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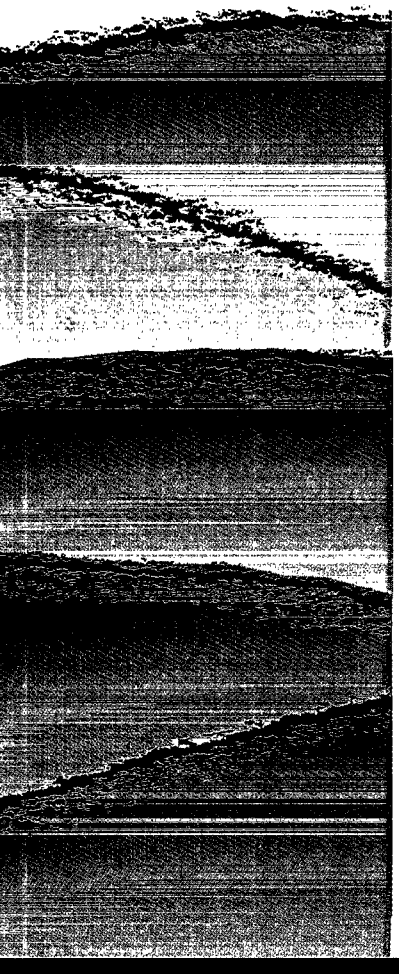
Landfill Reclamation

This fact sheet describes new and innovative technologies and products that meet the performance standards of the Criteria for Municipal Solid Waste Landfills (40 CFR Part 258).

Landfill reclamation is a relatively new approach used to expand municipal solid waste (MSW) landfill capacity and avoid the high cost of acquiring additional land. Reclamation costs are often offset by the sale or use of recovered materials, such as recyclables, soil, and waste, which can be burned as fuel. Other important benefits may include avoided liability through site remediation, reductions in closure costs, and reclamation of land for other uses.

Despite its many benefits, some potential drawbacks exist to landfill reclamation. This technology may release methane and other gases, for example, that result from decomposing wastes. It may also unearth hazardous materials, which can be costly to manage. In addition, the excavation work involved in reclamation may cause adjacent landfill areas to sink or collapse. Finally, the dense, abrasive nature of reclaimed waste may shorten the life of excavation equipment. To identify potential problems, landfill operators considering reclamation activities should conduct a site characterization study.

Landfill reclamation projects have been successfully implemented at MSW facilities across the country since the 1980s. This fact sheet provides information on this technology and presents case studies of successful reclamation projects.



The Reclamation Process

Landfill reclamation is conducted in a number of ways, with the specific approach based on project goals and objectives and site-specific characteristics. The equipment used for reclamation projects is adapted primarily from technologies already in use in the mining industry, as well as in construction and other solid waste management operations. In general, landfill reclamation follows these steps:

Excavation

An excavator removes the contents of the landfill cell. A front-end loader then organizes the excavated materials into manageable stockpiles and separates out bulky material, such as appliances and lengths of steel cable.

Soil Separation (Screening)

A trommel (i.e., a revolving cylindrical sieve) or vibrating screens separate soil (including the cover material) from solid waste in the excavated material. The size and type of screen used depends on the end use of the recovered material. For example, if the reclaimed soil typically is used as landfill cover, a 2.5-inch screen is used for separation. If, however, the reclaimed soil is sold as construction fill, or for another end use requiring fill material with a high fraction of soil content, a smaller mesh screen is used to remove small pieces of metal, plastic, glass, and paper.

Trommel screens are more effective than vibrating screens for basic landfill reclamation. Vibrating screens, however, are smaller, easier to set up, and more mobile.

Processing for Reclamation of Recyclable Material or Disposal

Depending on local conditions, either the soil or the waste may be reclaimed. The separated soil can be used as fill material or as daily cover in a sanitary landfill. The excavated waste can be processed at a materials recovery facility to remove valuable components (e.g., steel and aluminum) or burned in a municipal waste combustor (MWC) to produce energy.

Steps in Project Planning

Before initiating a landfill reclamation project, facility operators should carefully assess all aspects of such an effort.

The following is a recommended approach:

1. Conduct a site characterization study.
2. Assess potential economic benefits.
3. Investigate regulatory requirements.
4. Establish a preliminary worker health and safety plan.
5. Assess project costs.

Benefits and Drawbacks

Facility operators considering the establishment of a landfill reclamation program must weigh several benefits and drawbacks associated with this waste management approach.

Potential Benefits

Extending landfill capacity at the current site
Landfill reclamation extends the life of the current facility by removing recoverable materials and reducing waste volume through combustion and compaction.

Generating revenues from the sale of recyclable materials
Recovered materials, such as ferrous metals, aluminum, plastic, and glass, can be sold if markets exist for these materials.

Lowering operating costs or generating revenues from the sale of reclaimed soil
Reclaimed soil can be used on site as daily cover material on other landfill cells, thus avoiding the cost of importing cover soil. Also, a market might exist for reclaimed soil used in other applications, such as construction fill.

Producing energy at MWCs
Combustible reclaimed waste can be mixed with fresh waste and burned to produce energy at MWCs.

Reducing landfill closure costs and reclaiming land for other uses
By reducing the size of the landfill "footprint" through cell reclamation, the facility operator may be able to either lower the cost of closing the landfill or make land available for other uses.

Retrofitting liners and removing hazardous materials
Liners and leachate collection systems can be installed at older landfills. These systems can be inspected and repaired if they are already installed. Also, hazardous waste can be removed and managed in a more secure fashion.

Potential Drawbacks

Managing hazardous materials
Hazardous wastes that may be uncovered during reclamation operations, especially at older landfills, are subject to special handling and disposal requirements. Management costs for hazardous waste can be relatively high, but may reduce future liability.

Controlling releases of landfill gases and odors
Cell excavation raises a number of potential problems related to the release of gases. Methane and other gases, generated by decomposing wastes, can cause explosions and fires. Hydrogen sulfide gas, a highly flammable and odorous gas, can be fatal when inhaled at sufficient concentrations.

Controlling subsidence or collapse
Excavation of one landfill area can undermine the integrity of adjacent cells, which can sink or collapse into the excavated area.

Increasing wear on excavation and MWC equipment
Reclamation activities shorten the useful life of equipment, such as excavators and loaders, because of the high density of waste being handled. Also, the high particulate content and abrasive nature of reclaimed waste can increase wear on MWC equipment (e.g., grates and air pollution control systems).

This planning sequence assumes that project planners will make an interim assessment of the project's feasibility after each planning step. After completion of all five steps, planners should conclude the feasibility assessment by weighing costs against benefits. A thorough final assessment should include a review of project goals and objectives and consideration of alternative approaches for achieving those ends.

Conduct a Site Characterization Study

The first step in a landfill reclamation project calls for a thorough site assessment to establish the portion of the landfill that will undergo reclamation and estimate a material processing rate.

The site characterization should assess facility aspects, such as geological features, stability of the surrounding area, and proximity of ground water, and should determine the fractions of usable soil, recyclable material, combustible waste, and hazardous waste at the site.

Assess Potential Economic Benefits

Information collected in the site characterization provides project planners with a basis for assessing the potential economic benefits of a reclamation project. If the planners identify likely financial benefits for the undertaking, then the assessment will provide support for further investing in project planning. Although economics are likely to serve as the principal incentive for a reclamation project, other considerations may also come into play, such as a communitywide commitment to recycling and environmental management.

Most potential economic benefits associated with landfill reclamation are indirect; however, a project can generate revenues if markets exist for recovered materials. Although the economic benefits from reclamation projects are facility-specific, they may include any or all of the following:

- Increased disposal capacity.
- Avoided or reduced costs of:
  - —Landfill closure.
  - —Postclosure care and monitoring.
  - —Purchase of additional capacity or sophisticated systems.
  - —Liability for remediation of surrounding areas.
- Revenues from:
  - —Recyclable and reusable materials (e.g., ferrous metals, aluminum, plastic, and glass).
  - —Combustible waste sold as fuel.
  - —Reclaimed soil used as cover material, sold as construction fill, or sold for other uses.
- Land value of sites reclaimed for other uses.

Thus, this step in project planning calls for investigating the following areas:

- Current landfill capacity and projected demand.
- Projected costs for landfill closure or expansion of the site.
- Current and projected costs of future liabilities.
- Projected markets for recycled and recovered materials.
- Projected value of land reclaimed for other uses.

Investigate Regulatory Requirements

Landfill reclamation operations are not restricted under current federal regulations. Before undertaking a reclamation project, however, state and local authorities should be consulted regarding any special requirements. Although some states have enacted general provisions concerning the beneficial use of recovered materials, as of 1996, only New York State had established specific landfill reclamation rules. In most states, officials offer assistance in project development, and they review work plans on a case-by-case basis. A few states, such as New York and New Jersey, encourage landfill reclamation by making grant money available.

Establish a Preliminary Worker Health and Safety Plan

After project planners establish a general framework for the landfill reclamation effort, they must account for the health and safety risks the project will pose for facility workers. Once potential risks are identified from the site characterization study and historical information about facility operations, methods to mitigate or eliminate them should be developed. This information then becomes part of a comprehensive health and safety program. Before the reclamation operation begins, all workers who will be involved in the project need to be well versed in the safety plan and receive training in emergency response procedures.

Drawing up a safety and health plan can be particularly challenging given the difficulty of accurately characterizing the nature of material buried in a landfill. Project workers are likely to encounter some hazardous materials; therefore, the health and safety program should account for a variety of materials handling and response scenarios.

Although the health and safety program should be based on site-specific conditions and waste types, as well as project goals and objectives, a typical health and safety program might call for the following:

- Hazard communication (i.e., a "Right to Know" component) to inform personnel of potential risks.
- Respiratory protection measures, including hazardous material identification and assessment; engineering controls; written standard operating procedures; training in equipment use, respirator selection, and fit testing; proper storage of materials; and periodic reevaluation of safeguards.
- Confined workspace safety procedures, including air quality testing for explosive concentrations, oxygen deficiency, and hydrogen sulfide levels, before any worker enters a confined space (e.g., an excavation vault or a ditch deeper than 3 feet).
- Dust and noise control.
- Medical surveillance stipulations that are mandatory in certain circumstances and optional in others.
- Safety training that includes accident prevention and response procedures regarding hazardous materials.
- Recordkeeping.

The program should also cover the protective equipment workers will be required to wear, especially if hazardous wastes may be unearthed. The three categories of safety equipment used in landfill reclamation projects are:

- Standard safety equipment (e.g., hard hats, steel-toed shoes, safety glasses and/or face shields, protective gloves, and hearing protection).
- Specialized safety equipment (e.g., chemically protective overalls, respiratory protection, and self-contained breathing apparatus).
- Monitoring equipment (e.g., a combustible gas meter, a hydrogen sulfide chemical reagent diffusion tube indicator, and an oxygen analyzer).

Assess Project Costs

Planners can use information collected from the preceding steps to analyze the estimated capital and operational costs of a landfill reclamation operation. Along with the expenses incurred in project planning, project costs may also include the following:

- Capital costs:
  - — Site preparation.
  - — Rental or purchase of reclamation equipment.
  - — Rental or purchase of personnel safety equipment.
  - — Construction or expansion of materials handling facilities.
  - — Rental or purchase of hauling equipment.
- Operational costs:
  - — Labor (e.g., equipment operation and materials handling).
  - — Equipment fuel and maintenance.
  - — Landfilling nonreclaimed waste or noncombustible fly and bottom ash if waste material is sent off site for final disposal.
  - — Administrative and regulatory compliance expenses (e.g., recordkeeping).
  - — Worker training in safety procedures.
  - — Hauling costs.

Part of the cost analysis involves determining whether the various aspects of the reclamation effort will result in reasonable costs relative to the anticipated economic benefits. If the combustible portion of the reclaimed waste will be sent to an offsite MWC, for example, planners should assess whether transportation costs will be offset by the energy recovery benefits. Planners also need to consider whether capital costs can be minimized by renting or borrowing heavy equipment, such as excavating and trommel machinery, from other departments of municipal or county governments. Long-term reclamation projects may benefit from equipment purchases.

Case Studies

Table 1. Landfill Reclamation Project Summaries

Project	Operation Start	Mined Area	Use of Recovered Material	Main Objectives
Naples Landfill (Collier County, Florida)	April 1986 (ongoing).	10 acres	Cover material.	Decrease liability. Recover soil.
Edinburg Landfill (Edinburg, New York)	Dec. 1990 and June 1991 (both completed).	1 acre		Alternative to landfill closure.
	Aug. - Sept. 1992 (completed).	1.6 acre	Construction fill.	Reduce landfill footprint.
Frey Farm Landfill (Lancaster County, Pennsylvania)	Jan. 1991 - July 1996 (completed).	300,000 to 400,000 cubic yards	Waste-to-energy fuel. Cover material.	Recover fuel. Reuse of landfill capacity.

Source Based on: Dickinson, 1995.

Naples Landfill Collier County, Florida

In 1986, the Collier County Solid Waste Management Department at the Naples Landfill conducted one of the earliest landfill reclamation projects in the country. At that time, the Naples facility, a 33-acre unlined landfill, contained MSW buried for up to 15 years.

In an evaluation performed by the University of Florida on 38 of the state's unlined landfills, investigators discovered that the Naples Landfill (along with 27 others) posed a threat to ground water. Moreover, the high cost of complying with the state's capping regulations for unlined landfills concerned many county officials. Florida's capping regulations required the installation of a relatively impermeable cover or cap and postclosure monitoring.

Naples officials developed a reclamation plan with the following objectives: decreasing site closure costs, reducing the risk of groundwater contamination, recovering and burning combustible waste in a proposed waste-to-energy facility, recovering soil for use as landfill cover material, and recovering recyclable materials. Collier County never built the waste-to-energy plant. The project did prove successful, however, in recovering landfill cover material. The project proved less successful at recycling recovered materials (e.g., ferrous metals, plastics, and aluminum). These materials required substantial processing to upgrade their quality for sale, something the county chose not to pursue.

In 1991, the U.S. Environmental Protection Agency selected the Naples Landfill reclamation project as a demonstration project for the Municipal Solid Waste Innovative Technology Evaluation (MITE) program. The MITE program assessed the excavation and mechanical processing techniques used in the project for reclaiming cover material to be used in ongoing landfill operations. It also assessed the capacity and performance of equipment, the environmental aspects of the project, the characteristics of recovered materials, the market acceptability of recovered materials, and the probable costs and economics of the overall project. The MITE assessment found the processing techniques used in the Naples project effective and efficient for recovering soil but not for recovering recyclables of marketable quality.

During the MITE demonstration project, Collier County effectively and efficiently recovered a soil fraction deemed environmentally safe under Florida's MSW compost regulations. The 50,000 tons of reclaimed soil were suitable for use as a landfill cover material and as a soil medium for supporting plant growth.

Air quality monitoring indicated that landfill gas was not an issue at the reclamation site, apparently due to the high degree of waste decomposition that had already occurred. As a result of this finding, typical personnel protective gear worn during the project consisted of standard construction apparel.

Ongoing reclamation activities at the Naples facility focus exclusively on recovering soil for use as landfill cover material. All excavated materials other than the reclaimed soil and small amounts of recyclables are redisposed of in lined landfill cells. Reclamation activities are only performed on an as-needed basis. A 3-inch trommel screen is used to reclaim the soil cover material. The weight ratio of reclaimed soil to overs (i.e., materials caught by the screen), after white goods and tires are separated, is 60 to 40. This indicates that the Collier County landfill reclamation project is efficient given that 60 percent of the reclaimed material is reused as landfill cover material.

Based on 1995 prices, landfill cover material costs Collier County $3.25 per ton. According to Collier County's director of solid waste, the reclamation of cover material on an as-needed basis costs the county $2.25 per ton, a savings of $1 per ton.

According to county officials, the reclamation project yielded the following benefits: lower operating costs through reuse of cover materials, extended landfill life, reduced potential for ground-water contamination from unlined cells, and possible avoidance of future remediation costs.

Edinburg Landfill Edinburg, New York

The New York State Energy Research and Development Authority (NYSERDA) and the New York State Department of Environmental Conservation sponsored projects to assess the feasibility and cost-effectiveness of undertaking landfill reclamation efforts to avoid closures and reduce the footprint of state landfills. NYSERDA established these projects in anticipation of the closure of numerous landfills in New York State, and based, in part, on the success of the Naples Landfill reclamation project.

NYSERDA's first demonstration project was conducted at a 5-acre MSW landfill in Edinburg, New York, which received waste from 1969 to 1991. NYSERDA chose the Edinburg Landfill because of its small size and lack of buried industrial waste. After NYSERDA chose to sponsor the reclamation of 1 acre of the 5-acre landfill, Edinburg town officials expanded the project to reclaim 1.6 additional acres.

NYSERDA divided the Edinburg demonstration project into three phases. The first phase, started in December 1990, included the excavation of 5,000 cubic yards of waste from a 12-year-old section of the landfill at an average depth of 20 feet. The second phase, initiated in June 1991, included the excavation of 10,000 cubic yards of waste from a 20-year-old section of the landfill at an average depth of 8 feet. The first two phases of the demonstration project cost an estimated $5 per cubic yard for excavation and processing. This cost included the inspection and supervision of a fully contracted operation and was based on an average excavation rate of 1,000 to 1,200 cubic yards per day.

The third phase of the Edinburg project occurred from August to September 1992. NYSERDA provided the majority of the project funding, with the remaining funding (primarily for phase three) provided by the town of Edinburg. This third and final phase reclaimed an additional 1.6 acres (31,000 cubic yards) in 28 days. Because the town supplied required equipment and labor, the contracted cost for this phase decreased from $5 per cubic yard excavated to $3 per cubic yard. Subsequently, the town looked into reclaiming the remaining 2.4 acres of the landfill and completely eliminating the footprint. The proposed fourth stage proved unviable, so the remaining portion of the landfill will be capped.

The Edinburg Landfill is located in a soil-rich area that provides ample amounts of landfill cover material. For this reason, officials tested and approved the reclaimed soil (75 percent of the reclaimed material) for offsite use as construction fill in nonsurface applications. A test burn performed on the reclaimed waste found the British thermal unit (Btu) value to be lower than desired because of the high degree of waste decomposition and stones remaining in the screened material.

The recovered nonsoil materials, representing 25 percent of the reclaimed waste, were hand-sorted for potential recyclables. Although 50 percent of the nonsoil material was considered recyclable, cleaning the materials to market standards was not feasible. Some tires, white goods, and ferrous metals, however, were separated and recycled. The remaining materials were sent to a nearby landfill.

NYSERDA officials developed a worker health and safety plan for the Edinburg project that established work zones, personnel protection requirements, and other operating procedures. The inspectors, as well as all personnel working at the site, were required to wear respirators, goggles, helmets, and protective suits. Excavation equipment was used to separate suspicious drums and other potentially hazardous material for evaluation by the safety inspector using appropriate monitoring equipment. In the event that hazardous materials were encountered, the health and safety plan provided for a project contingency plan, a segregated disposal area, and special waste handling procedures. No significant quantities of hazardous materials, however, were unearthed.

The Edinburg Landfill Reclamation Project was successful both in securing offsite uses for the reclaimed soil and in reducing the landfill footprint to decrease closure costs. The economic benefits would be enhanced further if the avoided costs for postclosure maintenance and monitoring, as well as potential remediation and the value of recovered landfill space, are also considered.

Frey Farm Landfill Lancaster County, Pennsylvania

In 1990, the Lancaster County Solid Waste Management Authority constructed an MWC to use in reducing the volume of waste deposited in the Frey Farm Landfill, a lined site (double layers of 60-mil high density polyethylene sheeting on a 6-inch clay sub-base) containing MSW deposited for up to 5 years. After building the MWC, the quantity of waste received at the facility declined, leaving a significant portion of the MWC capacity unused. In an effort to increase the energy production and efficiency of the MWC, officials initiated a landfill reclamation project to augment the facility's supply of fresh waste with reclaimed waste.

The reclaimed waste had a high Btu value (about 3,080 Btu per pound). To achieve a more efficient, higher heating value of 5,060 Btu per pound of waste, four parts of fresh waste, which included tires and woodchips, were mixed with one part reclaimed waste.

