the public? What type of credentials should be required? And who is going to assess the risk of risk assessors?

These laws have created a framework within which professionals must work into the twenty-first century. These laws were designed to protect the public health and regulate sources of contamination. It is difficult to clearly define the balance between protecting the public and fairly regulating sources of contamination. In many respects, correctly balancing these concerns will be the ultimate task in the regulation and protection of ground water.

## REFERENCES

Code of Federal Regulation (CFR).