CHAPTER TWENTY-ONE

Toxic, Hazardous and Nuclear Waste

Toxic, hazardous, and nuclear waste present two distinct challenges: addressing a legacy resulting from improper and inadequate methods for disposing of hazardous substances, and ensuring that present procedures are satisfactory for safeguarding the future. In addition, there is a further challenge: protecting public health and the environment from toxic pollution in ways that are more effective, efficient, affordable, and fair.

The legacy of past behavior and the inadequacy of scientific understanding came to light dramatically in the late 1970s, when the nation was alerted to extensive contamination at Love Canal, New York, and other sites. In response, Congress in 1980 passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)—better known as the "Superfund" law. The law created a program to clean up abandoned hazardous waste and restore natural resources at sites across the country. At most sites, cleanup work is performed or funded by companies responsible for the contamination, who are strictly liable for the costs of response incurred by governmental or private parties. Taxes on chemical and petroleum production support a trust fund that pays for cleanup where these companies are insolvent or defunct, and that supports EPA's program costs for overseeing cleanup at priority sites.

Superfund complements the provisions of the 1976 Resource Conservation and Recovery Act (RCRA), which requires tracking of the generation and transport of hazardous waste and provides for regulations to ensure safe treatment and disposal. RCRA also established programs to address leaking underground tanks and other waste management issues, such as waste minimization and recycling. In 1992, the Federal Facilities Compliance Act amended RCRA to clarify that federal facilities are subject to this law to the same extent as any person, with the result that most U.S. military and nuclear waste is subject to control under this act. Nuclear waste is primarily under the purview of the Nuclear Waste Policy Act of 1982.

While CERCLA and RCRA rely on more traditional liability and regulatory schemes, the 1986 Emergency Planning and Community Right-to-Know Act (EPCRA) enhances public protection through the power of information and local preparedness. The centerpiece of EPCRA's data disclosure and emergency planning provisions is the Toxics Release

Inventory (TRI), a database on releases, off-site transfers, and other waste-management activities for over 650 chemicals and chemical categories from manufacturing facilities. The act also provides for states to establish state and local planning groups to develop emergency response plans for each community. To date, states have established over 3,400 Local Emergency Planning Committees (LEPCs). Facilities are required to make information available to the public through LEPCs on the hazardous chemicals present at that facility. A 1994 nationwide survey indicated that 79 percent of the LEPCs are functioning and most of these have completed emergency response plans, thereby strengthening their ability to respond to chemical emergencies.

DEALING WITH THE PAST: SUPERFUND CLEANUPS

The 1980 Superfund law (CERCLA) is designed to deal primarily with the cleanup of hazardous waste sites. Under the law, parties who owned or operated a vessel or facility, or transported or arranged for disposal of hazardous substances at the vessel or facility, are subject to strict, joint, and several liability for the costs of response and related natural resource damages. These liability provisions are coupled with an array of enforcement tools, which enable EPA to compel the parties responsible for contamination to perform the cleanup. Under the July 1996 Executive Order 13016, certain other agencies also may compel response actions. Alternatively, EPA may clean up a site using the CERCLA Trust Fund, which is supported by excise taxes on chemical feedstocks and petroleum, by a more broadly based corporate environmental tax, and by general revenues.

Whether the government or a private party conducts the cleanup, any Superfund monies expended at the site may be recovered from responsible parties. However, EPA recovery of cleanup costs is not possible where contamination is attributable to non-viable parties at a site. To ensure that litigation does not delay cleanup, CERCLA generally provides that challenges to EPA cleanup decisions may not be brought until after the cleanup action has been completed or an enforcement action has been brought.

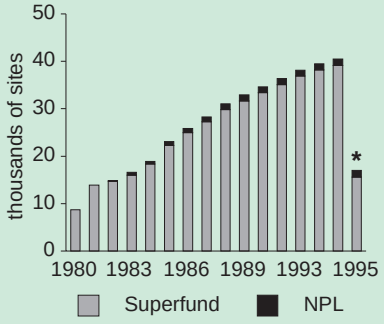
CERCLA was amended and reauthorized in 1986 and reauthorized without amendments in 1990. The 1990 legislation extended the Superfund taxes through December 31, 1995. The statute's liability provisions remain in effect and Congress has continued to appropriate to the Superfund program using surplus monies in the Hazardous Substances Trust Fund—the Superfund. Because Congress has traditionally appropriated most funds to the program from the Superfund, reinstatement of a funding source for the Superfund will be necessary if the program is to continue without interruption once this surplus is depleted.

CERCLA authorizes EPA to investigate sites and to create a National Priorities List (NPL) of those sites where contamination presents the most serious

threat to human health and the environment. EPA's remedial program is focused on these NPL sites. By September 1995, a total of 1,374 sites had been listed or proposed for listing. Work was under way at 93 percent of these sites, and permanent cleanup construction was in progress or complete at 60 percent of these sites. Permanent cleanup construction had been completed at 346 sites, or 25 percent of the sites on the NPL, since the inception of the program. In addition, EPA had identified 40,094 potentially hazardous waste sites across the nation (Figure 21.1). About 94 percent of these sites have been assessed by EPA to determine if further action is needed. By the end of 1995, EPA had removed 24,472 low-priority sites, leaving 15,622 remaining in the inventory.

In addition to long-term remediation of NPL sites, EPA conducts "removals"—short-term response actions—at many more sites where a release or threatened release of hazardous substances presents a threat to public health, welfare, or the environment. Removals can be conducted at both NPL and non-NPL sites, but are limited to actions that can be completed in less than one year and that cost no more than $2 million. Through fiscal 1995, the removal program had conducted 4,271 removal actions at 3,245 sites, including 2,617 non-NPL sites.