Between 1991 and 1993, approximately 287,000 cubic yards of MSW were excavated from the landfill. These reclamation activities processed 2,645 tons of screened refuse per week for the MWC. As a result, Lancaster County converted 56 percent of the reclaimed waste into fuel. The county also recovered 41 percent of the reclaimed material as soil during trommeling operations. The remaining 3 percent proved noncombustible and was reburied in the landfill. By the end of the project in 1996, landfill operators had reclaimed 300,000 to 400,000 cubic yards of material.

Before the reclamation work began, officials prepared a safety plan for work at the site and assigned a full-time compliance officer to oversee the operations. During reclamation, workers took precautions to avoid damaging the site's synthetic liner, since it would be reused following the reclamation operations. An initial layer of protective material surrounded the synthetic liner system, aiding worker precautions by acting as a buffer between the liner and the excavation tools. Continuous air monitoring for methane, both in the cabs of vehicles and in the reclamation area, enhanced the operation's safety operations.

Benefits of the project at Frey Farm Landfill include: reclaimed landfill space, supplemented energy production, and recovered soil and ferrous metals. Drawbacks include: increased generation of ash caused by the high soil content found in reclaimed waste, increased odor and air emissions, increased traffic on roads between the MWC and the landfill, and increased wear on both the landfill operation and MWC equipment (i.e., due to the abrasive properties of the reclaimed waste).

Costs for the resource recovery portion of the project were relatively low for the following reasons:

- The distance for transporting both the reclaimed waste and the ash was only 18 miles each way.
- The management authority avoided commercial hauling prices by using its own trucks and employees to transport the reclaimed waste and the ash.
- The landfill and MWC were operated by the same management authority, thus no tipping fees were required. (Generally, a higher tipping fee can be charged at an MWC for reclaimed waste because of its abrasiveness and higher density, which increases the wear and tear on equipment.)

By 1996, MWC facility operators no longer needed supplemental feed materials from Frey Farm Landfill to run at full capacity. Thus, landfill officials concluded the reclamation project in July of that year.

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A Snapshot of the Superfund Program

Hazardous waste, improperly disposed over time . . . complex chemical combinations . . . contamination that may affect surface water, soil or ground water . . . properties that change hands leaving indistinct records . . . pioneer technology . . . and evolving scientific knowledge . . . These are some of the challenges confronting Federal, State, and local Superfund program officials in identifying, evaluating, and cleaning up abandoned or uncontrolled hazardous waste sites. Site ownership and operational histories are not always clear, making it difficult to determine responsible parties. Several media – components of the environment, including surface water, ground water, soil, and air – may be contaminated and the pathways of exposure may threaten sensitive ecosystems as well as human health and welfare. Treatment technologies are evolving constantly to address more effectively the broad spectrum of contaminants found at multi-use facilities. At the same time, the costs of cleanup are expanding, and the affected public at hazardous waste sites must have opportunities to be involved in the cleanup process.

Historical Goals

The Superfund program is one of the nation's most ambitious and complex environmental programs. Launched in 1980, with the passage of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Superfund's primary goal is to protect human health and the environment. This goal is achieved in several ways.

- First, CERCLA provides unparalleled enforcement powers based on the belief that polluters should take responsibility for cleaning up their own wastes.
- Second, CERCLA's authority for Federal response enables EPA to protect human health and the environment in the event responsible parties do not take timely, adequate action.
- Finally, CERCLA establishes a Hazardous Substances Response Trust Fund to cover the costs of enforcement and cleanup activities.

The Challenge

At the outset of the Superfund program, EPA's primary challenge was to respond to cleanup requests while building an organizational structure and staff, developing program policies and guidance, and accumulating money in the Trust Fund to support program operations. Today, EPA has a solid infrastructure in place to manage this complex program. In ongoing efforts to enhance its management systems and engineering capabilities, EPA is exploring new frontiers in science and technology. Total Quality Management (TQM) approaches, which are revolutionizing the business world, are being implemented and EPA is sharing with the public tangible environmental improvements.

In 1989, the Administrator of EPA completed a Management Review of the Superfund Program (commonly known as the 90-Day Study). This review provides a candid self-evaluation of past program activities and achievements, identifies conflicting mandates and needs for program enhancements, and makes a commitment to following a practical plan for the future. This plan is based on a set of eight strategic goals:

- **Control acute threats immediately**. EPA will get into the field fast, size up the scope of the problem, and undertake appropriate action right away to ensure protection from immediate threats to people and the environment.
- **Emphasize enforcement**. EPA will encourage or compel responsible parties to conduct more site work to increase the total number of cleanups.
- **Address worst sites/worst problems first**. After attacking the immediate threat, the Agency will begin the earliest remedial work to address problems that remain high priority when compared to competing problems at other sites.
- **Monitor and maintain sites over the long-term**. EPA will monitor Superfund sites over the long-term to ensure that the remedy remains protective of human health and the environment.

. . . the Agency has a clear plan for the second decade of Superfund and beyond . . .

- **Develop and use new technologies.** EPA will develop, demonstrate, and use permanent technologies to achieve final site cleanups, to the maximum extent practical.

- **Improve efficiency of program operations.** EPA will improve the efficiency of program operations by pursuing a "one Superfund" approach to site cleanup activity and enforcement against polluters.

- **Encourage full public participation.** EPA will increase the role of citizens in Superfund decisions and encourage clear and consistent two-way communication with the public.

- **Foster cooperation with other Federal and State agencies.** EPA will work with State agencies, natural resource trustees, Indian Tribal Governments, and other Federal agencies to ensure an effective and cooperative relationship.

EPA developed these eight goals based on the lessons learned during the first 10 years of the program, and will build upon those lessons to chart the course for the future.

The Turning Point: A New Strategy

From these goals, a strategy for the next decade of Superfund has emerged. Simply stated, that strategy is to:

- **Enforce aggressively**
- **Make sites safe**
- **Make sites clean**
- **Bring new technology to bear in solving hazardous waste problems.**

The Superfund program's theme of solving the worst problems at the worst sites first is right in step with the Agency's overall policy for prioritized risk reduction. Under this policy, resources are directed toward the worst problems first to minimize risk and maximize protection of human health and the environment.

. . . resources are directed toward the worst problems first to minimize risk and maximize protection . . .

Today, a decade after CERCLA's enactment, the guiding principles of the original Superfund program remain intact. In fact, the Superfund Amendments and Reauthorization Act of 1986 (SARA) adopted the majority of policies and procedures the Agency had developed during the first 5 years of the program, and provided a number of changes to strengthen and fine tune the program. In November of 1990, Congress passed a 3-year extension of the taxing authority for Superfund, ensuring uninterrupted implementation of the program through 1994.

The Future Is Built On The Past

EPA recognizes that the hazardous waste problem in the United States remains large, complex, and long-term. There are no easy solutions, but the Agency has a clear plan for the second decade of Superfund and beyond. EPA is conducting studies that will help define the total universe of Superfund sites, how much it will cost to clean up those sites, and the future role of enforcement and States in reaching the ultimate goal of protecting human health, welfare, and the environment.

This 10-year perspective report is designed to provide an overview of Superfund program activities, to illustrate the clear progress that has been made in addressing uncontrolled hazardous waste sites nationwide, and to point the direction for the future of the program.

Responses to hazardous substance releases under the Superfund program are guided by the:

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980
- Superfund Amendments and Reauthorization Act of 1986
- National Oil and Hazardous Substances Pollution Contingency Plan (March 1990).

Rules And Tools

Superfund was created by Congress in 1980 with the passage of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). CERCLA arose out of the need to protect citizens from the dangers posed by abandoned or uncontrolled hazardous waste sites. Most Americans can remember nightly news broadcasts in the late 1970s describing the thousands of leaking drums and ground water threats discovered at the Love Canal site in Niagara Falls, New York. CERCLA gave the Federal government broad authority to respond to hazardous substance emergencies, and to develop long-term solutions for the nation's most serious hazardous waste problems like Love Canal.

The term "Superfund" referred to a $1.6 billion Hazardous Substance Response Trust Fund established to pay for cleanup and enforcement activities at waste sites. This fund was financed primarily with a tax on crude oil and 42 commercially used chemicals. The tax supported the concept that those responsible for environmental pollution should assume the cost. The original law also enabled the Federal government to recover the costs of its actions from those responsible for the problem, or to force them to clean up the hazardous site at their own expense.

On October 17, 1986, the Superfund Amendments and Reauthorization Act of 1986 (SARA) was enacted. SARA reflected EPA's experience in administering the complex Superfund program during its first 6 years. The reauthorized law made several important changes and additions to the program:

- Increased the size of the Trust Fund from $1.6 billion to $8.5 billion
- Stressed the importance of permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites

. . . those responsible for environmental pollution should assume the cost.

- Established specific cleanup goals and schedules
- Required Superfund actions to consider the standards and requirements found in other Federal and State environmental laws and regulations
- Expanded the statutory cost and duration limits on removal actions
- Provided new enforcement authorities and settlement tools
- Increased State involvement in every phase of the Superfund program
- Increased the focus on human health problems posed by hazardous waste sites
- Encouraged greater citizen participation in making decisions on how sites should be cleaned up

- Expanded research and training activities to promote the development of alternative and innovative treatment technologies

- Required cleanup of Federal facilities to meet Superfund requirements.

In response to the tragic toxic chemical release in Bhopal, India, and a subsequent serious incident in Institute, West Virginia, Congress also established new reporting requirements for facilities that handle hazardous chemicals. Title III of SARA, the Emergency Preparedness and Community Right-to-Know Act of 1986, established a four-part program to define an emergency planning structure at the State and local levels; require emergency notification of hazardous chemical releases; require notification of chemical use, storage, or production activities; and define annual emissions reporting requirements.

The Superfund response effort is guided by the National Oil and Hazardous Substances Pollution Contingency Plan, commonly referred to as the National Contingency Plan (NCP). This plan outlines the steps that EPA, the U.S. Coast Guard, and other Federal agencies must follow in responding to situations in which hazardous substances or oil are released into the environment. Fourteen Federal agencies are members of the National Response Team (NRT), which is responsible for planning and coordinating preparedness and response actions.

The NCP, which actually predates Superfund, was originally written to implement provisions in the Clean Water Act having to do with spills of oil and hazardous substances into navigable waters. It has been revised three times: first to incorporate the 1980 Superfund program, then later in 1985 to streamline the Superfund process, and most recently in March 1990 to address significant changes in the Superfund program resulting from the enactment of SARA. The NCP is currently being revised to include the new requirements of the Oil Pollution Act of 1990.

The national goal described in the NCP is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste. The Superfund program expects to achieve this goal in several ways:

- Use treatment technology on principal threats, wherever practical

- Consider isolation and containment for wastes posing minimal threats or where treatment is impractical

- Combine treatment with containment, as necessary

- Supplement engineering solutions with institutional controls such as deed restrictions wherever appropriate

- Consider innovative treatment technologies

- Return ground waters to their beneficial uses as soon as possible.

The Superfund Process

The process established by the NCP for meeting these expectations and handling hazardous waste problems begins with learning where a hazardous waste site might exist (see Superfund Process Flowchart, Figure 1). If, based on a preliminary

Two Types Of Response: Removal And Remedial Actions

Every Superfund site is unique, and cleanups must be tailored to the specific needs of each site or release of hazardous substances. From the beginning of the process, EPA makes a concerted effort to encourage those responsible to pay for cleanup. However, if an immediate problem threatens human health, welfare, or the environment, EPA will take action. EPA can respond to hazardous substance releases in two ways as defined by CERCLA:

- **Removal Actions**—short-term actions which stabilize or clean up a hazardous site that poses a threat to human health or the environment. Typical removal actions include removing tanks or drums of hazardous substances from the surface, excavating contaminated soil, installing security measures at a site, or providing a temporary alternate source of drinking water to local residents.

- **Remedial Actions**—the study, design, and construction of longer-term and usually more expensive actions aimed at permanent remedy. EPA can take remedial actions only at sites on the National Priorities List (NPL)—EPA's list of the nation's most serious hazardous waste sites. Typical remedial actions include removing buried drums from a site, constructing underground walls to control the movement of ground water, incinerating wastes, or applying bioremediation techniques or other innovative technologies to contaminated soil.

evaluation there is an emergency requiring immediate action, the next step is to act as quickly as possible to remove or stabilize the threat. These actions are known as removals (see box on previous page).

Even after the necessary emergency action has been taken to control the immediate threat, in some cases contamination may remain at the site. A more detailed analysis of the contamination may be necessary to determine if further work needs to be done to find a permanent solution at the site. If long-term action is necessary, a decision must be made regarding the relative national priority of that particular site. These long-term actions are known as remedial actions (see box on previous page). An investigation of the extent of contamination and analysis of the range of alternative remedial actions Superfund might take is then conducted. Concerns of the State and local community are seriously considered in determining which alternative to select. Efforts also are made to find individuals or companies responsible for the contamination and make them pay for and/or conduct the cleanup.

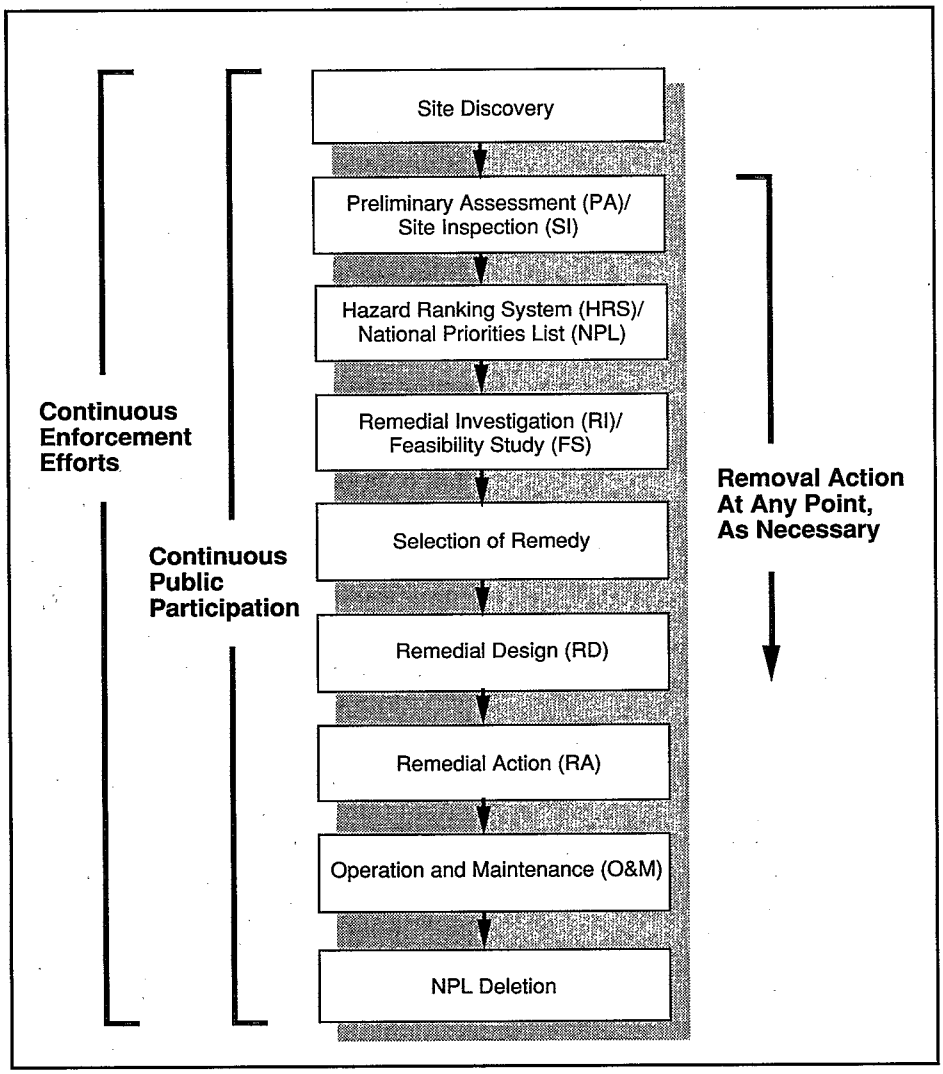
After the remedial action has been selected, it must be designed and constructed. Once action has been completed, the site often must be monitored and maintained, a responsibility which is assumed by the State or responsible party.

Typically, a Superfund cleanup action follows this sequence of events, but not always. For example, an emergency requiring immediate attention can occur at a site which already is undergoing a long-term remedial action.

At all stages of response, work can be done by a State or EPA using the Trust Fund, or by responsible parties as a result of enforcement efforts. In addition, community relations activities and enforcement actions take place throughout the cleanup process to ensure optimal use of Trust Fund resources and the involvement of all interested parties in the decisionmaking process.

The following sections of this report examine in detail each step of the decisionmaking process for Superfund removal and remedial responses, highlight the major accomplishments in each program area, and provide an overview of new Superfund program initiatives.

Figure 1
Superfund Process Flowchart



Removal Actions

Fires, explosions, contaminated drinking water, and toxic fumes. These are just some of the situations the removal program regularly confronts. When there is no time for lengthy analysis of a hazardous substance release and no one else is available who has the technical and financial capability to respond, Superfund removal program personnel are on the scene responding as quickly as possible to reduce immediate threats to human lives and the environment.

The removal program has been the most rapidly productive component of the Superfund program, with more than 2,300 cleanups started and 1,900 cleanups completed since 1980 (see Figure 2). Virtually every day in 1990, a removal action was started somewhere in the U.S. and its territories. That rate has been remarkably consistent since 1987 when the Superfund Amendments and Reauthorization Act (SARA) doubled its limits on time and cost for removals to 12 months and $2 million. While remedial actions are usually more expensive, extensive, and often receive more media coverage, the removal program has been a key contributor to the overall success of the Superfund program in responding to hazardous substance threats across the country.

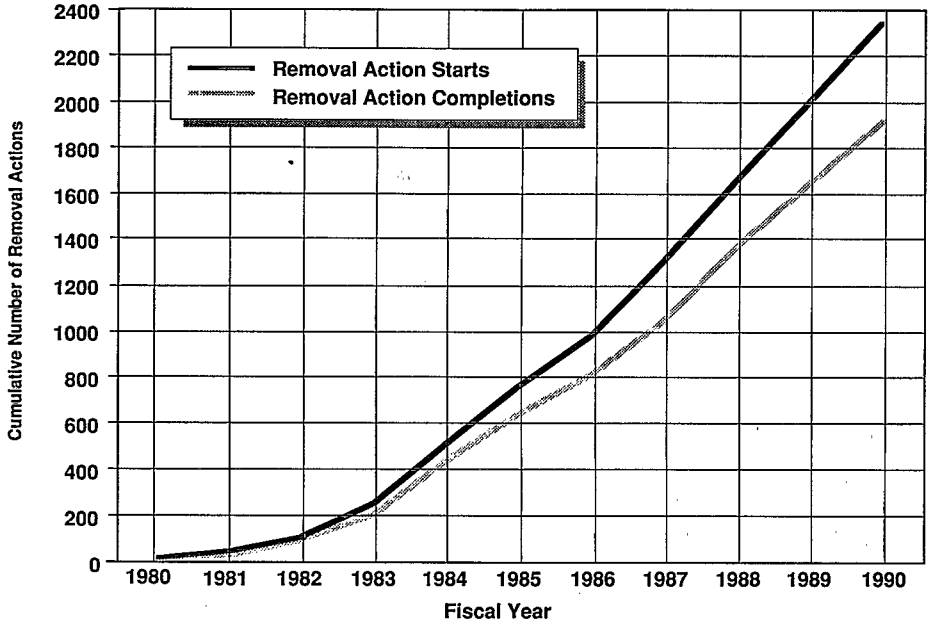
Removal actions are taken at all types of sites including inactive waste facilities such as open dumps or landfills that have been closed down or abandoned; "midnight dumps" where drums or other containers have been illegally disposed of in secluded woods, open fields, or other locations; active manufacturing or waste disposal facilities, chemical manufacturers, and operating landfills; and transportation-related accidents such as toxic chemical releases from derailed trains or overturned trucks. Covering a wide range of situations, removal actions typically include a variety of substances and health and environmental threats. For example, removal actions address threats to communities and ecosystems from fire and explosion; human direct contact risks due to drinking water or soil contamination; improper

. . . the most rapidly productive component of the Superfund program.