Figure 21.1 U.S. Superfund and NPL Sites, 1980-1995



Source: See Part III, Table 70.
Note: *>24,000 low-priority sites removed under EPA's Brownfields initiatives. NPL=National Priorities List.

State and federal agencies other than EPA also have significant authorities for hazardous substances response and natural resource restoration. In addition to the cleanup responsibilities each agency has for its own facilities, federal agencies, states, and Indian tribes serve as trustees for natural resources that are injured as a result of a release or threatened release of hazardous substances. These natural resource trustees, which include the Department of the Interior, the Department of Agriculture, the National Oceanic and Atmospheric Administration, the Department of Defense, and the Department of Energy, have authority to seek natural resource damages. These damage recoveries then may be used to replace, restore, or acquire the equivalent of the injured resource. At NPL sites, this role consists primarily of ensuring that remedial action fully addresses natural resource concerns, and seeking any additional steps that may be necessary to achieve restoration. At non-NPL sites, trustee agencies may seek to recover damages and use them for restoration and for source control, an activity that can also be part of response actions.

Superfund monies are not available, however, to fund natural resource restora-

tion, and thus the natural resource damage programs have had more limited support than EPA's remedial program. To enhance the program authority of natural resource agencies that now lack access to the Superfund, Executive Order 13016 provides these agencies with authority to issue administrative orders to compel responsible parties to perform response work.

At Love Canal, perhaps the most famous of all Superfund sites, EPA's remedial program has substantially improved conditions by successfully completing site remediation, recovered a significant amount of the response cost, and secured the agreement of the responsible party to assume responsibility for long-term monitoring. From 1942 to 1952, Hooker Chemicals and Plastics (now Occidental Chemical Corporation) used Love Canal as a dump for over 21,000 tons of mixed chemical wastes. In the ensuing years, homes and even an elementary school were built in the area above and around the covered landfill. Over time, contamination migrated to groundwater and into basements of houses, sewers, creeks, and ultimately the nearby Niagara River. In the late 1970s, the area was declared an environmental emergency and 950 families were evacuated.

Cleanup of Love Canal has been complex but successful. Cleanup operations have included containment of the leaking landfill; removal and disposal of sediments from sewers and creeks; removal and cleaning of soils near the school; and buyout of properties in the area. In 1988, EPA issued the Love Canal Habitability Study. The agency concluded that several portions of the area were again clean enough for people to move back to the neighborhood. Other areas, while not suitable for homes, were sufficiently clean for commercial or industrial use. Today, revitalization of the area continues. Nearly 200 homes have been sold, 60 others are undergoing renovation, and new residential developments are being built. In addition, a settlement with Occidental Chemical resulted in recovery of most of EPA's response costs and $325,000 in natural resource damages.

Reinventing Superfund

Superfund has been subject to numerous criticisms over the years. People who live near these sites often have been frustrated by the slow pace of the cleanup process. Many of those who are subject to Superfund liability have complained that enforcement actions are not fair and that cleanup costs are excessive.

Beginning in 1993, EPA initiated three rounds of administrative improvements to increase enforcement fairness, reduce transaction costs, improve cleanup effectiveness and consistency, expand public involvement, and enhance the states' role in the program. These include:

- To streamline the settlement process, EPA established model "de minimis" settlement agreements. By allowing the "little guy" to get out of the process early and fairly, these agreements have protected well over 12,000 small-volume contributors of hazardous waste at approximately 190

sites. EPA indirectly provided relief to many thousands of even smaller contributors by issuing guidance in July 1993 clearly stating the agency's intention not to pursue such parties.

- EPA's reforms are intended to enhance enforcement fairness for larger firms as well, and thereby promote more rapid settlement of liability for cleanup costs. To minimize contribution litigation, EPA has issued guidance to ensure that cleanup orders are issued to as many viable, responsible companies at a site as practicable by stating that cleanup orders will be issued to the largest manageable number of known viable parties. EPA also has increased use of the Superfund Trust Fund to pay for part of the "orphan shares" of responsibility attributable to insolvent or defunct parties (where the viable parties agree to undertake the cleanup), and is testing an allocation process in which a neutral party establishes the basis for settlements by allocating shares of cleanup responsibility among all responsible parties.

- EPA reformed the remedy selection process by giving greater emphasis to future land use; clarifying consideration of cost and risk issues; and reducing redundancy through RCRA/CERCLA integration guidance. To ensure that these reforms are consistently applied and that costs are appropriate to cleanup needs, EPA has established presumptive remedies for several classes of contamination, and introduced cost-effectiveness "rules of thumb" for remedy selection. In addition, EPA created a National Remedy Review Board comprised of EPA personnel. This board reviews proposed cleanup decisions and makes advisory recommendations to regional management for exceptionally high-cost actions. This process ensures sound, cost-effective decisionmaking that is consistent with current law and regulations.

- EPA is providing a facilitator in each region to serve as a direct point of contact for concerns of the community and other affected groups. The ombudsman will have access to a top regional management official and will facilitate resolution of concerns that cannot be informally resolved by regional personnel.

- EPA has created an electronic bulletin board on the Internet that allows communication among all Superfund stakeholders. The bulletin board includes an easily accessible guide to current state and federal guidance. The bulletin board will provide access to information for organizations that maintain site information repositories and administrative records within communities. Universities and the Hazardous Substance Research Centers may be utilized to provide additional information.

These reforms, coupled with the general maturing of the program, appear to be generating greater success in completion of cleanups. From FY 1983 through FY 1992, construction was completed at only 149 toxic waste sites on the NPL, an average of less than 15 sites per year. By contrast, from FY 1993 through FY 1995,

construction was completed at 197 NPL sites, an average of more than 65 sites per year. The Administration is seeking appropriations to ensure completion of approximately 500 sites from FY 1997 through FY 2000, an average of 125 sites per year—nearly doubling the pace of cleanup. Not counting sites where construction has been completed, there are an additional 472 NPL sites where construction is underway.