A removal action provides a rapid and flexible response to reported health and environmental hazards, wherever and whenever they occur. Removals are:

- Investigated and assessed within hours of being reported, 24 hours a day, 365 days a year.
- Conducted at both National Priorities List (NPL) and non-NPL sites.
- Conducted by On-Scene Coordinators (OSCs) from EPA or the U.S. Coast Guard (USCG).
- Kept consistent with any potential long-term remedial actions.
- Limited, unless specially exempted, to 12 months for completion and $2 million in costs.

Figure 2
Removal Action Starts and Completions*

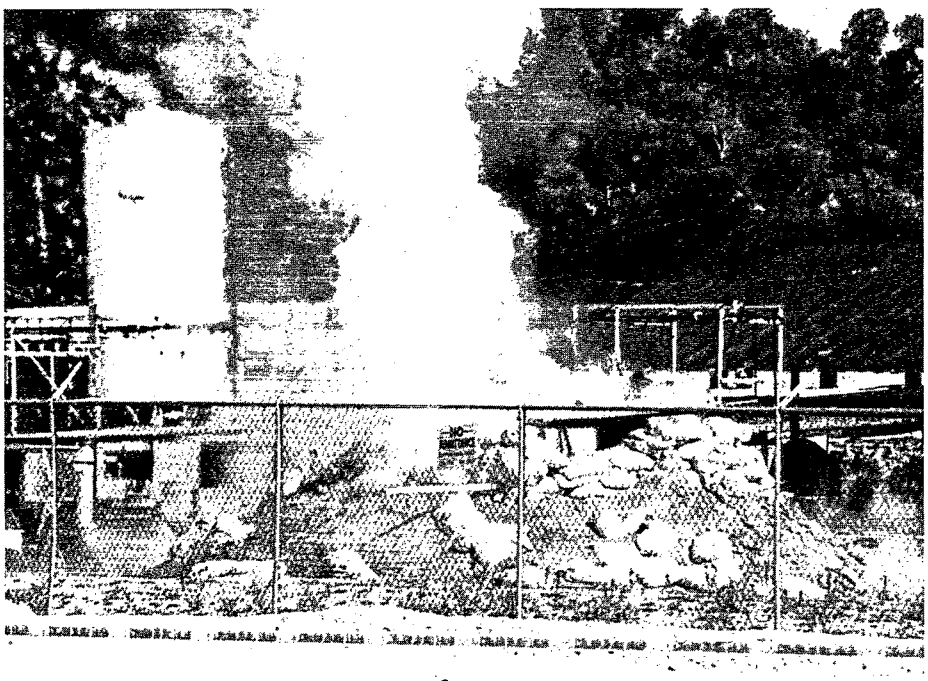


* Totals are for combined EPA, U.S. Coast Guard, and Potentially Responsible Party-lead removal actions

Removal Actions Address A Variety Of Threats

In 1983-1984, EPA conducted an assessment of the Fike/Artel Chemical site, a chemical manufacturing plant in Nitro, West Virginia. The owners agreed to clean up the site. Hazardous conditions remained, however, and when the site was abandoned in June 1988, the West Virginia Department of Natural Resources requested EPA's further assistance. The four-acre site contained approximately 5,000 drums above ground, cylinders, laboratory chemicals, buildings, and a lagoon of processed waste water, all in various stages of deterioration. Nearly the same number of drums was suspected to be buried on site. Two bunkers holding an estimated 100,000 pounds of highly incendiary elemental sodium, located only 500 yards from downtown Nitro, presented an immediate threat to public safety. A tank with deteriorating valves, containing methyl mercaptan (a chemical that attacks the respiratory and central nervous systems) also remained on site.

The OSC initiated an emergency removal. Activities included 24-hour site security and new fencing; detonating potentially explosive cylinders containing hydrogen cyanide; sampling, packing, and removing drums; remote crushing of unidentified lab containers; draining, backfilling, and reseeding the waste water lagoon; and building decontamination, treatment, and storage structures. Further investigation is currently underway to determine the nature and extent of soil and ground water contamination.



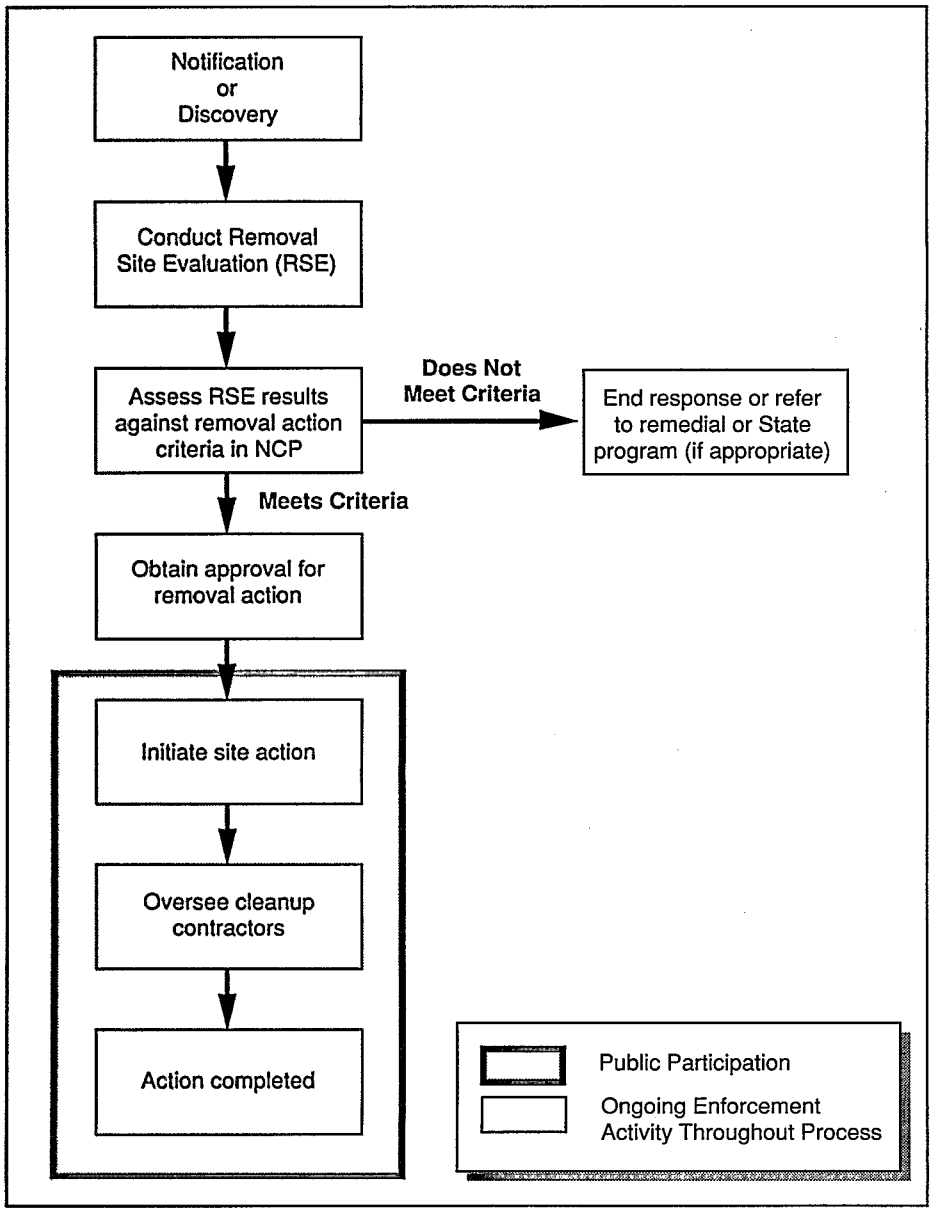
storage of hazardous substances in drums, tanks, and other containers; and deterioration of site conditions due to bad weather. Generally, removal actions include one or more of the following activities:

- Evacuating or temporarily relocating people to protect human health
- Stabilizing or detonating hazardous materials to prevent fires and explosions
- Providing site security—signs, fences, guards—to limit access and prevent direct contact with hazardous substances
- Providing an alternate water supply
- Containing, removing, or treating hazardous substances by:
  - Controlling drainage
  - Stabilizing berms or dikes
  - Closing or draining lagoons
  - Capping soils or sludge
  - Excavating and removing contaminated soil
  - Removing drums or other containers
  - Using chemical stabilization.

While remedial actions require that a site be on the NPL, removal actions do not. To date, 29 percent of all completed removal actions have taken place at NPL sites; 71 percent have involved non-NPL sites.

Of the 351 removal actions begun in 1990, about two-thirds were managed directly by EPA Regional offices. The remainder were managed either by the USCG, which has responsibility for oil discharges and hazardous substance releases in coastal waters and some inland waterways, or by potentially

Figure 3
Overview of Removal Process



responsible parties (PRPs), whose cleanup activity is monitored by EPA or USCG. In light of Superfund's increased emphasis on enforcement, it is significant that the number of PRP-managed removal actions has steadily increased, accounting for 98 of the 351 starts in 1990.

Organization And Procedures For Rapid Response

The National Response Center (NRC), operated by the USCG in Washington, D.C., is the official clearinghouse for all reports of oil and hazardous substance releases. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that any manufacturer, waste facility operator, or common carrier immediately report releases of hazardous substances (above substance-specific thresholds known as "reportable quantities") to the NRC.

When the release or potential release is from an inactive waste facility or from an illegal dump, however, reporting is less routine. The amount of the release—and even the substance being released—may not be known immediately, and the NRC may receive only partial information from State or local public safety officials or the general public.

Whether information is complete or partial, the NRC alerts the appropriate EPA or USCG Regional OSC as well as State officials and other Federal agencies with a potential interest. The NRC also alerts the EPA Emergency Response Division in Washington, D.C., which sets policy for and manages the removal program; but the NRC's primary responsibility is the immediate notification of the designated Regional OSC. OSCs are on call 24 hours a day to respond to reports of releases that may require a Superfund removal action.

The first task of the OSC may be to assist public safety officials in their efforts to protect the public. This may include emergency efforts to secure the site, ensure fire control, provide emergency alternate water supplies, or assist in temporary evacuation.

Major Removal Action Participants

In addition to EPA and USCG, many other Federal, State, and local agencies frequently take an active role in the removal program:

- **Agency for Toxic Substances and Disease Registry (ATSDR):** An agency of the Department of Health and Human Services, ATSDR is responsible under CERCLA for conducting health assessments after the release of hazardous substances.
- **Department of Defense (DOD):** The U.S. Army Corps of Engineers has specialized equipment and personnel available to assist in removal actions.
- **Department of Energy (DOE) and Nuclear Regulatory Commission (NRC):** DOE and NRC provide specialized assistance when radioactive substances are involved.

  In addition, DOD and DOE are specially authorized under CERCLA to conduct emergency removal actions at their own facilities.
- **State and local governments:** State and local public safety agencies are often the first responders to a release. They are responsible for initiating public safety measures and directing evacuations according to existing State or local procedures. EPA has established a program to reimburse local governments for some of the costs associated with their emergency responses. In addition, all States have representation on Regional Response Teams. Finally, individual States may enter into agreements to conduct Fund-financed removal actions.

After public safety has been secured, the OSC begins a removal site evaluation. The objective is to determine the potential for or source of the release, the threat to human health, whether another party is conducting a proper response, and the appropriate course of action. Regional and National Response Teams are available to provide technical assistance to the OSC during this evaluation. With this assistance, the OSC is responsible for documenting the situation and determining whether a short-term, relatively low-cost response—a removal action—is sufficient to stabilize or clean up the site.

If the OSC determines that the situation does not require a removal action, the site may be referred to the Hazardous Site Evaluation Division of EPA to be evaluated for inclusion on the NPL and possible remedial action, or it may be referred to another interested Federal or State agency for action.

While the site is being evaluated, the OSC also must determine whether one or more PRPs are capable and willing to assume responsibility, under EPA supervision, for the appropriate course of action. If the PRPs are unknown, unwilling, or incapable of assuming timely responsibility, the OSC initiates a CERCLA-funded removal action. Identified PRPs are not released from responsibility, however. Throughout the course of the removal action, the OSC or enforcement personnel continue efforts for PRP involvement and cost recovery. Throughout the planning and execution of a removal action, opportunity for public participation is mandated by CERCLA. Information must be provided and public response solicited. Only the requirements of public safety are allowed to override this policy. Figure 3, on the previous page, presents an overview of the removal process.

New Directions For The Removal Program

The most sweeping changes to the removal program have occurred as a result of expanded statutory and regulatory authorities. Among the most significant changes implemented as a result of SARA, and reflected in subsequent revisions to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), are:

- **Expanded response authority:** The limitations on removal actions were increased from 6 to 12 months, and from $1 million to $2 million, to reflect actual time and cost constraints encountered during the first 6 years of the program. These expanded limits increase the flexibility of the removal program to respond to various threats and help achieve greater coordination with the remedial program.
- **Contribution to remedial performance:** Removal actions must be designed to contribute to the efficient performance of any subsequent long-term remedial action.

Expanded Authority And State-Of-The-Art Technology

Southeastern Wood Preserving in downtown Canton, Mississippi operated from 1928 until early 1979, when its owners filed for bankruptcy and abandoned the site. EPA initiated an emergency removal action in June 1986 to stabilize three unlined, over-flowing surface impoundments containing creosote sludge and water. Thirty-thousand gallons of water were pumped from the flooded areas of the site. EPA proposed that the second phase of cleanup consist of either on-site treatment or off-site disposal of the stabilized sludge.

In December 1988, the Department of Agriculture's Soil Conservation Service (SCS) contacted EPA. While surveying a creek that borders the site, SCS had noticed oily waste leaching into the creek. Through an Interagency Agreement, SCS worked with EPA to excavate the contaminated soils.

In August 1989, EPA approved an exemption from the 12-month statutory limit on removal actions. The Region approved additional funds to continue excavations and to conduct on-site treatment of the contaminated sludges. The sludges threaten to contaminate soil and drinking water (a municipal well is within 100 feet of the site) and continue leaching into the creek (children playing in a park a mile downstream from the site have complained of creosote burns). EPA is proposing to use biological remediation to treat the 8,000 cubic yards of contaminated soil left on the site. In August 1990, the EPA Region obtained an exemption from the $2 million statutory limit to cover additional costs to meet stringent land disposal and air emission standards. Bioremediation is scheduled to begin in 1991.

- **Use of alternative technologies:** When possible, EPA considers cost-effective removal action alternatives that use recycling or treatment of waste rather than land disposal. This requirement promotes the use of cleanup technologies that reduce the toxicity, mobility, or volume of waste.

- **Compliance with applicable or relevant and appropriate requirements (ARARs):** On-site removal activities are expected to identify and comply with all Federal (beyond CERCLA) and State environmental and human health laws to the extent possible given the circumstances of the removal. This ensures that removal actions are conducted in a way that best prevents damage to human health, welfare, and the environment.

- **Off-site disposal:** If a removal action requires off-site disposal of hazardous wastes, those wastes must be sent to environmentally-sound (RCRA-approved) facilities. This helps to ensure that wastes from removal actions will not create future Superfund sites.

These changes in authority and program emphasis have increased the removal program's flexibility to respond to hazardous substance releases while also promoting environmentally sound technologies and practices that reduce threats to human health and welfare. The removal program continues to evolve in its flexibility and responsiveness as the Agency endeavors to control immediate threats to people and the environment.

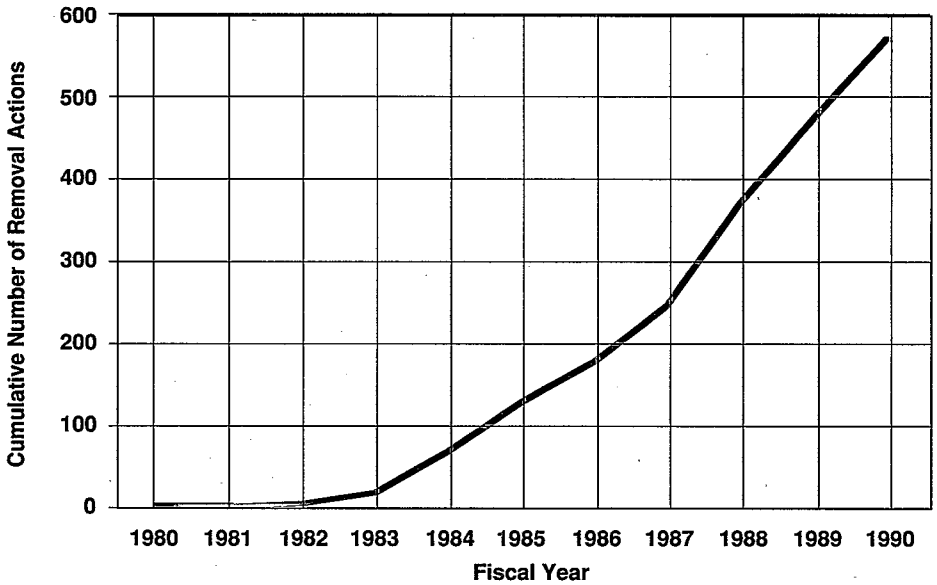
Recently, the Superfund Management Review set forth a comprehensive, long-term strategy for the Superfund program. Three elements of the eight-part strategy have especially important implications for the removal program:

- Control acute threats immediately
- Address the worst sites and worst problems first
- Emphasize enforcement to induce private party cleanup.

Progress towards these goals had already begun within the removal program prior to the Superfund Management Review. For example, the Regions expanded an evaluation effort already underway concerning the need to control acute threats immediately at existing NPL sites. EPA also established timeframes for conducting assessments at newly proposed NPL sites and for follow-up. Additionally, EPA is focusing on methods to accelerate response at NPL sites that use removal and remedial program coordination to make sites safer and address the worst sites first. While the majority of threats at NPL sites are addressed through the remedial program, certain sites may benefit from the flexibility and streamlined response options offered by the removal program. Finally, EPA is emphasizing a strong "enforcement first" approach for the Superfund program in order to promote more private party cleanups through the use of enforcement and settlement authorities.

The strength of the removal program lies in its ability to mobilize expertise and resources to respond to immediate, critical hazardous substance threats. Remedial actions often receive more attention, as local sites are scored and evaluated for inclusion on the NPL. They also generally receive more resources, as long-awaited, full cleanups are planned and implemented. But the removal program is fast, flexible, and operates whenever and wherever a release or a potential for a release of hazardous substances poses a threat to human health, safety, or the environment.

Figure 4
Enforcement-Lead Removal Actions *



* Figures shown are for enforcement-lead removal action starts at NPL and non-NPL sites.

The increase in cost limits for removal actions does not mean, of course, that the removal program has been exempted from national and EPA fiscal constraints. Priorities have been set—addressing immediate threats at NPL and non-NPL sites first. Less immediate threats at NPL sites will be addressed only as resources permit. Enforcement has steadily improved, as well. Overall, there were 98 PRP-led removal actions in 1990, up from 47 in 1986. Enforcement is now making it possible to address a greater number of sites each year (see Figure 4).

Over the last 10 years, the removal program has developed an organization and procedures in keeping with its mission. It has been able to maintain the speed and flexibility of a decentralized program while cultivating crucial health and safety expertise. The expanded response authority granted under SARA is not only an indication of rising response costs but an acknowledgment of the importance of the program within Superfund. The removal action program has been successful in creating an effective EPA presence at non-NPL sites and in stabilizing and mitigating the worst problems at NPL sites until the remedial program can implement complete cleanups.