Redeveloping Brownfields

Many of America's older cities and towns are scarred by brownfields—contaminated and/or abandoned industrial sites. In many cities and towns, the number of such vacant parcels is increasing, and redevelopment is difficult because of the many uncertainties associated with cleanup, liability, and cost issues. Fear of liability under Superfund and other laws posed severe impediments to cleanup and redevelopment of contaminated property on the part of municipalities, lenders, real estate developers, and investors. Understandably, private investors and developers tend to favor greenfields in outlying areas.

The Clinton Administration has developed a comprehensive approach to reduce the barriers and encourage redevelopment of these properties. EPA's Brownfields Action Agenda, which was unveiled in January 1995, includes funding for 60 pilot projects at brownfield sites. These projects are intended to provide EPA, states, and localities with useful information and new strategies for promoting environmental cleanup through redevelopment. These modest investments in brownfields assessment yield major returns for the communities that receive them. The first such project in Cleveland, Ohio, leveraged $4.2 million in private investment, created 200 jobs, and generated more than $1 million in new payroll taxes for the city.

These steps have been reinforced with administrative and legislative efforts to encourage lending for cleanup and redevelopment. By the end of 1995, EPA had removed more than 24,000 sites (or nearly two-thirds) from the Superfund site data base (CERCLIS). These sites represent those that the states and EPA investigated and found to be of no further federal concern. Many were found not to be seriously contaminated while others are being cleaned up under state programs. This action is making it easier for potential purchasers, developers, lenders, and communities to make investments in these properties and clean them up. The Clinton Administration also advocated legislation to clarify the potential liability of lenders and fiduciaries, thereby removing impediments to brownfield financing. These proposals were enacted in the final days of the 104th Congress.

In March 1996, the President also proposed a package of tax incentives to encourage brownfield redevelopment in distressed communities. Under this proposal, environmental cleanup costs incurred by new purchasers may be fully deducted in the year in which they were incurred, which would reduce the cost of capital for these types of investments by more than half. This $2 billion incentive is expected to leverage $10 billion in pri-

vate investment, which would return an estimated 30,000 brownfields to productive use. The tax incentive would be available in existing brownfield pilot areas, in areas with a poverty rate of 20 percent or more, in adjacent industrial or commercial areas, and in Empowerment Zones and Enterprise Communities. In August 1996, President Clinton further proposed an additional $300 million over four years to finance the assessment, cleanup, and redevelopment of brownfields sites.

This program advances the recommendations of the President's Council on Sustainable Development, which include calls for expanded partnership with communities and industry, new incentives for brownfields cleanup and redevelopment, and liability reforms that remove impediments to redevelopment while preserving the polluter-pays principle.

Federal Facilities

Contaminated federal facilities present some of the more prominent legacies of past mismanagement of toxics and hazardous materials. These facilities can be grouped into three major categories: the nuclear weapons complex; nonnuclear industrial contamination sites resulting from federal operations; and land managed by federal agencies with contamination from governmental or private activities.

The most difficult and costly challenge concerns the Department of Energy facilities that developed, produced, and tested nuclear weapons. These sites contain radiological and mixed wastes that present unique technological and practical impediments to prompt remediation and restoration. The cleanup effort is focused on 15 major DOE facilities and a dozen or so smaller facilities. Six of the major facilities—Hanford, Savannah River, Oak Ridge, Fernald, Idaho National Engineering Laboratory, and Rocky Flats—account for about 80 percent of DOE's environmental management budget.

The federal government is currently spending about $9 billion a year to address the federal facility cleanup problem, including DOE's ongoing waste management. Over the next 75 years, the cost of cleanup at DOE facilities is estimated to be $200-$350 billion (in 1995 dollars, including management of storage facilities), while costs at the facilities of other federal agencies (Defense, Agriculture, Interior, and the National Aeronautics and Space Administration) are estimated at $34-$38.5 billion (in 1994 dollars).

Improving Federal Facilities Cleanup, the October 1995 report of the interagency Federal Facilities Policy Group, found significant progress in the cleanup effort at federal facilities. This progress has been most notable at Defense Department sites, where contamination typically is comparable to that at private sector industrial sites. Progress also has been evident at DOE, where major management and contracting reforms have been implemented. However, there has been slower progress in site assessments, response actions, and natural resource restoration at land management agencies, such as DOI and USDA.

The report also found that a number of reforms are necessary to maximize the efficiency and effectiveness of the cleanup effort, and to ensure that the cleanups can be achieved within anticipated budget constraints. These include reforms to CERCLA; regulatory and administrative reforms to cleanup programs; management reforms at the agencies responsible for cleanups; and budget reforms to ensure more predictable funding streams for the cleanup effort. Many of the cleanup problems at these facilities may require more than reform. The Galvin Commission recently concluded that existing technology and scientific understanding may be inadequate to clean up federal facilities.

Separately, EPA convened a broad range of constituencies in its Federal Facilities Environmental Restoration Dialogue Committee (FFERDC), and developed a series of recommendations to improve the pace and public acceptance of federal facility cleanups. These recommendations have been endorsed by the relevant federal agencies, and are expected to yield more successful relationships between the federal agencies and their regulators, and between the individual facilities and their host communities.

DEALING WITH THE PRESENT

The principal thrust of the current federal approach to hazardous waste is to minimize generation, to recycle waste that is generated, to safely dispose of waste that cannot be prevented or recycled, to protect community right-to-know about toxic substances released into the environment, and to take firm but fair enforcement action against persons who violate environmental laws or who are liable for pollution. Concurrently, federal agencies are implementing reforms to eliminate regulatory burdens that yield high costs but little environmental benefit. In addition, some federal agencies such as DOE are supporting innovative technology development and research to improve scientific understanding of fundamental processes affecting waste transport and cleanup.