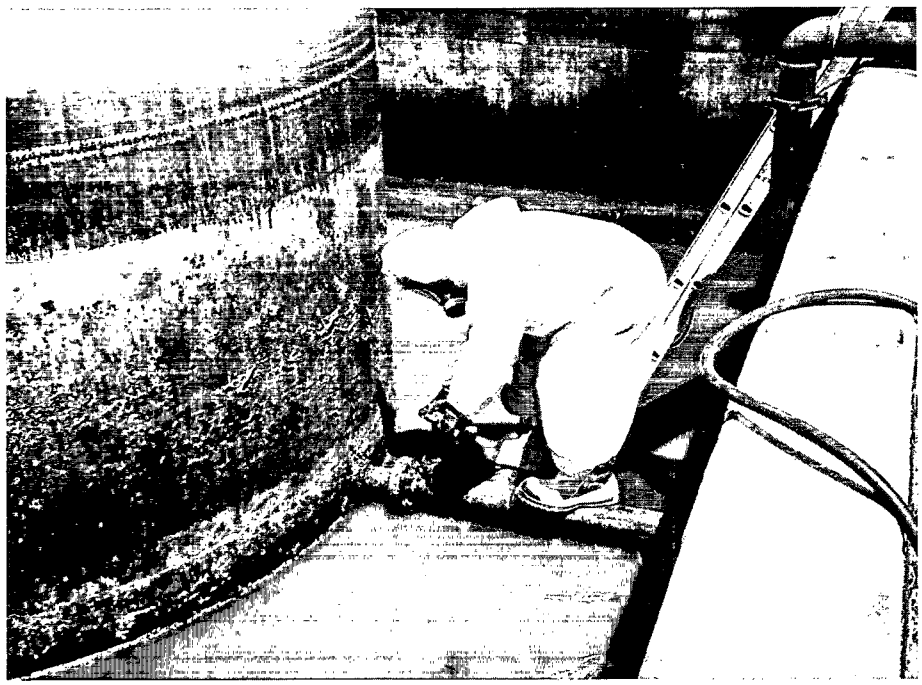
Site Assessment Activities

The primary goal of the site assessment program is to identify the most serious hazardous waste sites in the nation and list them on the National Priorities List (NPL), a catalogue of those sites with a potential need for remedial action. Site assessment is the initial phase of Superfund response, and the process by which EPA and the States identify, evaluate, and rank hazardous waste sites. Within this framework, however, specific objectives for the program have shifted over the course of Superfund's 10-year history. In part, this is because the scope and magnitude of the problem of neglected hazardous waste sites was vastly underestimated when the Superfund program began.

The Superfund program was originally conceived as a 5-year effort that would address the 400 worst abandoned hazardous waste sites in the nation, and gradually be phased out of existence. Since 1980, however, it has become clear that the total number and distribution of hazardous waste sites far exceeds any of the original estimates.

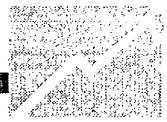
Between 1980 and 1986, the major emphasis for the site assessment program was on establishing program requirements and developing the Hazard Ranking System (HRS), which enables EPA to evaluate numerically the relative risk of each site listed in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), the official information system for the Superfund program. EPA then established a cut-off point for sites that would be eligible for Federal cleanup funds. It was the Agency's goal at that time to place a minimum of 400 of the nation's worst sites on the NPL, based on their HRS scores.

With the 1986 enactment of the Superfund Amendments and Reauthorization Act (SARA), Congress developed measurable goals for the Superfund site assessment program. Specifically, SARA mandated that for all sites listed in CERCLIS as of October 17, 1986, preliminary assessments (PAs) must be completed by January 1, 1988, and site inspections (SIs) must be completed by January 1, 1989. In addition, SARA required that EPA revise the HRS to emphasize potential human health risks and damage to ecosystems. These changes demonstrated that a new emphasis was being placed on the site assessment program, not just as a preliminary phase to the remedial program but as a rigorous screening program designed to determine which sites should continue through the process to NPL listing. The site assessment program is critical because once a site is listed on the NPL it becomes eligible for Federal cleanup funding.



Site assessment activities help identify and assess the most serious hazardous waste sites in the nation. These activities include the following steps:

- **Site discovery**—identifying hazardous substance releases through formal and informal channels
- **Preliminary assessment (PA)**—evaluating existing site-specific data for early determination of need for further action
- **Site inspection (SI)**—assessing on-site conditions and characteristics to determine if an HRS score should be developed
- **Hazard Ranking System (HRS) score**—applying a mathematical approach to assessment of relative risks posed by sites
- **NPL listing**—determining those sites that are eligible for Superfund-financed remedial action.



Since 1986, 10,700 sites have had PAs and 6,300 of these sites have undergone SIs. The NPL, which began in 1981 as an "Interim Priorities List" of 115 sites, now contains nearly 1,200 sites. Based on past rates of listing, the Agency expects to list approximately 100 sites per year. The NPL will likely contain 2,100 sites by the year 2000.

Congress developed measurable goals for the Superfund site assessment program.

The Site Assessment Process

Site Discovery

EPA learns of releases that potentially warrant Superfund response through both formal and informal channels. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) notification requirements mandate that any person who knows of a hazardous substance release notify the Federal government. Moreover, under SARA, owners or operators of facilities that produce, use, or store extremely hazardous substances are required to notify the local emergency planning committee and State emergency response commission if at any time a release exceeds reportable quantities, as described in the Removal chapter.

In addition to these mandatory reporting requirements, EPA has also relied on public petitions and informal citizen reports to learn about existing or potential hazardous waste sites. From time to time, Regions have taken an active role in locating sites that would otherwise go unnoticed. For example, Region X has an active site discovery program that uses geographic information systems and makes use of historical industrial business lists and EPA program lists to identify sensitive or vulnerable areas where releases would be significant.

Preliminary Assessments

The first step the Agency takes after learning of a potential site or release is to obtain and review all available reports and documentation about the site. As originally conceived, the PA was a desk-top evaluation of existing site-specific data designed to determine whether a site merits further action under CERCLA.

Recently, however, the scope of the PA has been expanded to provide more information and expedite the decisionmaking process. The expanded PA, which includes site reconnaissance and a projected numerical rating for the relative hazards posed, enables EPA to identify priorities more accurately and consistently, and allows for early identification of sites that need no further action by the Federal government.

About half of all sites are eliminated from further CERCLA consideration at this step, with a decision of no further remedial action planned (NFRAP). Sites that present a clear and immediate danger to human health and the environment and, therefore, require immediate action may be referred to the Superfund removal program. Other sites may be referred to other environmental programs, as appropriate. The remaining sites move on to the SI stage in the site assessment process. Approximately 5 percent of those sites receiving an HRS score go on to be included on the NPL. At any stage in the site assessment process, a site may be referred to the removal program, referred to another environmental program, or determined to need no further action.

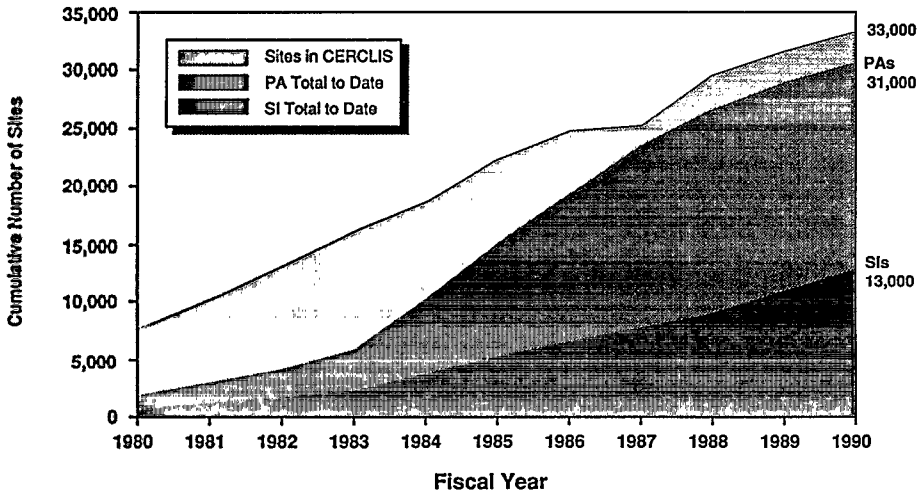
As of January 1990, 94 percent of the 33,000 sites currently in CERCLIS have been assessed, meaning that more than 31,000 PAs have been conducted over the course of Superfund's 10-year history. To prevent a backlog, and to comply with the intent of SARA, EPA's policy is to conduct a PA within 1 year of a site's listing in CERCLIS.

Site Inspections

If the preliminary assessment indicates a suspected release of hazardous substances that may threaten human health or the environment, EPA requires an inspection. The purpose of the SI is to investigate the site firsthand and determine if an HRS score should be developed. The inspection begins with a site visit and sample collection to define and characterize further the problems at a site. The primary objective of this in-depth assessment of site characteristics is to collect sufficient information to document an HRS score to the extent required for NPL listing. At times, an expanded site inspection has been necessary to fill data gaps and to serve as a bridge between the site assessment and remedial processes.

Approximately 12,800 SIs have been conducted since Superfund's inception. Figure 5 presents a summary of accomplishments in the site assessment program.

Figure 5
Historical Superfund Site Assessment Accomplishments



Hazard Ranking System

In response to a CERCLA mandate to establish a screening mechanism, EPA developed a mathematical approach to rate the hazards of sites. This model, known as the HRS, enables EPA to assess the relative risk posed by sites in the CERCLIS data base, and thereby determine which sites should be listed on the NPL. To evaluate risk, the original HRS examined three pathways of exposure: ground water, surface water, and air. A composite score for each site was developed by considering three factors for each pathway : likelihood of release, waste characteristics, and targets.

EPA develops and refines the score at each step of the site assessment process, with the percentage of hard data increasing as more samples are taken. The score at each stage of the process determines whether or not a site will continue to be considered for inclusion on the NPL.

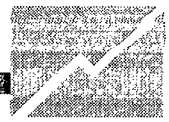
A revised HRS (rHRS) was proposed in December of 1988, and finalized in December of 1990. The system was revised to portray more accurately the degree of relative risk to both human health and the environment. The key changes in this revision take into account, to the extent possible:

- The population at risk
- The potential for drinking water contamination
- The potential for direct human contact
- The potential for ecosystem destruction
- Damage that may affect the human food chain
- Actual or potential contamination of ambient air.

The rHRS affects every stage of the site assessment process. The purpose of the HRS, however, remains unchanged. It remains a screening tool used to evaluate a site's risk and determine its eligibility for the NPL. The HRS score does not, however, provide an indication of the feasibility, desirability, or nature of the cleanup action that will ultimately be undertaken.

NPL Listing Process

Sites of hazardous releases must be included on the NPL in order to be eligible for Superfund-financed remedial action. The listing of sites on the NPL is accomplished in one of three ways. The most common is for the site to score at least 28.50 on the HRS. Second, each State is given the opportunity to designate



one site, which it considers its highest priority, for the NPL. Although less frequently used, the third approach is to list sites for which the Agency for Toxic Substances and Disease Registry (ATSDR) has issued a health advisory, that EPA determines pose a significant threat to human health and that EPA expects will be more effectively addressed under the remedial program, as opposed to using its removal authority.

The promulgation of the revised HRS is perceived as an opportunity to implement far-reaching changes in the NPL listing process and to incorporate Total Quality Management (TQM) tenets into the process. The primary goal is to move sites from discovery to listing in the 4-year timeframe mandated by SARA. The change most visible to the general public will be the publication of two NPL Updates per year. These offer the public an opportunity to comment on a site and receive responses from EPA, before actually placing the site on the NPL.

Site Assessment Accomplishments

The Agency has made substantial progress in the past few years in standardizing and streamlining the site assessment process. These efforts have resulted not only in an overall improvement in the quality and timeliness of assessment activities, but also in more effective State involvement and greater consistency nationwide.

The Superfund remedial program has evolved into a mature, revitalized program aimed at prompt action to address threats to human health and the environment. Once EPA places a site on the National Priorities List (NPL), it becomes eligible for long-term remedial activity. Cleaning up these sites is a long, complex process that may take millions of dollars and many years to complete. Remedial sites typically have multi-media contamination (soils, surface water, ground water) by many different types of chemicals. The sites often must be broken up into several individual projects to address all of the problems at the site, which may encompass acres, or even miles. EPA is developing new, innovative technologies to provide permanent, cost-effective solutions at NPL sites.

The Remedial Process

The 1986 amendments to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) brought new challenges to the remedial program. EPA now strives toward permanent remedies using alternative technologies to land disposal to protect human health and the environment. EPA is meeting this challenge by creating systems for information exchange, technology development programs, and a streamlined remedial process that has addressed more than 1,000 remedial sites during the last 10 years.

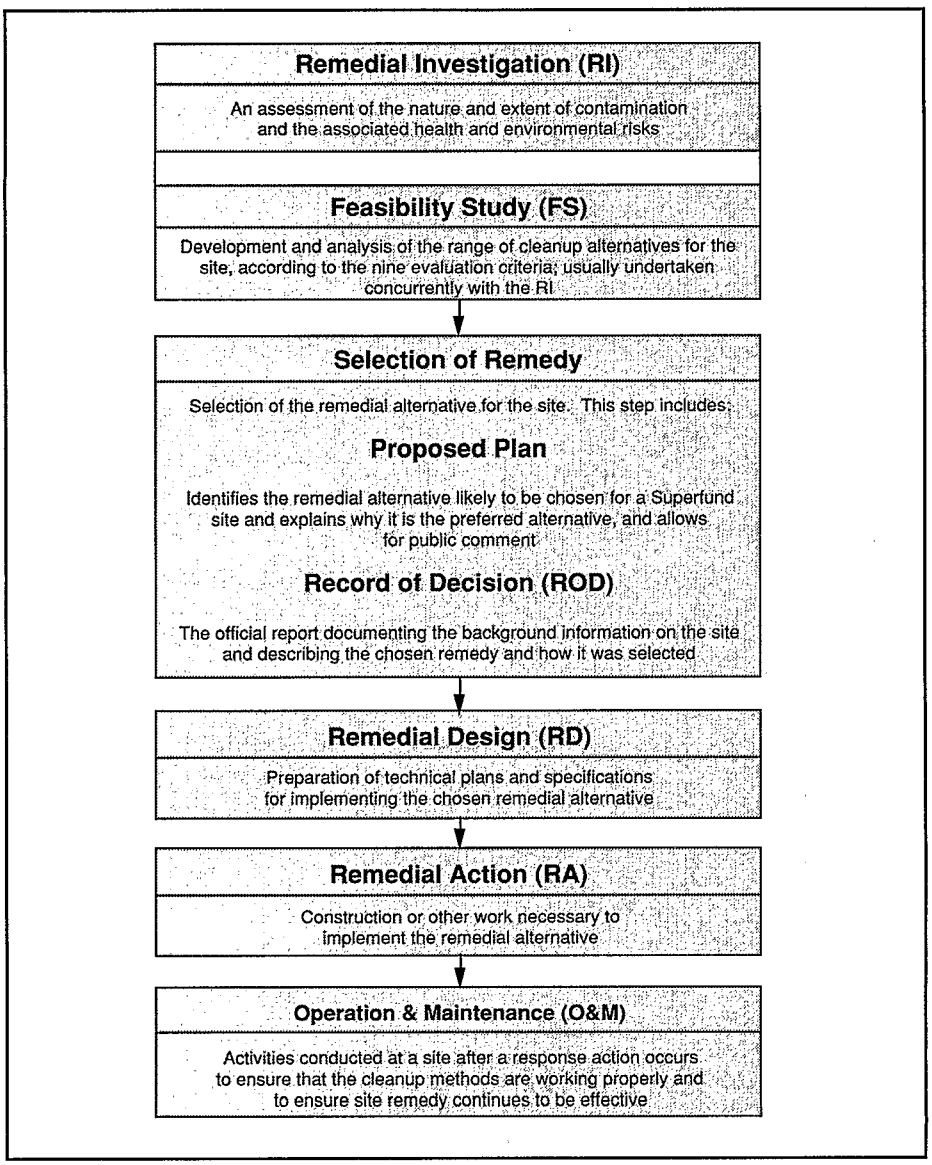
. . . an established, action-oriented program for cleaning up the highest priority sites.

The remedial process is complex, requiring extensive data gathering and analysis to characterize the scope of the problem and potential threats to human health and the environment, and to develop and implement workable solutions to the

Remedial actions at NPL sites provide permanent, cost-effective solutions to the most serious hazardous waste sites. The primary goals of the remedial program are to:

- Protect human health and the environment
- Address worst sites/worst problems first
- Emphasize permanent remedies using innovative treatment technologies.

Figure 6
The Remedial Process



problem. During the first phase of the remedial process, the approach to eliminating, reducing, or controlling risks at the site is conceived, evaluated, and selected. Once this remedy is approved, it is designed, implemented, and monitored. The five major steps that make up the remedial process are shown in Figure 6. Developing a workable, permanent solution for a hazardous waste site requires care—and involvement from the community—at each step of the process. The overall remedial program goal is to select a remedy that reduces or eliminates the risks to people and the environment, now and in the future.

Although the majority of remedial activity in the past has been funded through the Trust Fund, EPA is aggressively pursuing responsible parties to undertake and finance the cleanup activities. Responsible parties now conduct more than 60 percent of remedial actions, and that percentage is expected to continue to increase. In some cases, the responsible parties clean up the sites voluntarily, under the supervision of EPA or the State. If no responsible parties have been found, or if there are problems getting them to act, EPA will proceed using Trust Fund monies and recover costs later.

The State may decide to conduct and finance the cleanup by itself, or may enter into a Cooperative Agreement with EPA whereby the State undertakes certain remedial activities financed by the Fund. In either case, EPA provides oversight throughout the remedial action. While the Hazardous Site Control Division at EPA Headquarters manages the overall remedial program, the Remedial Project Managers (RPMs) in each EPA Region provide the day-to-day direction and oversight of site activity. Whether EPA or the State has the lead in cleaning up a site, CERCLA requires that the State contribute 10 percent of the cleanup costs for sites that were privately owned or operated and 50 percent of costs for sites that were owned or operated by the public. In addition, once EPA and the State have certified that the remedy is working properly, the State finances further operation and maintenance.

Remedial Investigation

Once a site is placed on the NPL, the lead agency must further assess the site problems. Similar to the initial site inspection prior to listing on the NPL, this involves an examination of site characteristics in order to better define the problem. The remedial investigation (RI), however, is much more detailed and comprehensive than the initial site inspection. The RI is designed to define the nature and extent of the problem and to provide information needed to develop and evaluate cleanup alternatives. It is carried out by a team of health and environmental scientists to determine the existence and nature of any actual or potential threat that may be posed to human health or the environment, and defines the boundaries or extent of any contamination found at a site. The Stauffer Chemical example (see box, next page) illustrates the complexity of site problems and data collection needs.

Feasibility Study

EPA develops more than one possible approach for Superfund remedial action at a site, and carefully compares the advantages and disadvantages of each approach. These analyses of alternatives are called feasibility studies (FSs).

In an FS, environmental engineers and other technical staff consider, describe, and evaluate options for cleaning up the site, using the data collected in the RI as a basis and collecting additional information as needed. Once the cleanup alternatives are defined, the feasibility study examines each alternative according to nine criteria, and portrays their effectiveness. The kinds of questions an FS answers are:

1. **Overall protection of human health and the environment.** Will the remedy protect human health and the environment; how are risks eliminated or controlled by the remedy?

2. **Compliance with applicable or relevant and appropriate requirements (ARARs).** Does the remedy meet all of the applicable requirements of State and Federal environmental laws and regulations?

These first two criteria are categorized into a group called "threshold criteria" because they are the minimum requirements that each alternative must meet to be eligible for selection as a remedy. After these criteria are applied, the FS reviews:

3. **Long-term effectiveness and permanence.** Does the remedy protect human health and the environment over time?

4. **Reduction of toxicity, mobility, or volume.** How well do the treatment technologies perform in reducing the threats at a site?

5. **Short-term effectiveness.** How well are the community and cleanup workers protected during the remedial action?

6. **Implementability.** What is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution?

7. **Cost.** How much will the remedy cost, including estimated capital (e.g., supplies and equipment, and contractor costs) and operation and maintenance costs?

Remedial Investigation At Stauffer Chemical

The Stauffer Chemical site in Mobile County, Alabama, was the location of chemical company operations from two adjacent plants. Waste from the plants included plant refuse, used samples, and solid wastes containing a variety of herbicides and pesticides. The waste was placed in unlined landfills and waste ponds, some of which drained into a local pond. The disposal practices at both sites contributed to ground water contamination. The owners installed monitoring wells and a system to treat the ground water in the 1970s. Because the ground water was not getting cleaner, in 1982 the State installed monitoring wells, data from which formed the basis for EPA placing the site on the NPL. EPA then informed the previous owner that an RI must be initiated at the site.

During the RI, EPA examined the type and extent of the contamination on the surface, and how the ground water was affected by the site contamination. The surface contamination was characterized by sampling of soils around the landfills and ponds and sampling of the liquids in the ponds and other surface water in the area. To investigate the ground water contamination, EPA sampled and analyzed the data from more than 40 water and monitoring wells. The results of the RI showed a range of threats, including ground water contaminated with carbon tetrachloride and other contaminants, ponds containing contaminated soils and sludges, landfills containing a combination of wastes that could be leaching into the ground water, and mercury detected in the sediments of a nearby wetland.