TRI

The Toxics Release Inventory (TRI) presents a useful but not completely comprehensive picture of toxic releases into the environment. The reporting requirement historically has been limited to certain specified industrial categories, to firms with 10 or more employees, and to firms that manufacture or process more than 25,000 pounds or use more than 10,000 pounds of any listed chemical during the calendar year. For 1994, the TRI list included 343 chemicals and 22 chemical categories. The Clinton Administration repeatedly expanded the scope of TRI reporting, requiring reporting by federal facilities in 1994, nearly doubling the list of chemical releases that must be reported for 1995 (to about 650 substances), and proposing the addition of seven new industrial categories to the list of TRI reporters.

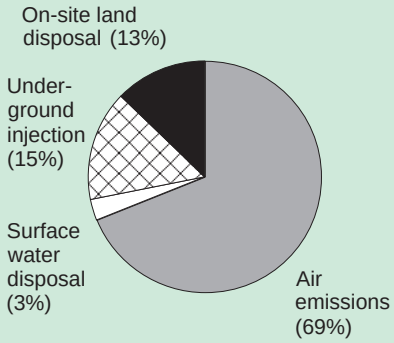
The risk to human health and the environment posed by these releases depends on many factors, including the toxicity of the chemical, the extent of exposure, the type of release, and the conditions of the environment. Small releases of highly toxic chemicals may present a greater risk than large releases of less toxic chemicals. Direct releases to the air may pose a greater threat to human health than contained releases, such as certain types of underground injection.

According to TRI data for on-site releases in 1994, 22,744 facilities released 2.26 billion pounds of listed toxic chemicals into the environment (Figure 21.2). Air emissions accounted for 69 percent of the total, followed by underground injection (much of it controlled releases into subsurface wells) at 15 percent, releases to landfills and other types of land disposal at 13 percent, and releases to water at 3 percent.

Facilities also transferred nearly 3.8 billion pounds of toxic chemicals to off-site locations for recycling, energy recovery, treatment, and disposal (Figure 21.3). Nearly 65 percent of all transfers (by weight) were for recycling, while less than 8 percent were for disposal.

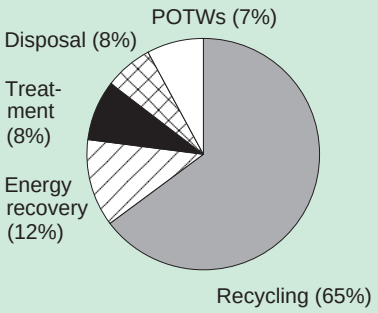
The states with the largest quantities of toxic releases are primarily in the South and Midwest (Figure 21.4). Texas, with 250 million pounds of releases, was the leading state in terms of total releases. By industrial sector, the chemical industry (851 million pounds) is the leading sector, followed by primary metals and paper (Figure 21.5). By company, DuPont (203 million pounds) leads in total releases. By individual facility, the leaders for total releases are DuPont facilities in Pass Christian, Mississippi, with 60 million pounds, and in New Johnsonville, Tennessee, with 57 million pounds.

Figure 21.2 Distribution of U.S. Toxics Releases, 1994



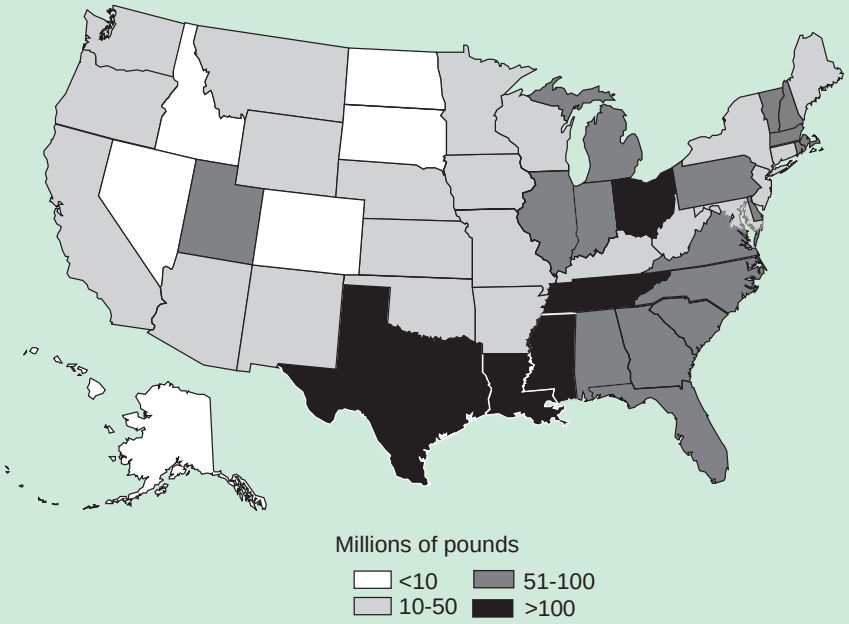
Source: U.S. Environmental Protection Agency, *1994 Toxics Release Inventory: Public Data Release* (EPA, Washington, DC, 1996).
Note: Total releases=2.26 billion pounds.