Based on the RI, EPA had the information it needed to develop alternate solutions to the problems posed by the site. EPA discovered what contaminants existed, where they were located, and the level of contamination in each area. It was a long, difficult task of collecting the needed information. It took more than 3 years from when EPA informed the previous owner of the site that an RI was necessary to when the RI report was completed. During the final phases of the RI, however, EPA began to conduct the next step in the remedial process, the feasibility study.

Evaluation criteria 3 through 7 are known as the "primary balancing criteria" that are used to identify major trade-offs among the alternatives. The last two criteria are:

8. **State acceptance.** Does the State concur with, oppose, or have no comment on the preferred alternative?

9. **Community acceptance.** Does the affected community concur with, oppose, or have no comment on the preferred alternative?

These final two criteria, which are determined after the proposed plan, are called "modifying criteria" because new information or comments from the State or the community may modify the preferred alternative or lead to another response action being considered. Then the alternatives are compared against each other to identify the most effective remedy.

The public has the opportunity to review the RI and FS reports. These reports are placed in the site information repository, which is usually located at a local library.

RI/FS Accomplishments

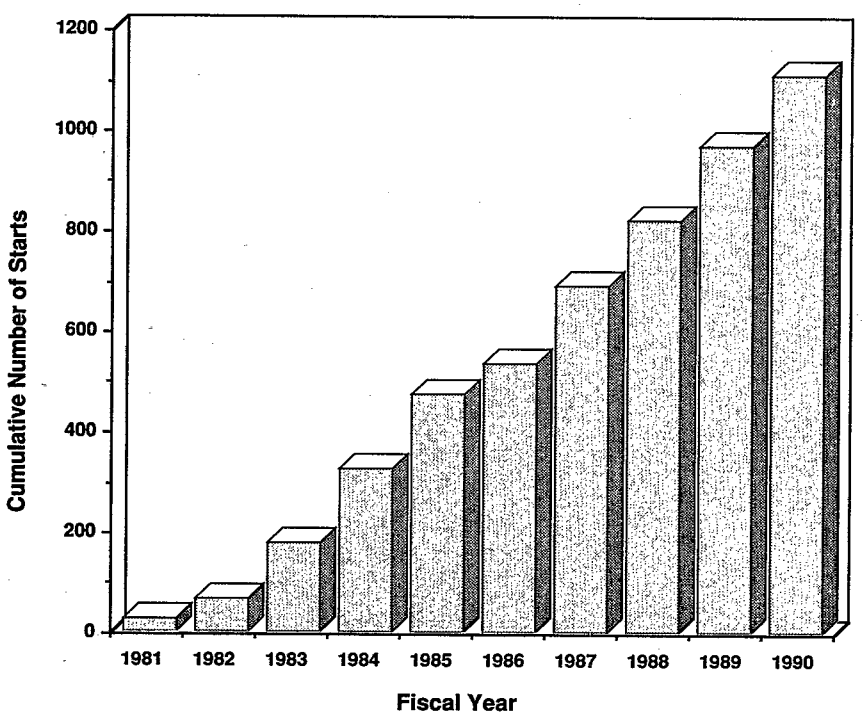
The Superfund Amendments and Reauthorization Act (SARA) set mandatory deadlines for the commencement of RI/FSs: by October 1989, EPA had to have started at least 275 RI/FSs. EPA more than met this ambitious goal as the mandated number of RI/FSs were underway 3 months ahead of the deadline. By the end of FY90, EPA had started RI/FSs at more than 1,000 sites and completed RI/FSs at more than 600 sites. Figure 7 shows the trend in RI/FS starts over the past 10 years.

Feasibility Study At Stauffer Chemical

As with many Superfund sites, the problems at the Stauffer site are complex. A wide variety of contaminants were detected in the ground water, in ponds, in landfills, and in a nearby swamp. To address the worst problems at the site first, EPA divided the cleanup into smaller units or phases, referred to as operable units. Operable units are separate actions that are incremental steps toward completely cleaning up the site. They may be actions that address all problems on one geographic part of a site, or they may address a specific problem throughout the entire site (e.g., contaminated soil or ground water). The operable units at this site were divided into five areas: the sludge ponds, waste water pond, landfills, swamp, and ground water. From this point, the operable units may be analyzed separately and cleanup alternatives selected in separate FS reports. EPA first chose to develop a remedy for the ground water contamination at Stauffer. Human health and the environment were threatened by contaminated ground water in the aquifer that serves as the principal source of water for people living in the area.

The following alternatives for ground water remediation were developed in the FS, based on the results of the RI: 1) take no action (used for comparative purposes at every site); 2) use the present ground water treatment system; 3) modify the present system to include additional extraction wells off-site, and include the testing of treatment alternatives later in the cleanup process (pilot-scale or other treatability tests); and 4) use the present system with the addition of a soil treatment system. EPA analyzed each of these alternatives against the nine evaluation criteria and against each other to allow EPA officials to determine a preferred alternative.

Figure 7
First RI/FS Starts



The Stauffer Chemical site illustrates the complexity of the RI/FS process. Several initiatives, however, are underway to streamline and expedite the RI/FS process. EPA is limiting the number of remedial alternatives considered in the RI/FS to those with clear potential effectiveness. This will reduce resources spent on evaluating alternatives that are impracticable. In addition, EPA is in the process of developing prototype RI/FSs and remedy-selection models for site situations that occur frequently, such as municipal landfills, polychlorinated biphenyls (PCB) sites, and wood-treating facilities. Such prototypes will be used as a starting point for planning and conducting studies. RPMs can start with the prototype and adapt it to the specifics of their site.

Deciding Upon A Course Of Action

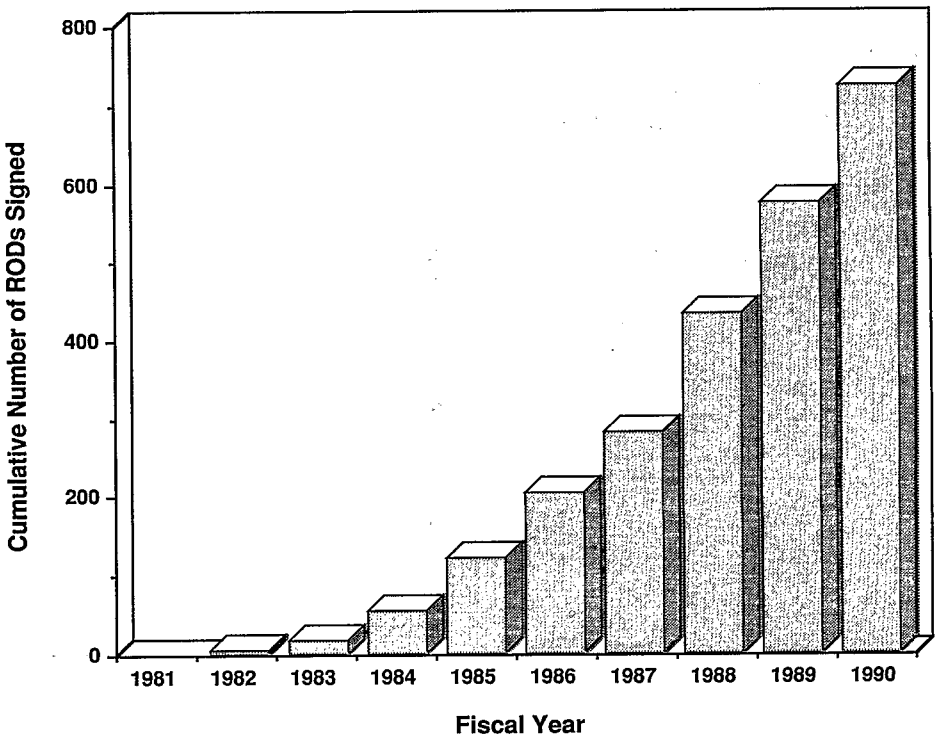
Once the alternatives for cleanup at a site have been evaluated and a preferred alternative has been decided, EPA formally requests comment from the public by presenting this information in the Proposed Plan. The Proposed Plan summarizes the alternatives analyzed in the detailed analysis of the FS, the preferred remedy and the rationale for that preference, any proposed waivers to cleanup standards, and the position of the support agency (e.g., the State) on the Proposed Plan and preferred alternative.

In the Stauffer Chemical Proposed Plan, EPA documented the analysis of the four alternatives against the nine evaluation criteria and against each other. EPA concluded that Alternative #3—a modified treatment system—passed the first two criteria and provided the best balance among the remaining criteria, compared to the other alternatives.

The public is given the opportunity for a public meeting to discuss issues related to the site and to submit oral and written comments to EPA during the 30-day public comment period. Following receipt of public comments and any final comments from the support agency, the remedial action is selected and the rationale is documented in the Record of Decision (ROD). The ROD details the remedial action plan for a site or operable unit, certifies that the remedy selection process followed the requirements in CERCLA and the National Contingency Plan (NCP), discusses the technical details of the remedy, and provides the public with a consolidated source of information about the site. Once the Regional Administrator or the Assistant Administrator of the Office of Solid Waste and Emergency Response signs the ROD, it is released for informational purposes and placed in the administrative record for the site. More than 700 RODs have been signed since the program began. Figure 8 shows the number of RODs that have been signed since FY81.

The ROD has become much more valuable than simply documenting the remedy selected at one site. It is a record of what to do in a given set of conditions. EPA has developed a detailed data base of RODs, called the Records of Decision System (RODS). RODS serves as an information base for similar site conditions and to promote national consistency among RODs.

Figure 8
RODs Signed



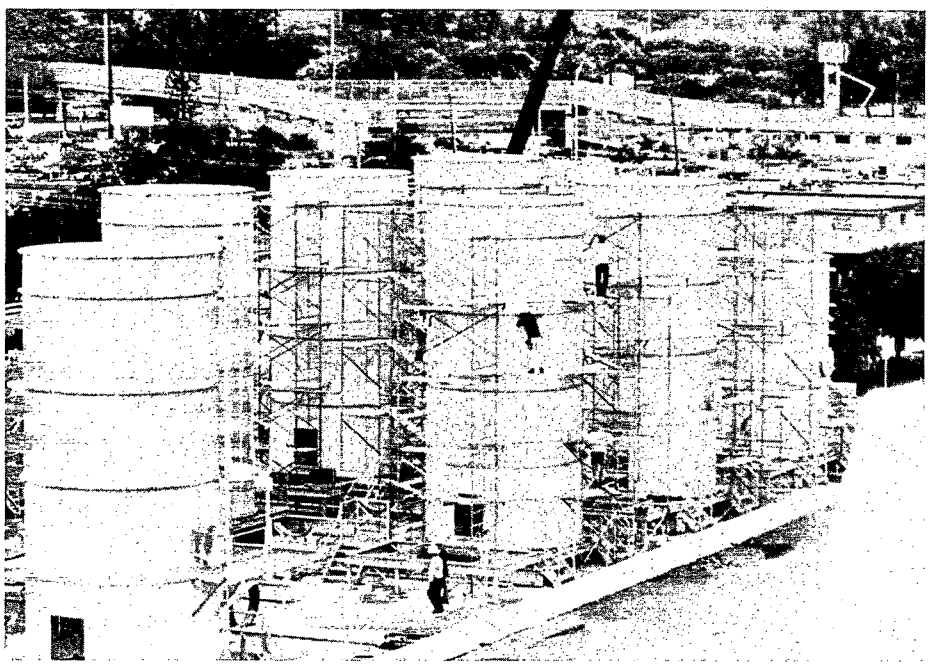
Designing And Constructing The Cleanup

Once the course of action has been selected and approved, it is time to design the remedial action and carry it out. These are the last phases of the remedial process: remedial design (RD), remedial action (RA), and operation and maintenance (O&M). Unlike other EPA programs which regulate activities of the private sector, here EPA actually manages the construction projects, designing the selected remedy and implementing that design.

RD is an engineering phase in which technical drawings and specifications are developed for the subsequent RA, based on the selected remedy documented in the ROD. EPA assigns RD and RA work to either the Alternative Remedial Contract Strategy (ARCS) contractors, the U.S. Corps of Engineers, or the U.S. Bureau of Reclamation, depending on the type of remedy and the estimated cost of the project. States and responsible parties continue to manage the design and construction of those Superfund actions for which they have lead responsibility. EPA RPMs provide environmental oversight.

Remedial action projects may appear to be like any other major construction project, but in fact, the presence of hazardous substances at the site demands specially trained engineers, scientists, and other personnel; complex treatment equipment; and special construction planning and health and safety procedures. In fact, a crucial element of the RD/RA phase is the development and implementation of the Site Safety and Contingency Plans to protect on-site personnel and surrounding communities from the physical, chemical, and/or biological hazards of the site. These plans include information on chemicals present, equipment being used, precautions to be taken, and steps to take in the event of an emergency situation at the site, including decontamination procedures. Remedial action projects also differ from the usual construction project in that the large volume of wastes to be treated at many sites extends the RA performance period over several years and results in costs of tens of millions of dollars.

After the RPM certifies that the remedial action is complete and the remedy is operational and functional, the O&M phase begins. O&M activities include ground water and air monitoring, inspection and maintenance of the treatment equipment remaining on site, and maintenance of any security measures such as signs and fencing. The State or responsible party usually assumes responsibility for these activities, while EPA is responsible for oversight to ensure the site is maintained and remains safe.

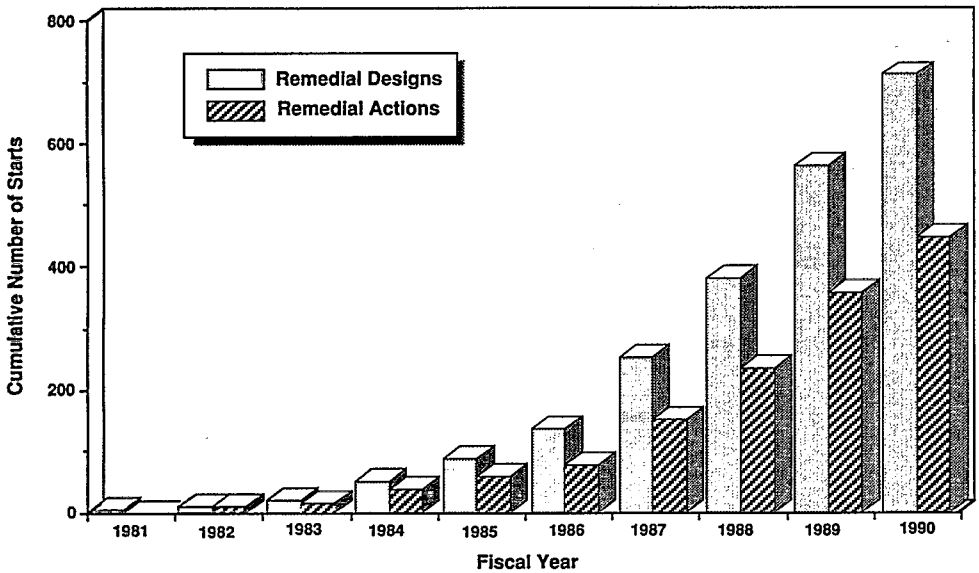


Remedial Action Accomplishments

SARA set ambitious goals for beginning remedial actions at Superfund sites: by October 1989, the program had to have started RAs at 175 sites, and by 1991, another 200 RAs must be started. EPA met the goal for RA starts in 1989. Figure 9 shows the trend of RD and RA starts over the past 10 years.

EPA has made remedial action a top priority and has taken several steps for continuous improvement in the pace and quality of RAs at Superfund sites. By streamlining the RI/FS and remedy selection processes—through the use of prototype RI/FS and remedy selection models, an up-to-date ROD data base, technical support from Headquarters, and a peer review process—today there are more sites in the construction pipeline than ever before. To address SARA mandates for permanent remedies and the use of alternative technologies where possible, EPA has set up technical

Figure 9
RD and RA Starts



Use Of Technologies At French Limited Site

Innovative technologies are being moved out of the laboratories and into the field, as illustrated by the remedial alternative selected for the French Limited site in Crosby, Texas. More than 300,000 cubic yards of industrial wastes from local petrochemical companies were deposited in an unlined pit at this site. Sludge and soil from the waste pit were contaminated with PCBs, organics, and metals. A removal action was conducted at the site in 1982 to contain the wastes and to eliminate the immediate threats. The potentially responsible parties (PRPs) for the site then funded and prepared an RI/FS. In deciding among the various alternatives for remedial action at the site, EPA had to choose one that provided the best balance among the nine evaluation criteria. In addition, EPA gave serious consideration to alternatives that met the preferences outlined in SARA: cleanup alternatives that foster recycling or treatment of waste rather than land disposal; and remedies that employ treatment technologies that permanently and significantly reduce the threats posed by the waste.

EPA concluded that a new treatment technology called bioremediation best met all of the above criteria. Bioremediation uses micro-organisms to detoxify organic matter. As a condition to selecting the remedy, EPA required the PRPs to conduct a pilot study at the site before applying this treatment on the entire site. The pilot study had to prove that bioremediation was at least as effective as the other alternatives at the site (mainly, incineration) and did not pose additional significant threats during the process. The pilot study, which was conducted on a half-acre section of the site, was very successful, reducing the threats posed by the waste while posing no significant health threats during treatment. In addition to being an effective remedy, bioremediation was supported by the State and community and was half as costly as incineration. The site is presently in the RD phase, with the RA anticipated to begin in 1991. Almost 50 percent of the treatment remedies approved in RODs over the last 2 years involve innovative technologies, and that percentage is expected to continue to rise in the coming years.

expert support systems and technology evaluation programs to ensure that existing knowledge and creative ideas are being shared around the country.

New Remedial Program Initiatives

The remedial program is now an established, action-oriented program for identifying and cleaning up the highest priority sites. The main principles driving the program today are:

- **Address worst sites/worst problems first.** After abating immediate threats, EPA will initiate the earliest remedial work to address the highest priority problems (e.g., imminent threat to human health, highly toxic, highly mobile contaminants). In many cases, EPA is taking action in deliberate stages that will result in continuous improvements until the site is finally cleaned up to human health and environmental standards. This may

include dividing the site into operable units so that immediate attention is given to the highest priority areas at a site. Depending on site conditions, EPA will take actions to initially prevent exposure and control risk; further actions will be taken to reduce or eliminate the risk. EPA is making sites "cleaner"—while ensuring that the stages of site cleanup are consistent with the final remedy—at as many NPL sites as soon as possible.

- **Monitor and maintain sites.** In addition to quick action at a site, EPA will monitor and maintain sites over the long-term to ensure that the remedy at each site is fully protective of human health and the environment. As part of the effort to monitor site conditions, EPA will conduct, at least every 5 years after the initiation of the response action, a review of all sites where hazardous substances remain on site. EPA also will maintain the effectiveness of the remedy over the long-term by promptly correcting any problems that are identified. EPA will report annually to Congress the results of all 5-year reviews.

- **Emphasize permanent remedies using innovative technologies.** The ultimate success of the Superfund program depends on the selection of remedies that reduce risks to human health and the environment in the short term, and eliminate the risks in the long term. This initiative involves seeking alternative technologies to land disposal, developing new technologies for more effective cleanup, and ensuring that these technologies provide permanent protection to the extent possible. SARA requires that EPA give strong preference to such remedies in cleaning up Superfund sites.

EPA has been successful in creating an environment conducive to providing such remedies. This has involved reducing regulatory and policy barriers to the use of treatment technologies and providing extensive technical assistance, expert advice, and information transfer to make the best use of the information that is available now and that is under development. EPA is aggressively supporting the research, development, demonstration, and evaluation of new treatment technologies to provide state-of-the-art protection at Superfund sites.

EPA has made great strides in advancing the pace and quality of long-term cleanup at Superfund sites since the response to hazardous chemicals found at Love Canal, New York. The future of hazardous waste cleanup is a challenge that can and will be met. The Superfund program has built up a sizeable reservoir of knowledge in its first 10 years. The remedial program is in place and information on effective remedies is being developed and shared throughout the program. Cleanup activity at NPL sites is at every stage of the remedial "pipeline"—sites that are in the Superfund study and cleanup process. The program will continue to grow and address site problems through aggressive goals, effective communication, and shared responsibility.

One of Superfund's major goals is to have responsible parties pay for and conduct cleanups at abandoned or uncontrolled hazardous waste sites. The foundation of Superfund's enforcement program is the Comprehensive Environmental Response, Compensation, and Liability Act's (CERCLA) strict, joint and several liability standard. Under this standard, each potentially responsible party (PRP)—those owners and operators, waste generators, and transporters at a site—may be fully liable for all site cleanup costs, regardless of waste share or fault.

In getting responsible parties to pay for or conduct site cleanups, EPA uses three, broad enforcement authorities to:

- Reach settlements
- Issue orders
- Recover costs.

When CERCLA was reauthorized and amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986, Congress reinforced and significantly strengthened the law's enforcement provisions. SARA provided enforcement "tools" to facilitate settlement negotiations, and enhanced the enforcement measures available to EPA in the event that responsible parties do not settle. In addition, the Superfund Management Review established the "One Superfund Program—Enforcement First" concept to encourage or compel responsible party cleanups rather than using the Trust Fund, and to integrate all EPA response and enforcement activities. The result has been a seven-fold increase, over the last 4 years, in the total value of settlements to $3.7 billion (as shown in Figure 10). PRPs now conduct more than 60 percent of Superfund remedial actions.

One Superfund Program—Enforcement First.

EPA can negotiate settlements with responsible parties to have them conduct or pay for site cleanups. If negotiations fail, EPA issues orders to responsible parties to compel site cleanup. EPA also can use Trust Fund monies to cover cleanup costs and attempt to recover the costs later through litigation. To conserve Trust Fund dollars for "orphan" sites, those where no liable, financially-viable PRPs exist, EPA's top priority is to use all its enforcement tools and reach settlement agreements with responsible parties.

The Enforcement Process

The enforcement process begins immediately after a site is proposed for listing on the National Priorities List (NPL) (see Figure 11). At the start of the NPL listing process, EPA begins looking for PRPs who may be liable for contamination at a site. These PRP identification activities are known as a PRP search. When EPA has enough information to identify a party as potentially

Figure 10
Total Value and Number of PRP Settlements

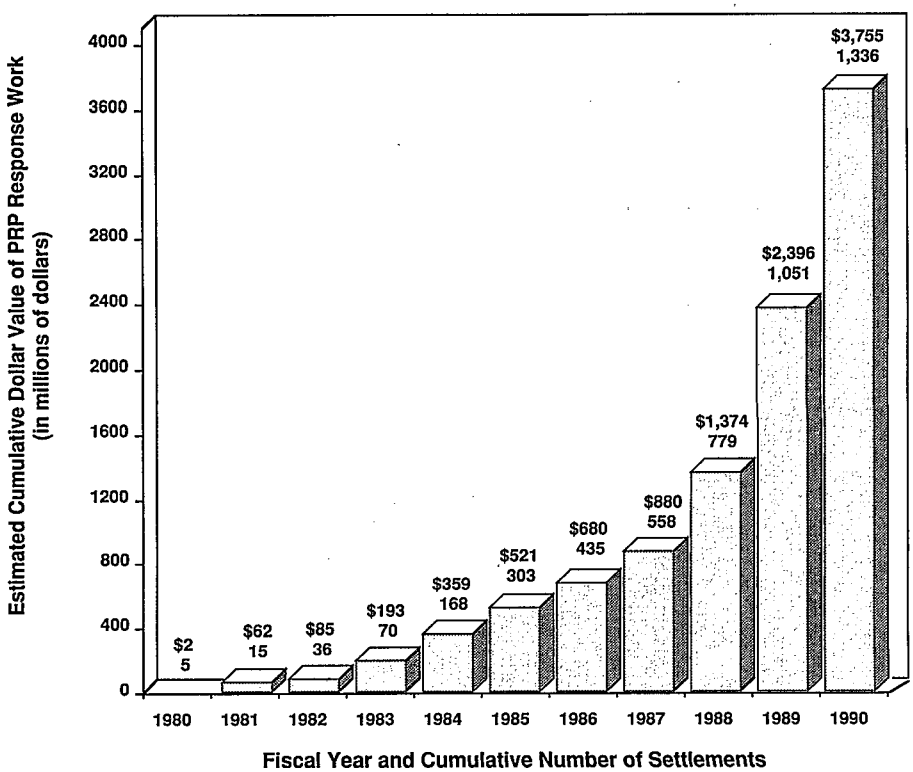
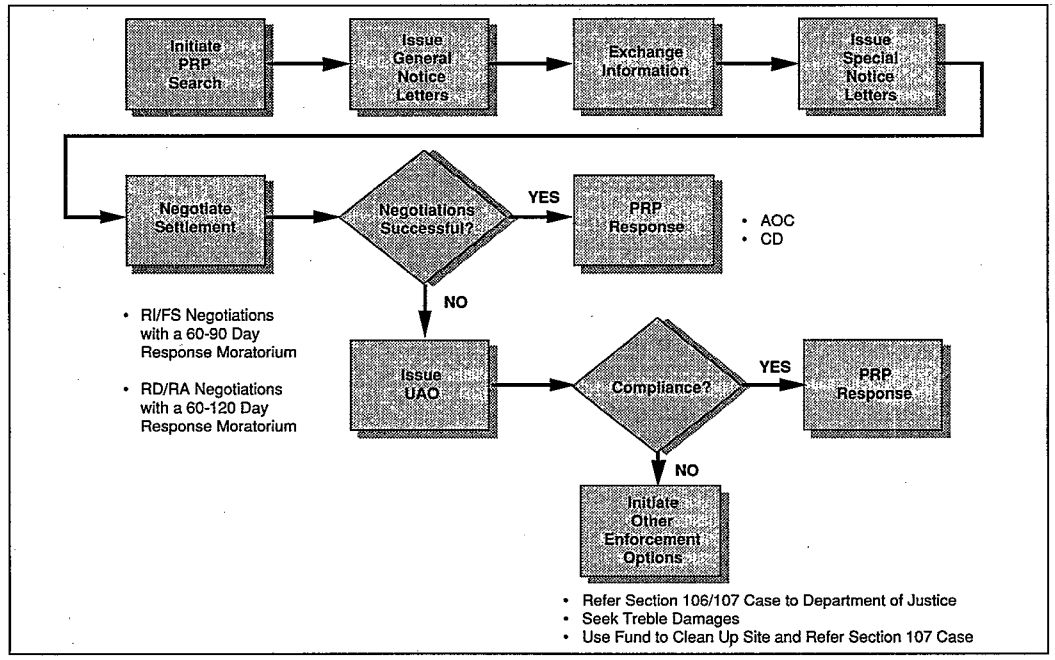


Figure 11
Basic Enforcement Process



responsible for the site, EPA issues a general notice letter to each PRP notifying them of their potential liability. As soon as PRPs are identified, EPA begins exchanging information with them concerning site conditions, PRP connections to the site, and other potentially responsible parties.

Based on information obtained during the PRP search and information exchange process, EPA also may issue special notice letters to PRPs. The special notice letter begins a formal negotiation period and establishes a moratorium (60-90 days for RI/FS negotiations, 60-120 days for RD/RA negotiations) on certain response and enforcement activities. If within 60 days, PRPs make a "good-faith offer" to conduct the response action, the moratorium may be extended to provide additional time for reaching a final settlement. An administrative

Enforcement Tools

- **Covenant Not to Sue:** EPA may grant a "covenant not to sue" to settling PRPs who agree to conduct an RD/RA. This covenant releases settling PRPs from either "present" or "future" liability, or both. "Present" liability refers to a PRP's obligation to pay response costs already incurred by the government and to complete remedial activities set forth in the Record of Decision (ROD) or consent decree. "Future" liability covers additional response activities beyond those specified in the ROD or consent decree. These covenants typically are issued in conjunction with de minimis settlements.

- **De minimis Settlements:** EPA may enter into de minimis settlements where the settlement includes only a minor portion of the response costs, and where wastes contributed represent a relatively minor amount and are not highly toxic, compared to other wastes present at the site. De minimis settlements allow contributors of small amounts of waste to resolve their liability.

- **Mixed Funding Settlements:** Under mixed funding, EPA and settling PRPs share the costs of a response action.

- **Nonbinding Preliminary Allocations of Responsibility (NBARs):** EPA may use an NBAR, which is an allocation of total response costs, to assist PRPs in allocating liability among themselves. NBARs are not binding on the Government and may not be admitted as evidence in court. However, an EPA-prepared NBAR may help a large number of PRPs reach a settlement.

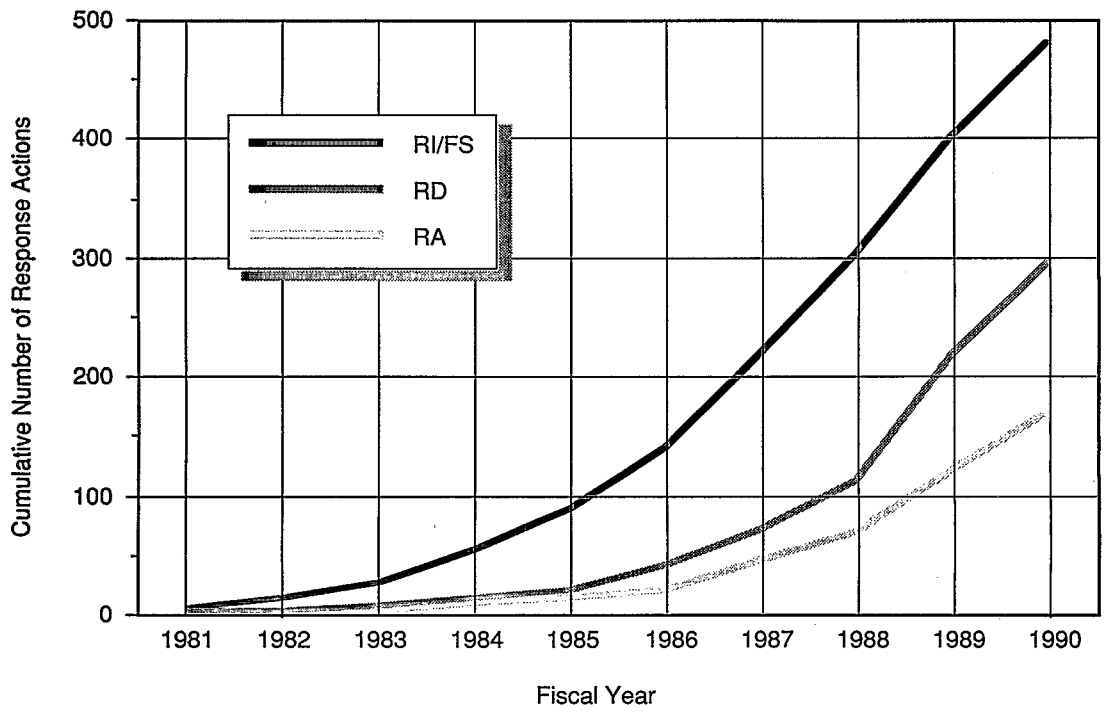
record for a site, which includes all documentation relating to the selected remedy, is usually established as soon as the site is discovered. The administrative record is the basis for any judicial review of a settlement or the selected remedy by the court.

Settlement agreements may be reached to conduct a remedial investigation/feasibility study (RI/FS) or a remedial design/remedial action (RD/RA). EPA has a variety of enforcement tools provided by SARA to encourage PRPs to settle (see box on previous page). If PRPs do not agree to conduct the RI/FS, they may settle at a later date to conduct the RD/RA. However, PRPs who are actively involved in site work from the time they receive a general notice letter, and who conduct the feasibility study, can have more input on the remedy that is selected. Figure 12 summarizes PRP involvement in response actions since Superfund's inception.

A settlement agreement to conduct an RI/FS is usually formalized in an administrative order on consent (AOC). AOCs are issued under EPA's administrative authority and legally bind both EPA and the settling PRPs. Although AOCs are not lodged in court, the Department of Justice (DOJ) may review certain RI/FS settlements. RD/RA settlements, however, must be lodged in court by DOJ, in the form of a consent decree. For all settlements, DOJ represents EPA in actions brought by responsible parties.

If PRPs do not settle, EPA can either issue orders to force liable, financially viable PRPs to conduct the response action, or spend Trust Fund monies and recover the costs from the PRPs later. For RD/RAs, EPA routinely issues unilateral administrative orders (UAOs) to force non-settling PRPs to implement the remedy themselves. UAOs are legally binding and do not require EPA to sue PRPs in court to become effective. In addition, UAOs do not provide PRPs some of the advantages of settlements, such as protection from other PRPs or other third parties seeking contribution for response costs. Non-compliance with a UAO can result in civil penalties of $25,000 per day, and if Trust Fund monies are spent, EPA may seek triple the cost of the response action (treble damages) in cost recovery litigation. Finally, if PRPs do not comply with a UAO, EPA may sue in court and obtain a court order forcing them to conduct the response action and to reimburse EPA for its oversight costs.

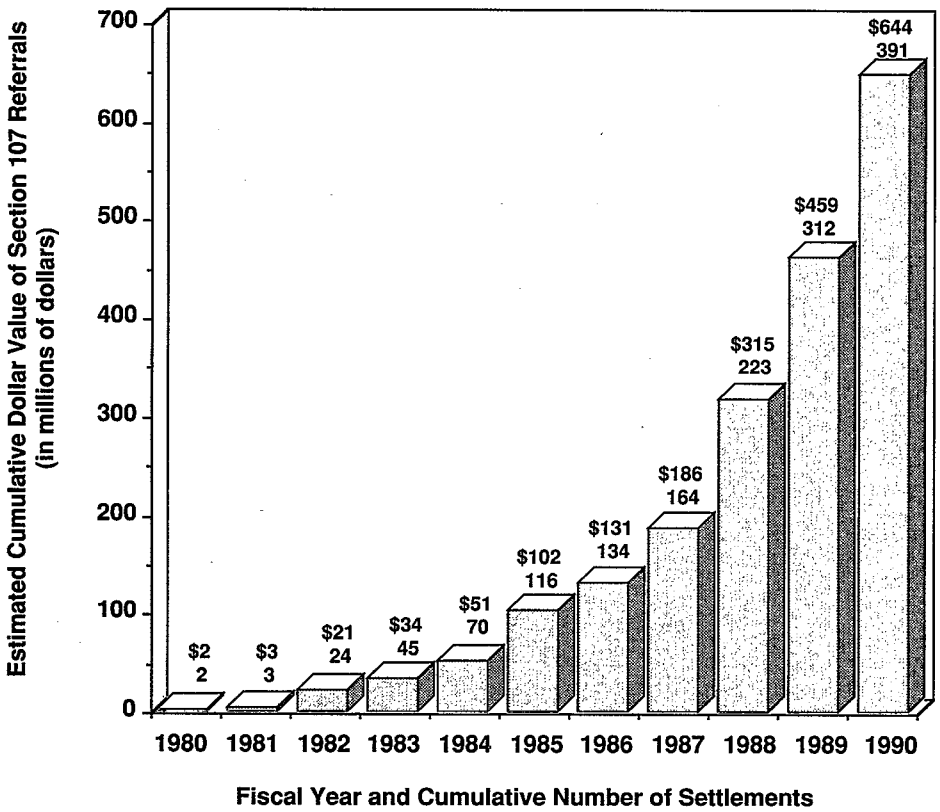
Figure 12
Trend in PRP-Financed Response Actions



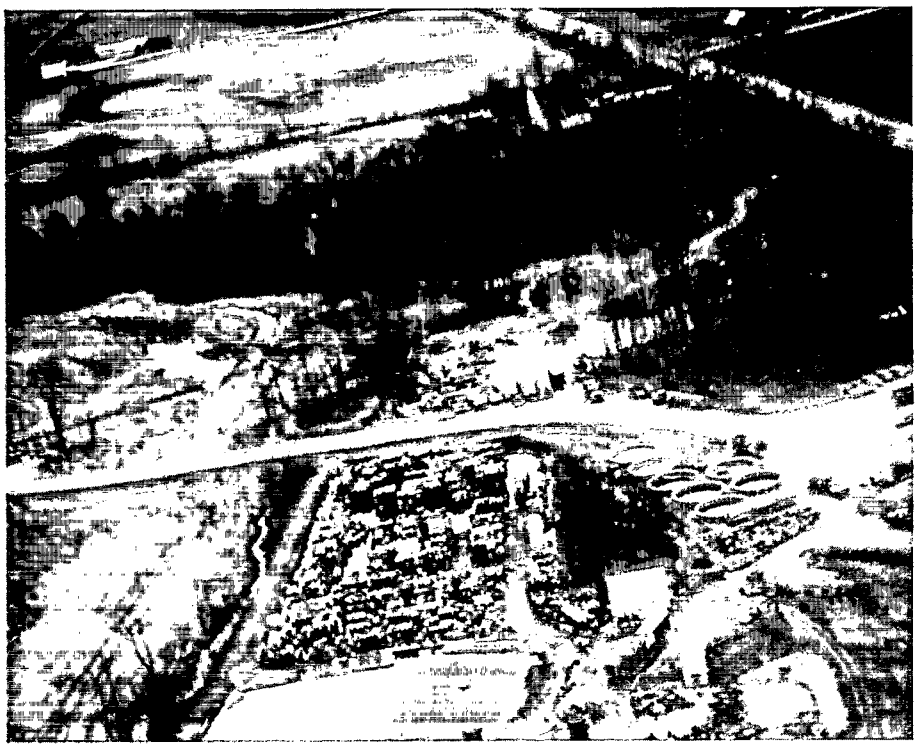
EPA also has the option to spend Trust Fund monies to conduct the cleanup, and then recover the costs from the responsible parties. Under CERCLA, any past and present owner and operator at a site, as well as waste generators and transporters, can be held fully liable by the courts for complete cleanup costs. During a response action, EPA develops a cost recovery case and refers it to DOJ for litigation. Since 1980, EPA has referred 391 civil cases seeking $644 million in past costs to DOJ (see Figure 13).

Aggressive enforcement efforts are necessary to the Superfund program because the cost of cleaning up all the sites on the NPL far exceeds the money available in the Trust Fund. For its part, EPA has developed critical guidance and model administrative documents, produced a draft cost recovery regulation to expedite cases, and hired 500 new personnel based on recommendations in the 1989 Superfund Management Review to push sites through to cleanup. With the enforcement program's infrastructure in place and the implementation of the "One Program—Enforcement First" concept, the involvement of PRPs in Superfund cleanups will continue to grow.

Figure 13
Total Value and Number of Section 107 Cost Recovery Referrals



Public Participation In Decisionmaking



Like every component of the Superfund program, the community relations initiative has grown and matured since Superfund's inception in 1980. From the beginning, EPA recognized the importance of community input and involvement in the hazardous waste site cleanup process. Agency staff at Headquarters and in the field realized that the most innovative cleanup technology could not be considered successful if it was not accepted by the "affected public"— the people who live and work near the hazardous waste sites. In the early days of the program, community relations activities generally occurred on an informal, site-specific basis. There were no required activities; specific communication and information needs of the interested citizens determined each site's public participation initiative. As the program evolved, the Agency formulated policy statements and developed program guidance. The 1982 National Oil and Hazardous Substances Pollution Contingency Plan (NCP) contained requirements for community relations at all remedial sites and for removals lasting more than 120 days. In 1986, the Superfund Amendments and Reauthorization Act (SARA) added legislative requirements and in 1989, the Superfund Management Review made recommendations to further improve the community relations program. Throughout the years, one aspect of the program has been maintained—EPA still conducts community relations activities on a site-specific basis. Although today's program has many required activities, each one is tailored to the specific issues of importance to the public, the level of concern, the history of public involvement, and the economic and social structure of the community.

Superfund community relations activities are important to:

- Promote two-way communication
- Provide input to technical decisions
- Discover useful site information
- Focus and resolve conflict.

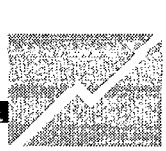
Achieving Public Participation

Community relations activities have occurred at every site at which an RI/FS has been started and at all removal sites where time has allowed. Community relations efforts promote two-way communication among members of the public, State and local officials, other Federal agencies such as the U.S. Corps of Engineers, the U.S. Coast Guard, and the Department of Defense, and EPA.

Community relations efforts promote two-way communication.

The community relations program encourages communication with affected citizens and participation in decisionmaking. It has three main objectives:

- Give the public the opportunity to comment on and provide input to technical decisions.



- Inform the public of planned or ongoing actions and keep them apprised of the nature of the environmental problem, the threats it may pose, the responses under consideration, and the progress being made.

- Focus and resolve conflict. Conflict may be unavoidable in some circumstances, but it can be constructive if it brings into the open alternative viewpoints.