Figure 21.3 Distribution of U.S. Toxics Transfers, 1994



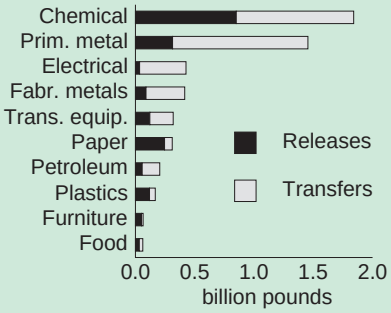
Source: U.S. Environmental Protection Agency, *1994 Toxics Release Inventory: Public Data Release* (EPA, Washington, DC, 1996).
Note: Total transfers=3.795 billion pounds. POTWs= publicly owned treatment works.

Figure 21.4 Toxic Releases by State, 1994



Source: U.S. Environmental Protection Agency, *1994 Toxics Release Inventory: Public Data Release* (EPA, Washington, DC, 1996).

Figure 21.5 Toxics Releases and Transfers by Selected U.S. Industries, 1994

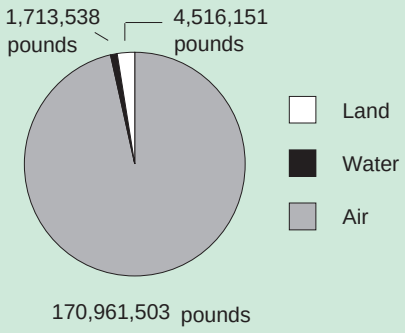


Source: See Part III, Table 73.
Note: Data are from EPA's Toxics Release Inventory.

TRI designates 118 chemicals as known or suspected carcinogens. More than 177 million pounds of TRI-listed carcinogens were released to the air, water, and land (excluding underground injection) in 1994 (Figure 21.6). Two chemicals—dichloromethane and styrene—accounted for more than half of the total releases.

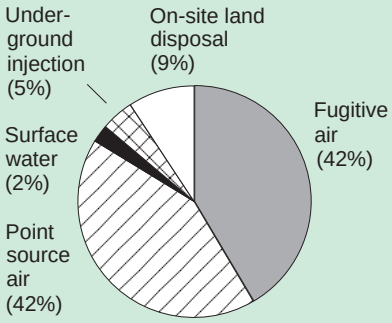
Federal facilities were required to report to the TRI for the first time in 1994. Releases by federal facilities totaled 9.8 million pounds in 1994 (Figure 21.7). Air emissions constituted nearly 84 percent of all releases. The Department of Defense accounted for nearly 73 percent of the total. Off-site transfers totaled

Figure 21.6 U.S. Releases of OSHA* Carcinogens, 1994



Source: U.S. Environmental Protection Agency, *1994 Toxics Release Inventory: Public Data Release* (EPA, Washington, DC, 1996).
Note: *Occupational Safety and Health Administration.

Figure 21.7 Toxics Releases by U.S. Federal Facilities, 1994



Source: U.S. Environmental Protection Agency, *1994 Toxics Release Inventory: Public Data Release* (EPA, Washington, DC, 1996).
Note: Total releases=9.8 million pounds.

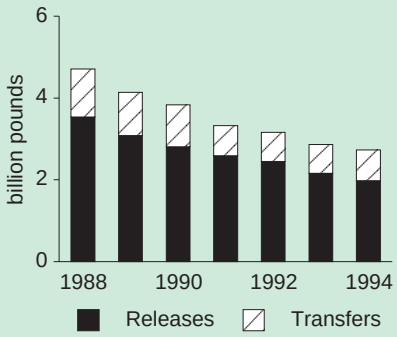
10.4 million pounds, of which half was for recycling and one fourth for disposal. The Department of Defense accounted for nearly 95 percent of all transfers in 1994.

Trends in TRI Releases

Since 1988, EPA's baseline year for TRI comparisons, reported toxic releases have declined by 44.1 percent (Figure 21.8). The sharpest declines have been to air and surface water, while declines in underground injection and releases to land have been less dramatic. From 1993 to 1994, releases to land and underground injection actually increased slightly.

Discharges to surface water decreased by 156 million pounds between 1993 and 1994, from 203 million pounds to 47 million pounds. Virtually all of this decrease is attributable to large decreases from just two IMC-Agrico fertilizer facilities in Louisiana. These two facilities implemented pollution prevention and control measures to decrease runoff of phosphoric acid and other chemicals.

Figure 21.8 Trends in U.S. Toxics Releases and Transfers, 1988-1994



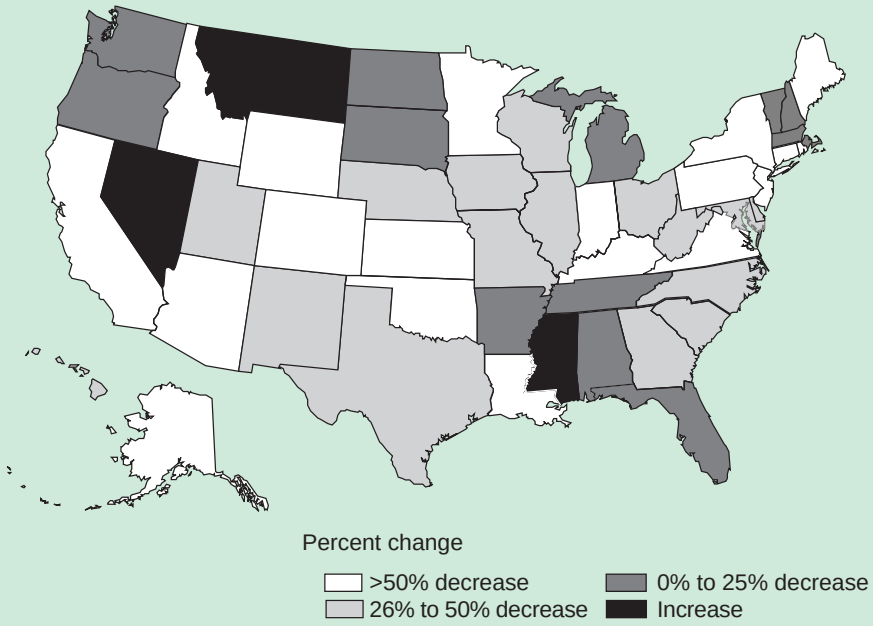
Source: See Source for Part III, Table 72.
Note: Data are standardized to account for changes in reporting requirements. Graph does not include transfers for recycling or energy recovery as these transfers were not required to be reported for 1988-1990.