Every phase of the technical schedule for site cleanup has corresponding community relations requirements. For a remedial site, a Community Relations Plan (CRP) must be developed before RI/FS field work begins. The CRP is the "work plan" for community relations activities that EPA will conduct during the entire cleanup process. In developing a CRP, Agency staff members conduct interviews with State and local officials and interested citizens. Through this one-on-one interaction, EPA learns about citizen concerns, site conditions, and local history. This information is used to formulate a schedule of activities designed to keep citizens apprised and to keep EPA aware of community concerns. Typical community relations activities include public meetings, at which EPA presents a summary of technical information regarding the site and citizens can ask questions or comment; small, informal public availability sessions at which EPA representatives make themselves available to citizens; and development of fact sheets, which the Agency distributes periodically to keep citizens up-to-date on site activities.

Part of every CRP is the establishment of an information repository. EPA is required to set up a file of information related to the site in a building accessible to citizens. Usually housed in a library or town hall, the repository contains reports, studies, fact sheets, and other documents containing information about the site. EPA continually updates the repository and must ensure that the facility housing the file has copying capabilities.

After the RI/FS is completed and EPA has recommended a preferred cleanup alternative, the Agency sends to all interested parties a Proposed Plan outlining the cleanup technologies that were studied and explaining why EPA prefers one remedy over the others. At this time, EPA also begins a public comment period during which citizens are encouraged to submit comments regarding all alternatives. Once the public comment period ends, EPA develops a Responsiveness Summary, which contains EPA responses to public comments. The Responsiveness Summary becomes part of the Record of Decision (ROD), which provides official documentation of the remedy chosen for the site.

Community relations activities occur at specific points in the remedial process, as shown in Figure 14. In addition to meeting these Federal requirements, EPA makes every attempt to ensure that community relations is a continuing activity designed to meet the specific needs of the community.

What EPA Has Learned

Superfund participants at the Federal, State, and local levels acknowledge the importance of public participation in the Superfund program. Because it is such an integral part of all cleanup operations, EPA is constantly striving to improve its communications with the public. Agency experience over the past 10 years has yielded general conclusions about the nature of public involvement in hazardous waste issues, and, in turn, about the most helpful approaches to public participation. EPA has learned, for example, that its decisionmaking ability is enhanced by actively soliciting comments and information from the public. In addition, experience has shown that the earlier EPA establishes a working relationship with citizens near a site, the greater chance there is for trust and confidence to develop between the parties. EPA also has found that communities often are able to provide valuable information on local history, citizen involvement, and site conditions. Establishing a dialogue between Agency staff and citizens, therefore, allows both the public and EPA access to important information. This dialogue can help identify citizen concerns about the site, enabling EPA to be most responsive to community needs.

By planning at the outset for a high level of citizen involvement, EPA has usually been able to avoid the delays in cleanup which might otherwise arise from uninvolved and disaffected citizens. Consequently,

Figure 14
Overview of EPA Community Relations Requirements

Decision Point (Technical Process)	EPA Community Relations Requirements	Opportunities For Participation
NPL Listing	Publish the proposed additions to the NPL in the Federal Register; solicit comments through a public comment period	Submit comments in support of or opposition to the site being listed on the NPL
RI/FS and Administrative Report	Develop Community Relations Plan (CRP)	Participate in on-scene interviews; submit names for mailing list
	Establish information repository and administrative record	Periodically review site-related information
	Announce and describe the TAG Program	Assess community need for TAG; if appropriate, submit application
Proposed Plan	Notify public of Proposed Plan; make plan available in information repository and administrative record	Review alternatives
	Provide opportunity for public meeting	Request meeting; gain further insight into cleanup alternatives
	Conduct a minimum 30-day public comment period	Submit written or oral comments on the alternatives
ROD	Prepare Responsiveness Summary; make it and ROD available in information repository and administrative record	Review and comment on EPA decision document
RD/RA	Revise CRP, if necessary	Participate in on-scene interviews
	Make remedial design available in information repository and administrative record	Review remedial design
	Prepare fact sheet on remedial design	Read fact sheet
	Provide opportunity for public meeting	Request meeting; gain further insight into design
NPL Deletion	Place copies of information supporting the proposed deletion in the information repository	Review information regarding proposed deletion
	Publish a notice of intent to delete in the Federal Register and solicit comments through a minimum 30-day public comment period	Submit comments in support of or opposition to the site being deleted
	Respond to comments and include responses in the final deletion package in the information repository	Review the final deletion package

Agency staff members are committed to listening to citizen concerns and fully involving the public in the decisionmaking process "early, often and always."

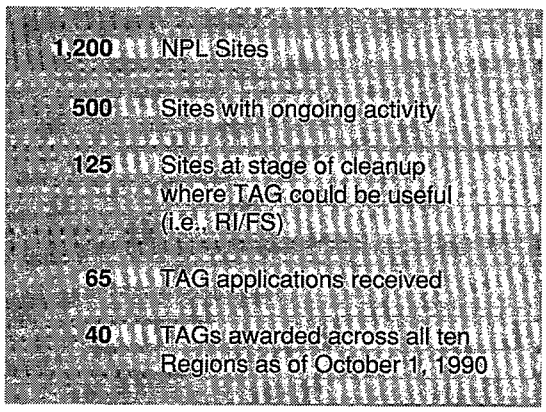
The Technical Assistance Grant (TAG) Program

One of the most significant accomplishments of the Superfund community relations program is the awarding of technical assistance grants or TAGs. Established by Congress in 1986, the TAG program helps ensure that affected individuals are well informed about the conditions and activities at Superfund sites in their communities. The program provides groups with grants to hire independent technical advisors who can help them understand technical information related to cleaning up a site. One grant of up to $50,000 is available for each site as long as the site is listed or has been proposed for listing on the NPL, and EPA has begun its response action at the site. If the site is a complex one, it is possible to receive additional funding. To date, EPA has awarded 40 grants across all ten EPA Regions, as shown in Figure 15.

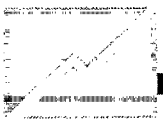
Groups eligible to receive TAGs are groups of individuals who live near the site and whose health, economic well-being, or enjoyment of the environment is directly threatened. Such groups could be existing citizens' associations, environmental or health advocacy or similar organizations, or coalitions of such groups formed to deal with community concerns about a hazardous waste site and its impact on the surrounding area.

In general, grant funds may be used to hire technical advisors to increase citizen understanding of existing information about the site, or that is developed during the Superfund cleanup process. Grant monies are often used to pay technical advisors to review site-related documents, meet with the recipient group to explain technical information and interpret technical information for the community.

Figure 15
Technical Assistance Grants Accomplishments



EPA has Community Relations Coordinators and TAG Coordinators at Headquarters and in each EPA Region. The addresses and telephone numbers of Headquarters and Regional Offices are presented at the end of this document.



Roles Of States And Indian Tribes

States continue to take lead responsibility for Superfund response at many sites, and that number is expected to increase significantly as individual State hazardous waste programs mature. For example, States have led nearly 300 remedial investigation/feasibility studies (RI/FSs) and more than 80 remedial actions (RAs) since the program's inception, with the most dramatic increase in Superfund activity happening during the last 4 years.

States and political subdivisions (such as county governments) with the necessary technical and management expertise are authorized to lead cleanup efforts. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) also requires EPA to coordinate with States when the Federal government leads site response.

State and Indian Tribal involvement in the Superfund program is based on:

- Requirements found in the Superfund Amendments and Reauthorization Act (SARA),
- Procedures outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and Superfund Administrative Regulation, and
- Formal agreements between States, political subdivisions, or Indian Tribes and EPA.

In the earlier days of the Superfund program, EPA focused on involving States in individual remedial activities, while the Agency developed a better understanding of the requirements for effective response. EPA relied on comprehensive guidance for State participation because the original Superfund law provided few procedures for getting States involved. The enactment of SARA strengthened and broadened State involvement in Superfund by specifying the points at which State participation is required. SARA outlines minimum requirements for involving States in virtually every phase of Superfund decisionmaking. As a result, States can participate in enforcement, removal actions, site assessment, and remedial activities. SARA also enables EPA to help States increase their role in site-specific response by funding their non-site-specific, general Superfund programs.

SARA extends this EPA/State interaction to Indian Tribes, as well. EPA must treat Indian Tribal governments substantially the same as States, which may either lead a response or provide support when EPA leads the activities. To be considered the same as States, an Indian Tribe must be Federally recognized by the Bureau of Indian Affairs, have jurisdiction over a site in EPA's data base of hazardous waste site information or a site on the National Priorities List (NPL), and have a Tribal governing body that is promoting health, safety, and welfare of the affected population.

Local governments also play an important role during a Superfund cleanup. Localities may lead a response action and often provide important public safety measures during emergencies, for which they may receive some financial assistance under the Local Governments Reimbursement (LGR) program. The LGR program is intended to ease the financial burden on local governments from conducting temporary emergency measures in response to a hazardous substance threat. The program offers assistance of up to $25,000 per response directly to local governments.

Statutory And Regulatory Framework

CERCLA authorizes the Federal government to lead hazardous waste response activities at a site, or to transfer the necessary funds and management responsibility to a State (State-lead), a political subdivision of a State, or a Federally recognized Indian Tribe. Regardless of which level of government leads a response, the State must make certain assurances to EPA. As part of these assurances, the State must pay part of the cleanup costs. If the site was privately operated at the time of the hazardous substance release, the State must pay 10 percent of the costs of the actual cleanup. If the State or a locality operated the site when hazardous substances were disposed there, it must pay 50 percent or more of all Federal response costs.

In addition to helping defray some of the costs, a State must also ensure the availability of a disposal facility for hazardous materials removed from a site during cleanup, as well as ensure its capacity to adequately handle all hazardous wastes generated within the State over 20 years, starting from 1989. Operation and maintenance of the selected remedy once the cleanup is completed and is proven to be running smoothly also is the responsibility of the State as part of its assurances to the EPA.

The NCP (Subpart F) clarifies how EPA will achieve substantial and meaningful involvement by each State and Indian Tribe. The Superfund Administrative Regulation (40 CFR Part 35 Subpart O) defines how EPA can transfer funds for site response to State, political subdivision, and Indian Tribal Superfund programs to support the development of their programs'

goals and maintain their effectiveness to respond to hazardous waste threats.

Promoting State And Indian Tribal Involvement

EPA has developed four ways to involve States, Indian Tribes, and political subdivisions in Superfund:

- **Cooperative Agreements:** Cooperative Agreements transfer funds from EPA to States, political subdivisions, or Indian Tribes to lead site-specific responses or to cover the costs of their participation in Federal-lead or other CERCLA activities. A Cooperative Agreement also is the legally binding document to obtain required State cost shares and CERCLA section 104 assurances when a State or Indian Tribe leads a remedial action. Under a Cooperative Agreement, the State, political subdivision, or Indian Tribe can lead a response at a site or several response actions at one or more sites.

- **Superfund State Contracts (SSCs):** SSCs are joint, legally binding agreements between a State or Indian Tribe and EPA that assure the transfer of cost-sharing funds when EPA is leading a Superfund response action. SSCs document that States or Indian Tribes have made all required assurances under CERCLA, as amended. They also can be used to specify required State involvement during a political subdivision-lead response.

- **Core Program Cooperative Agreements:** EPA created Core Program Cooperative Agreements to provide general Superfund program support funds to States and Indian Tribes. Core Program funding defrays the cost of essential State and Indian Tribe activities that cannot be accounted for on a site-specific basis, but are essential to an active role in CERCLA implementation. For example, States and Indian Tribes have used Core Program Cooperative Agreements to pay for administrative and clerical salaries, computer resources, program management, recordkeeping, and training.

- **Superfund Memoranda of Agreement (SMOAs):** EPA developed SMOAs to define the working Superfund partnership between EPA and a State or Indian Tribe. A SMOA is an optional document that specifies the procedures that EPA and a State or Indian Tribe will use to implement CERCLA and the NCP. These procedures then serve as the basis for site-specific Cooperative Agreements or SSCs.

State And Indian Tribal Accomplishments

The number of State-lead activities is greatest in the site assessment program. States have identified more than 32 percent of the sites that are currently listed in EPA's inventory of hazardous waste sites. To date, States have assumed responsibility for approximately 20,500 preliminary assessments (PAs), or nearly 60 percent of the national total. They have completed 19,500, or more than 58 percent of all PAs conducted within the Superfund program. States also have completed more than 4,500 site investigations (SIs) and Hazard Ranking System calculations, 32 percent of the total number of SIs that have been completed nationwide. Two Indian Tribal governments also have been awarded Cooperative Agreements to conduct site assessment activities.

States have made an equally significant contribution to remedial activities at hazardous waste sites (see Figures 16 through 18). Since 1980, States have completed 139 RI/FSs, 51 remedial designs (RDs), and 27 RAs. This represents 16 percent, 14 percent, and 15 percent of total nationwide RI/FS, RD, and RA completions, respectively. In addition, the number of ongoing activities led by States has grown steadily over time. This increase suggests a strong State commitment toward long-term cleanup activities. Four Indian Tribes also have been awarded Cooperative Agreements to conduct support agency activities during Federal-lead remedial response activities.

Each State and Indian Tribe may determine the role it will take in Superfund.

Core Program funds have also made a critical difference in increasing State and Indian Tribal Superfund capabilities. The Core Program began in FY87 with three States participating in pilot activities. Today, all States, Territories, and Federally recognized Indian Tribes are eligible to participate, and 44 States, the Territory of Puerto Rico, and three Indian Tribal governments are active in the program. Through the Core Program, each State, Territory, and Indian Tribal government has the opportunity to determine the long-term role it will take in Superfund.

State Superfund Program Success Stories:

Core Program Funds Make A Difference . . .

Mississippi's State Superfund Program has come a long way since 1987. From the passage of CERCLA until mid-1987, Mississippi had only four full-time staff and one part-time supervisor. Response operations were limited. In 1988, however, the State entered into a Core Program Cooperative Agreement with EPA which allowed Mississippi to expand its program and, therefore, its effect on cleaning up hazardous waste sites. This expansion, which continued with funding provided by Cooperative Agreements with the EPA in 1989 and 1990, included increasing professional staff dedicated to Superfund response four-fold, and subsequent participation in site assessment activities. In addition, the State's ability to take aggressive enforcement actions against individuals or firms responsible for contributing to abandoned hazardous waste sites improved.

Mississippi is currently pursuing enforcement activities under administrative orders at 100 sites, representing nearly one-third of the Mississippi sites listed in the CERCLA Information System (CERCLIS). The State has developed an enforcement action guidance document consistent with the NCP, entered into a SMOA with EPA, signed a Cooperative Agreement to provide funds to review technical documents and actions at its two NPL sites, entered into the nation's first SMOA with the Department of Defense (DOD) to oversee response actions at abandoned DOD facilities, and is in the final stages of negotiating a similar SMOA with the Department of Energy.

Political Subdivisions Can Play A Critical Role . . .

South Adams County, Colorado needed clean water. As part of a remedial action, EPA planned to provide local citizens with a permanent alternate water supply to take the place of contaminated existing sources. Design and construction of this were expected to take a substantial period of time to complete, and EPA was unable to provide an interim alternate water supply until the permanent one was in place. As a result, South Adams County offered to take the lead for the interim cleanup measures. The County entered into a political subdivision-lead Cooperative Agreement with EPA which provided an interim water supply that included hooking up residences and implementing other interim measures to protect the human health and the environment. Through its involvement in the Cooperative Agreement, South Adams County gained significant experience in site remediation activities as well as in the whole Superfund process. The County continued to play an active role in site actions throughout the entire remedial action.

Figure 16
State-Lead Remedial Investigation/ Feasibility Study Starts

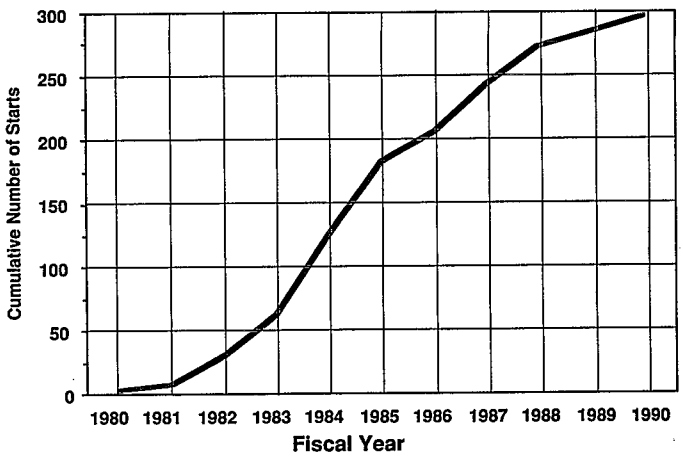


Figure 17
State-Lead Remedial Design Starts

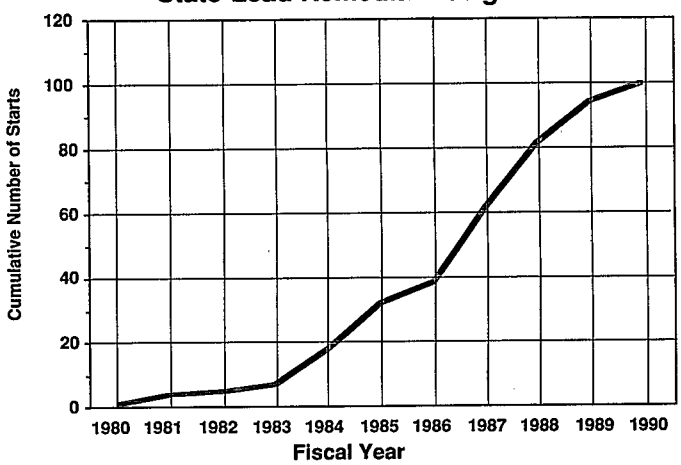
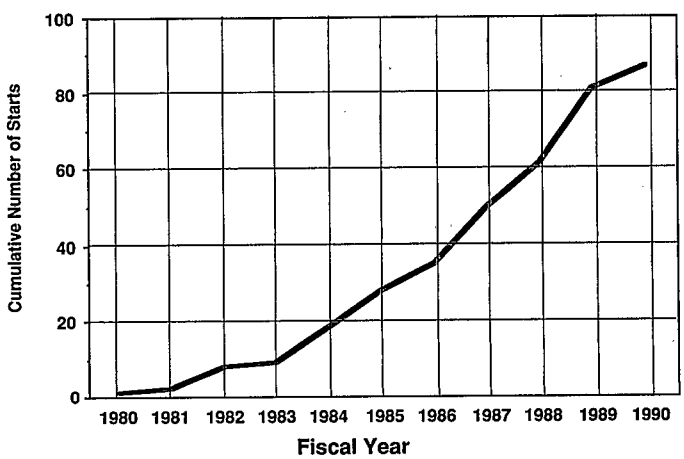


Figure 18
State-Lead Remedial Action Starts



EPA has developed a solid infrastructure for managing the complex Superfund program, including:

- Total Quality Management approaches for achieving program efficiency
- Methods for communicating tangible environmental improvements
- New frontiers in science, engineering, and technology.

EPA spent most of the first decade of Superfund getting its house in order, and developing and enhancing the organizational structure and management systems necessary to get the job done, with cleanup progress accelerating by the end of the decade.

Judging the seriousness of potential threats at each Superfund site and determining the best solution is a complex task. It requires a sophisticated infrastructure of management systems and scientific and technological expertise. One of Superfund's most significant accomplishments during its first decade has been the development of such a network. EPA has developed and continues to streamline management procedures and policies for administering the Superfund program.

In addition, efforts by the scientific and engineering community to solve the unique problems presented by Superfund sites have resulted in the development of a wide range of new techniques for treating hazardous substances and a greater understanding of their health effects.