Since 1988, air emissions have declined by 912 million pounds, or 40.5 percent. From 1993 to 1994, total air emissions declined by more than 50 million pounds, from 1.40 billion pounds to 1.35 billion pounds. Of the 10 chemicals with the greatest decreases in air emissions, three were ozone-depleting chemicals that were scheduled for phaseout by January 1, 1996. Air emissions of methanol rose 24 percent, largely because of changes in the methods used by pulp and paper mills to estimate their releases in 1994.

Texas, currently first in the nation for total TRI releases, has reduced its emissions by 98 million pounds (31.5 percent) since 1988 (Figure 21.9). Tennessee, now ranked second, has reduced emissions by 13 million pounds (8.1 percent). Louisiana, now ranked third, has reduced its emissions by 315 million pounds (72.4 percent), which is by far the largest decrease of any state in terms of pounds. Mississippi's emissions have climbed 19.7 percent, from 94 million pounds in 1988 to 113 million pounds in 1994, which has moved the state from seventeenth overall in 1988 to fourth in the nation in 1994.

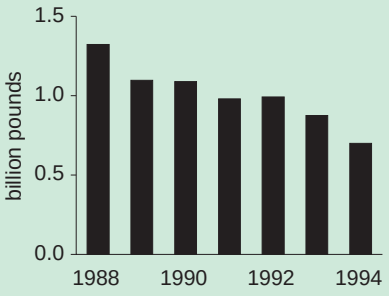
By industry, the chemical industry has had the largest absolute decrease in releases (622 million pounds) (Figure 21.10), whereas in percentage terms the

Figure 21.9 Percent Change in Toxic Releases by State, 1988-1994



Source: U.S. Environmental Protection Agency, *1994 Toxics Release Inventory: Public Data Release* (EPA, Washington, DC, 1996).

Figure 21.10 Toxics Releases by the U.S. Chemical Industry, 1988-1994



Source: See Part III, Table 73.

largest decreases from 1988–94 were reported by the electrical equipment, leather, and measurement/photographic instruments industries. The chemical industry has reduced its releases by 47.1 percent since 1988, or slightly better than the overall rate of 44.1 percent for all industry groups. The paper industry, which accounted for the third largest quantity of TRI releases in 1994, has reduced its releases by just 4 percent since 1988.

Trends in Source Reduction

The 1990 Pollution Prevention Act expanded TRI to require reporting of chemicals managed in waste. The law also established a waste management hierarchy, with a preference for source reduction activities.

Overall, facilities managed more than 26.5 billion pounds of TRI chemicals in waste in 1994. The chemicals, primary metals, and paper industries generated the most toxic chemicals in waste; these same three industries also ranked highest for total releases of TRI chemicals.

The quantity of toxic chemicals in waste increased 5.4 percent from 1993 to 1994 and is projected to continue to increase. Quantities that are released declined by 20.2 percent from 1991 to the projected total in 1996. Over the 1991–96 period, recycling is projected to increase by 17.9 percent, energy recovery by 13 percent, and treatment by 9.9 percent.

Some 32 percent of all TRI facilities reported at least one source reduction activity in 1994. Of all TRI forms submitted, 23 percent reported some source reduction activities.

Many companies are discovering that pollution prevention programs can significantly lower their operating costs (see Box 21.1).

The 33/50 Program

The 33/50 program is an EPA voluntary pollution reduction initiative that targets 17 high-priority TRI chemicals. For these 17 chemicals, EPA set two goals: by 1992, a 33 percent reduction in TRI releases and transfers (using 1988 as the baseline year), and by 1995, a 50 percent reduction. These goals translate to a reduction of nearly 750 million pounds of pollution from the nearly 1.5 billion pounds reported to TRI for 1988.

The 33/50 program has been remarkably successful. It has enlisted the active cooperation of 1,300 corporations and more than 6,000 TRI facilities. The 1992 interim 33-percent goal was achieved a year ahead of time, while the 1995 50-percent goal was actually achieved by

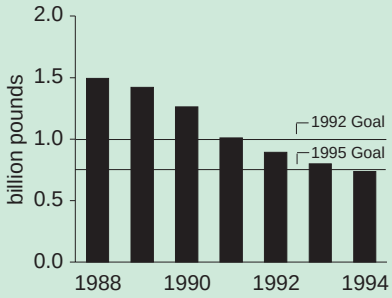
Box 21.1
Economic Gain Through Waste Minimization

One of the most attractive features of pollution prevention is the potential for "win-win" outcomes—those where a facility can reduce pollution and simultaneously lower its own costs. This was the result under a lawsuit filed by EPA against the DuPont Company's Chambers Works chemical plant in Deepwater, New Jersey—one of the largest chemical manufacturing facilities in the United States.

As part of the settlement between DuPont and EPA, DuPont agreed to pay a substantial penalty for past RCRA violations, to conduct an internal audit of its waste-generating activities, and to evaluate pollution prevention opportunities at the facility. In consultation with EPA, company officials identified 15 manufacturing processes with pollution prevention potential. The individual projects focused on reducing solvent waste, tar waste, and other chemical waste. One project even reduced packaging waste by introducing reusable chemical containers in place of disposable 55-gallon drums.

The effort has been a striking success. With 7 of the 15 projects implemented, DuPont has reduced waste from the affected processes by 73 percent. Once all projects are in place, DuPont expects that waste from all 15 processes will be cut roughly in half. More importantly, this waste reduction will yield benefits to the company as a result of reduced waste disposal and other regulatory costs. The total up-front investment for all 15 projects is expected to be about $6 million, while DuPont anticipates annual savings of about $15 million. DuPont is making the study publicly available as an example of how technological progress can be shared to further waste minimization.

Figure 21.11 U.S. Releases and Transfers of 33/50 Program Chemicals, 1988-1994



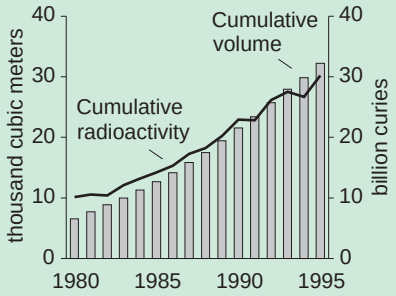
Source: U.S. Environmental Protection Agency, *1994 Toxics Release Inventory: Public Data Release* (EPA, Washington, DC, 1996).

1994, when reductions since 1988 totaled 757 million pounds (Figure 21.11).

Since the program's announcement in 1991, 33/50 chemicals have been reduced at nearly twice the rate observed for all other TRI chemicals (41.6 percent versus 22.3 percent). Since 1988, facilities owned by participants have reduced their releases and transfers of 33/50 chemicals by 60 percent, compared with a 35 percent reduction by nonparticipants.

As for chemicals in production-related waste, 33/50 chemicals have decreased slightly (0.9 percent) since 1991 and are forecast to decline by 4.5 percent in 1995 and more than 7 percent by 1996. Other TRI chemicals have increased significantly (9.2 percent) since 1991 and are

Figure 21.12 U.S. Generation of Spent Nuclear Fuel, 1980-1995



Source: See Part III, Table 69.
Note: Cumulative radioactivity includes decay.

forecast to continue increasing (4.3 percent in 1995 and 6 percent in 1996).

As a group and individually, 33/50 chemicals are being targeted for more source reduction activities than other TRI chemicals; 30 percent of all TRI facilities reported the occurrence of source reduction for 33/50 chemicals, compared to 20 percent for other TRI chemicals.

NUCLEAR WASTE

Nuclear waste encompasses a wide range of material. The Department of Energy and Nuclear Regulatory Commission (NRC) recognize six major types of waste.

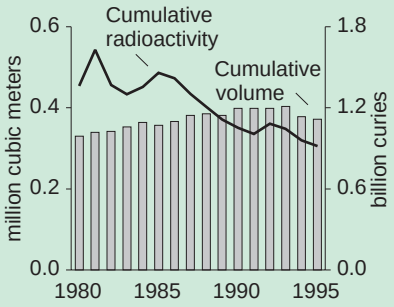
Spent Nuclear Fuel. These are fuel rods that have been permanently withdrawn from a nuclear reactor because they can no longer efficiently sustain a nuclear chain reaction. Spent fuel contains some relatively short-lived fission products as well as long-lived radionuclides such as plutonium, which remains dangerously radioactive for tens of thousands of years. Measured in terms of radioactivity, spent fuel accounts for about 95 percent of all accumulated radioactivity (Figure 21.12).

U.S. commercial nuclear reactors currently generate about 2,000 metric tons of spent fuel annually. The current total of about 30,000 metric tons of spent fuel is stored at about 70 power plant sites around the nation. The total is expected to reach 40,000 metric tons by the turn of the century.

High-level Waste. High-level waste includes highly radioactive residue created by spent fuel reprocessing, mostly for defense purposes in the United States. Enough long-lived radioactive elements remain to require isolation for 10,000 years or more (Figure 21.13).

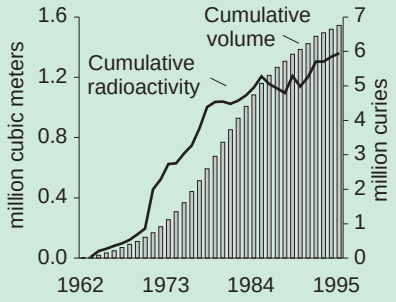
Transuranic Waste. Transuranic waste —relatively low-activity waste with some long-lived elements heavier than uranium (primarily plutonium)—is generated

Figure 21.13 U.S. Generation of High-Level Nuclear Waste, 1980-1995



Source: See Part III, Table 69.
Note: Cumulative radioactivity includes decay.

Figure 21.14 U.S. Generation of Low-Level Nuclear Waste, 1962-1995



Source: See Part III, Table 69.
Note: Cumulative radioactivity includes decay.

almost entirely by nuclear weapons production processes. Disposal via long-term isolation is planned for these wastes in the nation's Waste Isolation Pilot Plant. EPA will review and certify the ability of the facility to comply with established disposal standards.

Uranium Mill Tailings. These are sand-like residues from the processing of uranium ore. Mill tailings have low radioactivity but represent a large volume.

Low-level Waste. This is radioactive waste not classified as spent fuel, high-level waste, TRU waste, or mill tailings.

By volume, low-level waste makes up more than 85 percent of the U.S. total. In terms of radioactivity, it accounts for less than a tenth of 1 percent (Figure 21.14).

Mixed Waste. This is high-level, low-level, or TRU waste that contains hazardous non-radioactive waste.

The 1982 Nuclear Waste Policy Act called for disposal of spent nuclear fuel in a repository in a stable deep geologic formation. A 1987 amendment to the act restricted DOE's repository site studies to Yucca Mountain in Nevada. Answering questions about the viability of the site is expected to require several additional years of scientific work. DOE estimates that it will be able to complete this work in 1998 if requested budget amounts remain available. The 1982 act set a 1998 goal for loading waste into the repository. A permanent repository could not open until after a site is found viable and is licensed, a process that will take several years after completion of site characterization.

The nuclear industry is supporting legislation that would require DOE to open an interim waste storage facility near Yucca Mountain by 1998. By May 1996, House and Senate committees had approved the legislation. The Administration opposes early siting of an interim waste facility, arguing that waste should not be stored near Yucca Mountain before DOE has made a technical determination of the site's suitability for a permanent repository, and that adequate environmental safeguards must be in place.

Under the 1980 Low-Level Radioactive Waste Policy Act, states are authorized to form regional disposal compacts. Two commercial low-level waste sites are currently operating. The Washington site is accepting waste from states within its compact. South Carolina reopened its site to nationwide disposal in July 1995. A planned facility in California is currently undergoing additional environmental reviews.

Reform Steps

In recent years the Clinton Administration has tried to fine-tune federal policies on hazardous waste, emphasizing the targeting of regulations toward higher-risk chemicals, reducing the economic burden of the program, and encouraging greater community participation.

In November 1995, EPA proposed a new hazardous waste identification rule that will dramatically refocus the regulatory program on high-risk waste. When finalized, this rule will exempt from RCRA Subtitle C regulation certain waste that does not pose a significant public health threat—resulting in substantial savings to businesses handling this low-risk waste and allowing more time to focus on greater hazards to public health and the environment.

As part of its initiative for reinventing environmental regulation, the Clinton Administration also committed to identifying targeted amendments to provisions of RCRA that result in high costs and marginal environmental benefits. As a result of this initiative, the 104th Congress enacted the Land Disposal Program Flexibility Act of 1996, which eliminated a RCRA mandate requiring EPA to promulgate stringent and costly treatment requirements for certain low-risk wastes that already are regulated in Clean Water Act or Safe Drinking Water Act units. EPA considers these wastes to present little or no risk, due to existing regulation under other statutes and under state law, but a court decision (*Chemical Waste Management v. EPA*— also known as the "Third-third" decision) had required the agency to promulgate far more stringent requirements than the agency itself had sought for these low-risk wastes, which are not even classified as hazardous wastes. This targeted legislative fix to the LDR provisions eliminated these unduly stringent treatment requirements for certain wastes managed in injection wells already regulated under the Safe Drinking Water Act and surface impoundments already regulated under the Clean Water Act. Preliminary estimates suggest that this amendment could yield hundreds of millions of dollars in savings for the private sector.

The Administration also supported enactment of the Mercury Containing and Rechargeable Battery Management Act of 1996, which would establish uniform national labeling, storage, and transportation standards to encourage environmentally sound recycling of batteries, and prohibit the sale of certain mercury-containing batteries.

This bill furthered the steps EPA had taken administratively, most recently through the RCRA universal waste rule, to encourage recycling of rechargeable batteries in a manner that does not compromise environmental protection. As a result of this change, retailers and other entities that collect used batteries for recycling will be relieved of excessively burdensome regulations, and mercury loadings attributable to mercury-containing batteries should be reduced.

The Administration also has supported reforms to promote greater community participation in environmental protection. For example, East St. Louis is a highly industrialized area that has histori-

cally suffered from a variety of environmental problems. Key stakeholders have worked together to inform the community of ongoing environmental initiatives and progress, and to solicit input on future initiatives. The program has employed "good neighbor dialogues" to inform residents of progress in reducing releases of TRI chemicals. These chemicals have shown a marked decrease between 1988 and 1993. The effect can be seen directly: local hospital staff contend that the elimination of chemical spills at Monsanto and other industrial facilities has resulted in hundreds fewer emergency room admissions.

FUTURE CHALLENGES

In most respects, the Toxics Release Inventory has been a striking success. Faced with TRI information and community pressures, as well as fair but firm enforcement of statutory controls, environmental leaders in the business community have responded by aggressively reducing toxic releases, in part through commendable voluntary efforts. Building on this success, President Clinton announced a major right-to-know initiative in August 1996, aimed at increasing information available to families about potential toxic exposures to children. This Family Right-to-Know initiative is currently being developed by EPA and other federal agencies, and is likely to include new administrative and possibly legislative proposals to expand the information available to parents about toxic chemicals that may affect their families.

There are shortcomings in existing right-to-know programs, however, that remain to be addressed. For example, critics contend that TRI reporting can include "phantom reductions," such as changes in measurement or estimation that reduce releases on paper only, downturns in production, or shifts to unreported waste management activities. According to a 1991 EPA study, changes in production were the most frequently cited reason for reported reductions and accounted for the largest absolute change.

Although pollution prevention is clearly a policy goal, the TRI program does not effectively distinguish between pollution prevention measures and other practices that reduce pollution. For example, take the case of 1991 TRI reports for two New Jersey firms: Hatco Corporation released 10 pounds of phosgene gas (an acute neurotoxin) and DuPont emitted 1,298 pounds. What this report does not show, however, is that Hatco ships in almost 5 million pounds of phosgene annually, which poses a serious risk of a transportation or storage accident, while DuPont produced phosgene on-site and consumed most of the gas as an intermediate component.

In another case, Polaroid Corporation in 1994 reported an increase in releases, largely because record sales prompted the company to use older manufacturing processes that were not retooled for waste reduction. The data masked Polaroid's aggressive and successful effort to reduce toxics use. In 1994, the company used 8,642 pounds of ozone-depleting chemicals, a tiny fraction of the 125,949 used

in 1988. Yet under TRI, such dramatic reductions in use are hidden.

Finally, many scientific challenges lie ahead. There is a critical need to increase our fundamental understanding of processes affecting waste and improve our ability to model and predict the fate of toxic chemicals in the environment.

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