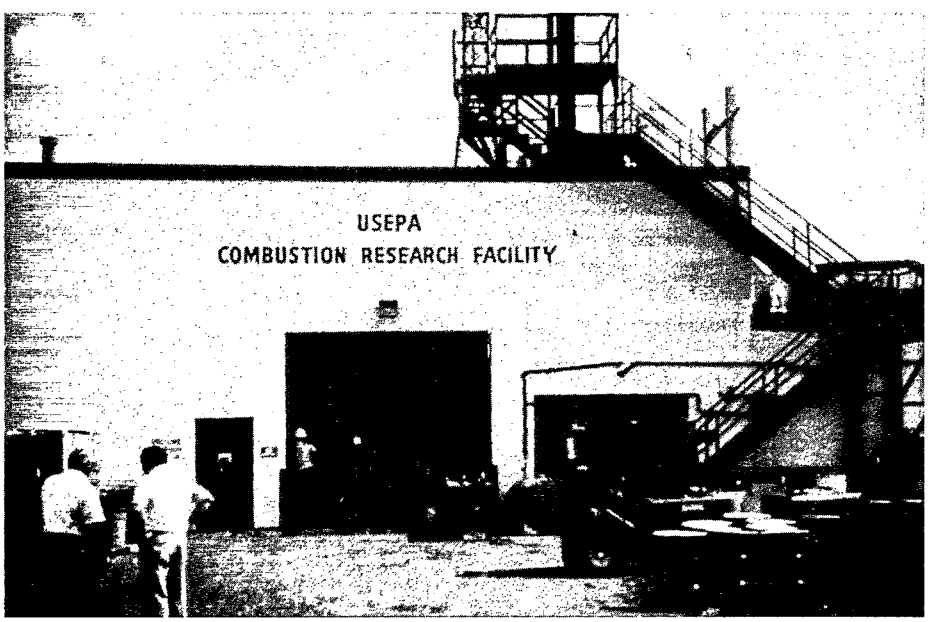
Building The Program

In 1980, the nation committed itself to a major Federal effort to tackle its hazardous waste problem. From this mandate, EPA designed, enacted, and put into place the Superfund program—its contracting mechanisms, management information systems, accounting procedures, scientific, legal and technical protocols, and program planning and evaluation measures. The early slow pace of the program stemmed, in part, from the difficulty of moving ahead before program policies, procedures, roles, and responsibilities were clearly defined. Today, the management foundation of Superfund is solidly in place and is continually being refined and enhanced.

Further, the Agency coordinates the efforts of EPA staff in its Washington, D.C., Headquarters, its frontline staff in ten Regional offices across the nation, State government staff, contractors, and private parties who assume responsibility for cleanup. Comprehensive information systems have been developed, not only to manage the large sums of money being spent and the efforts underway at hundreds of projects simultaneously, but also to exchange state-of-the-art technical information on chemicals, technologies, safety procedures, and sources of assistance. The Superfund program also has initiated a new strategic planning system aimed at identifying and prioritizing critical activities over a 5-year period. This system complements the Agency's overall planning activities for achieving cross-program integration and comprehensive risk reduction.

Managing For Continual Improvement

EPA has realized, however, that its infrastructure must continue to evolve, and has taken innovative steps to improve its performance. First, Total Quality Management principles are now being applied in all parts of the Superfund program to clearly define program customers and requirements, produce error-free work, improve operations constantly and forever, and effectively manage the workload by preventing waste and inefficiency. Another significant step was completion of the Agency's Superfund Management Review in 1989. The Management Review of the Superfund Program is providing the strategy for a second decade of increased program integrity and a full "pipeline" of site



activity. This review provided more than 50 recommendations for addressing fundamental issues facing the program:

- Reducing environmental risks from a growing list of sites that present new complexities
- Making defensible cleanup decisions, sometimes without complete knowledge of environmental and health risks
- Maximizing the use of treatment technologies, recognizing that many of these technologies are new and untested in the field
- Making efficient use of limited resources.

Today, EPA has completed nearly all of the more than 120 management improvement measures identified in this self-evaluation.

One of the most significant accomplishments of the Superfund Management Review is the development of a Long-Term Contracting Strategy for the Superfund program. The Agency's purpose in developing this strategy was to analyze the long-term contracting needs of the program, and design a portfolio of Superfund contracts to meet those needs over the next 10 years. Completed in September of 1990, the strategy will help integrate enforcement and site cleanup activities, enhance competition by reducing the size of contracts and creating more opportunities for smaller businesses, and provide greater management flexibility and improved oversight and cost control.

Communicating Program Results

Many have judged the success of the Superfund program by the number of sites removed from the NPL. While that number reflects one measure of progress, it does not begin to tell the entire story. Success for Superfund is more appropriately measured in terms of the **successive, incremental** cleanup steps that quickly reduce threats to people and the environment and ultimately provide long-term protection.

Instead of concentrating on continuous and complete cleanup of a few major sites, the Agency will now dedicate resources to ensure the greatest degree of public safety at the largest number of sites. The longer process of total site cleanup on a national scale will move forward steadily at the same time as incremental progress is being made at sites. Deleting a site from the NPL will become a distant goal, as EPA focuses on the more meaningful task of solving immediate problems that affect human health and safety.

. . . dedicate resources to ensure the greatest degree of public safety at the largest number of sites.

Superfund has made real environmental gains and has developed a new means of portraying progress. These new measures, known as environmental indicators, describe tangible environmental improvements in terms that are useful and familiar. For example, progress in making sites safer can be viewed in terms of efforts to control immediate threats (such as providing an alternate water supply). Progress also can be measured in terms of making sites clean (such as reaching goals for permanent site cleanup). A third way to characterize Superfund progress is EPA's efforts to bring technology to bear on site problems. As shown in Figure 19, on the following page, the Superfund program is using technology to remove contamination from the environment.

Developing The Science Behind The Solutions

The Superfund program has explored new frontiers in the applied sciences. To address hazardous substance problems, Superfund response personnel must understand how complex mixtures of chemicals travel through the soil, ground water, and the air. This has been a long and complex task for environmental scientists, requiring a combination of real world field sampling results and theoretical models.

EPA's knowledge of how contaminants enter and travel through environmental media has increased significantly as the Agency has evaluated more and more sites for possible Superfund response.

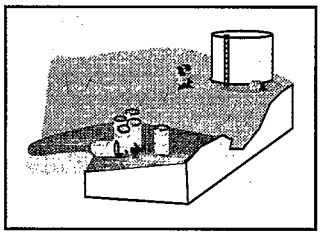
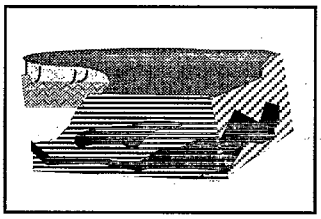
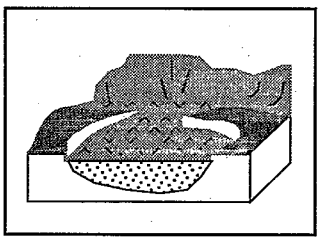
Of even greater complexity has been the task of estimating the degree to which human health is endangered by Superfund sites. Typically, people at risk because of a waste site have been exposed to very small quantities of hazardous substances over a prolonged period, and the health effects of these substances usually do not surface until long after the exposure has taken place. During the first decade of the Superfund program, EPA and other Federal agencies, particularly the Agency for Toxic Substances and Disease Registry (ATSDR) within the Department of Health and Human Services, focused on assessing risks at specific sites and refining the risk assessment process. As a result of the 1986 amendments to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), ATSDR also began preparing toxicological profiles for the most frequently

found substances at Superfund sites, and completed health assessments for all National Priorities List (NPL) sites within 1 year of their inclusion on the NPL.

Encouraging New Technology For Risk Reduction

The 1980 Superfund law did not have specific provisions for research and development of engineering techniques and equipment for handling, containing, treating, and disposing of hazardous substances. The Superfund Amendments and Reauthorization Act (SARA) required EPA to establish a formal research and development program, including demonstration programs for technologies that offer alternatives to conventional methods of handling site cleanups, and favoring methods that lead to the destruction or recycling of wastes rather than land disposal. SARA also called for training programs for hazardous substance response and research.

Figure 19
Waste Removed From The Environment

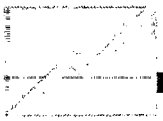
Pathway	Volumes Addressed
	**Polluted Land Surface:** Soil 4,130,000 cubic yards Solid Waste 5,270,000 cubic yards Liquid Waste 1,000,000,000 gallons
	**Polluted Ground Water:** 3,880,000,000 gallons
	**Polluted Surface Water:** 104,000,000 gallons

In 1986, EPA began the Superfund Innovative Technology Evaluation (SITE) program to promote the development and use of innovative technologies to clean up Superfund sites across the country. Now in its fifth year, SITE is helping to provide the treatment technologies necessary to implement new Federal and State cleanup standards aimed at permanent remedies rather than quick fixes. The SITE program is really three related programs: the Demonstration Program, the Emerging Technologies Program, and the Measurement and Monitoring Technologies Program.

To date, the major focus of the SITE program has been on the Demonstration Program, which is designed to generate engineering and cost data on selected, innovative technologies. In this program, technology developers are responsible for demonstrating their innovative systems at selected sites, while EPA is responsible for sampling, analyzing, and evaluating all test results. The information gathered during the demonstrations is used in combination with other data as a basis for selecting the most appropriate technologies for the cleanup of Superfund sites. More than 52 developers are now active participants in the Demonstration Program for field-scale technologies. They represent a wide variety of innovative technologies, from thermal treatment and bioremediation to soil washing, solvent extraction, and in-situ stripping. Since the first demonstration in 1987, EPA has conducted 19 demonstrations.

The Emerging Technologies Program provides 2-year funding to developers of emerging technologies to support bench-scale and pilot testing of innovative treatment technologies. EPA has accepted a total of 31 bench- and pilot-scale technologies to date. Laser technology is one method being investigated for use in reducing the toxicity of wastes at Superfund sites.

Lastly, the Monitoring and Measurement Technologies Program supports the development and demonstration of innovative field-ready technologies that detect, monitor, or measure hazardous substances in the air, surface water, soil, subsurface, and in waste materials and biological tissues. This program began in earnest in 1990, and four demonstrations have been completed. EPA continues to seek new information on field methods to measure and monitor contamination and its effects on the environment.



Future Directions And Challenges

Is the Superfund program working? Yes. This complex and challenging program is now up and running.

During the last 10 years, EPA has developed a program which has brought this country to a new level of understanding about hazardous substances and how they can be treated. The Superfund program is comprehensive, yet flexible and innovative. Its mission is both immediate and long-range; its focus is specific enough to handle individual site cleanups with precision, yet broad enough to encourage advances in a relatively new scientific and technical field.

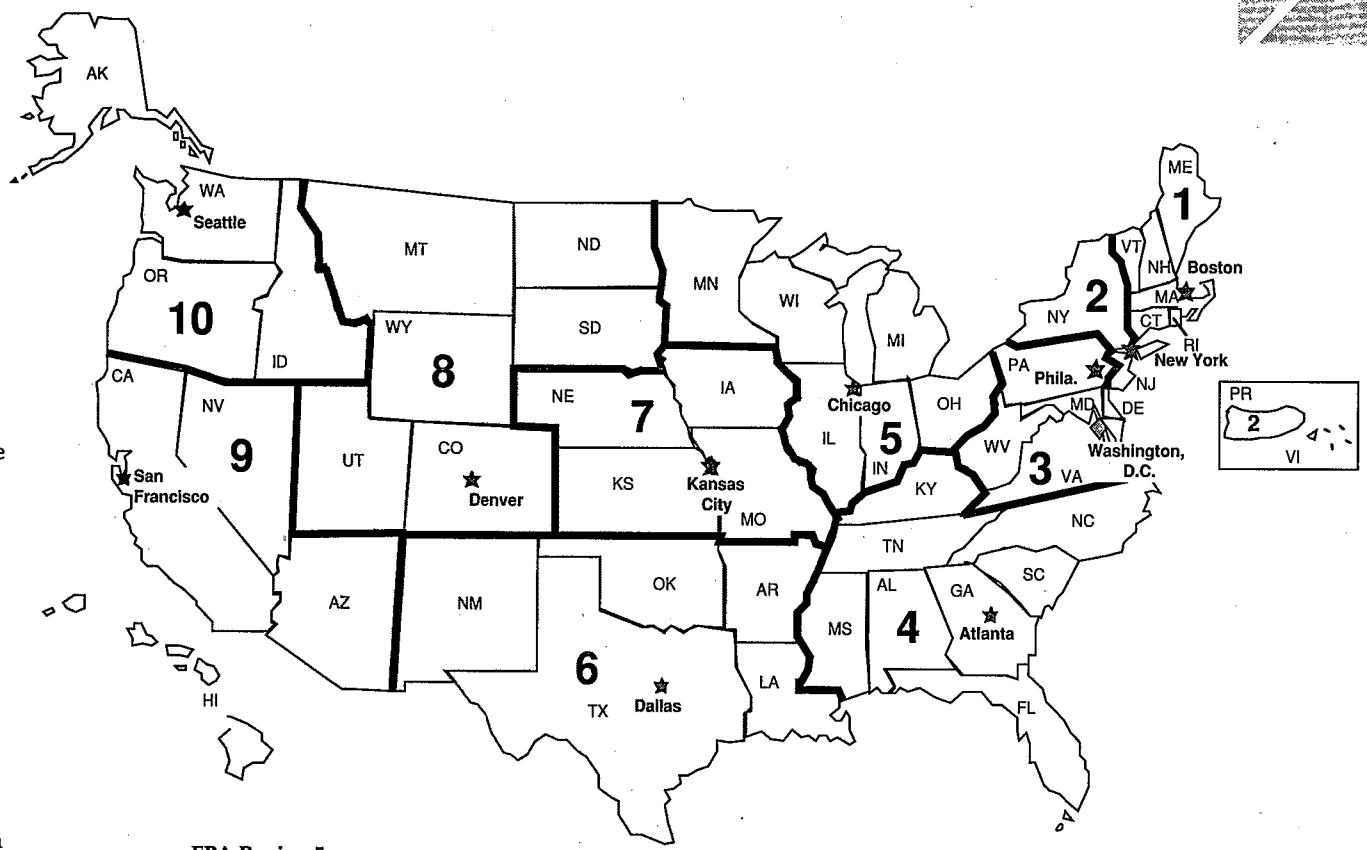
Superfund has resulted in permanent solutions to major hazardous waste problems already. But that is not enough. After 10 years of experience, the most important lesson that all Superfund participants have learned is that the program faces a workload stretching well into the next century. The hazardous waste problem in the United States remains large, complex, and long-term. The job ahead is enormous. It will take technical innovation and competence, management skill and creativity, and old-fashioned dedication and hard work to clean all the sites currently known to present unacceptable risk. And that number is growing, as new sites continue to be discovered.

The Agency is looking beyond the next 10 years to project a program for the future—Superfund 2000. Superfund 2000 is a concept for long-term program planning. As part of this concept, EPA is conducting studies of the possible universe of sites to be cleaned up by Superfund or other parties. An outyear liability model will help the Superfund program estimate possible future cleanup costs under different scenarios. The Agency also is looking at past remedy selection decisions and evaluating patterns that may indicate the future success of various technologies. Opportunities for greater program integration, particularly between the Superfund and Resource Conservation and Recovery Act (RCRA) programs, are being assessed. In keeping with the Agency-wide goal of increasing multi-media enforcement efforts by 25 percent, EPA is examining the future role of responsible parties and State and local governments in the Superfund program. All these studies and activities will help ensure that an integrated, pragmatic, and results-oriented Superfund program will continue to evolve.

The hazardous waste problem in the United States remains large, complex, and long-term.

The Agency is proud of its hard-won accomplishments in the Superfund program, and will continue to use new management and technological approaches to accelerate the pace of cleanup, expand its efficiency and activity, improve the quality of the program over time, and build public confidence. There are no miracle cures for the hazardous waste problem. But EPA has a clear and cogent strategy for meeting this challenge beyond this century and into the next millennium.

EPA Superfund Offices



U.S. Environmental Protection Agency
Office of Emergency & Remedial Response
401 M Street, SW
Washington, D.C. 20460
CML (Commercial): (202) 382-2090
FTS (Federal Telecommunications System): 382-7883

EPA Region 1
Waste Management Division
JFK Federal Building
Boston, Massachusetts 02203
CML: (617) 565-3715
FTS: 835-3715

EPA Region 2
Emergency & Remedial Response Division
Jacob K. Javitz Federal Building
26 Federal Plaza
New York, New York 10278
CML: (212) 264-2657
FTS: 264-2657

EPA Region 3
Hazardous Waste Management Division
841 Chestnut Building
Philadelphia, Pennsylvania 19107
CML: (215) 597-9800
FTS: 597-9800

EPA Region 4
Waste Management Division
345 Courtland Street, NE
Atlanta, Georgia 30365
CML: (404) 347-4727
FTS: 257-4727

EPA Region 5
Waste Management Division
230 South Dearborn Street
Chicago, Illinois 60604
CML: (312) 353-2000
FTS: 353-2000

EPA Region 6
Hazardous Waste Management Division
First Interstate Bank Tower at Fountain Place
1445 Ross Avenue, 12th Floor, Suite 1200
Dallas, Texas 75202
CML: (214) 655-6444
FTS: 255-6444

EPA Region 7
Waste Management Division
726 Minnesota Avenue
Kansas City, Kansas 66101
CML: (913) 551-7000
FTS: 276-7003

EPA Region 8
Hazardous Waste Management Division
999 18th Street, Suite 500
Denver, Colorado 80202-2405
CML: (303) 293-1603
FTS: 330-1603

EPA Region 9
Hazardous Waste Management Division
75 Hawthorne Street
San Francisco, California 94105
CML: (415) 744-1500
FTS: 484-1020

EPA Region 10
Hazardous Waste Division
1200 Sixth Avenue
Seattle, Washington 98101
CML: (206) 442-1200
FTS: 399-1200

For More Information

Dockets

Maintain the official rulemaking files, which include official statements of the Administrator's position, transcripts of hearings, litigation records, and public comments.

RCRA Docket And Information Center: Contains rulemaking files, publications, and background documents concerning the Resource Conservation and Recovery Act.
(202) 475-9327

Superfund Docket: Provides rulemaking files, background documents, and viewing copies of Records of Decision concerning the Comprehensive Environmental Response, Compensation, and Liability Act.
(202) 382-3046

Superfund Documents Center: Manages all aspects of document production, distribution, archiving, and maintenance of bibliography. Ensures that the bibliography is available to the public through the National Technical Information Service (NTIS) and provides document inventory service to agency staffs. Write Superfund Documents Center – OS-240.

Public Information Center: Maintains a broad spectrum of EPA program publications of general environmental interest, available to the public upon request.

Public Information Center
U.S. EPA (PM-211B)
401 M Street, SW
Washington, DC 20460
(202) 382-2080 or 475-7751

Hotlines

Provide information to the public and the regulated community in interpreting regulations and policies.

RCRA/CERCLA: Responds to questions from the public and the regulated community on the Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund). Hours of operation are Monday through Friday, 8:30 a.m. to 7:30 p.m. Eastern Time.
(800) 424-9346
(703) 920-9810 in the Washington, DC area
(800) 553-7672 TDD

Emergency Planning And Community Right-To-Know: Provides communities and individuals with help in preparing for accidental releases of toxic chemicals. This hotline is maintained as an information resource rather than an emergency number, and serves to complement the RCRA/CERCLA Hotline.
(800) 535-0202

Libraries

The EPA Headquarters library maintains a variety of reference materials, data bases, and both general and special collections on environmental topics, including hazardous waste.

Headquarters Library
EPA, Room M2904
401 M Street, SW
Washington, DC 20460
(202) 382-5921

In addition to the Headquarters library, there is a library in each of EPA's ten Regional Offices (the addresses appear on the "EPA Superfund Offices" page and the telephone numbers are listed on the next page).

National Response Center (NRC)

Operated by the U.S. Coast Guard, this emergency hotline is used to report spills of oil and other hazardous materials. Calls are accepted 24 hours a day, every day of the year.
(800) 424-8802
(202) 426-2675 in the Washington, DC area

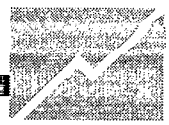
Hazardous Waste Ombudsman

Assists citizens and the regulated community who have had problems voicing a complaint or getting an issue resolved about hazardous waste. There is a Hazardous Waste Ombudsman at EPA Headquarters and one in each of EPA's ten Regional Offices (addresses on page 37).
(703) 557-1938

Center For Environmental Research Information (CERI)

Serves as a central point of distribution for EPA research results and reports. Also conducts workshops and seminars on environmental regulations, new technologies, and the health effects of environmental chemicals. The Center plays a major role in Superfund research, development, and response.

CERI
U.S. Environmental Protection Agency
Cincinnati, OH 45268
(513) 569-7391



For information on training for and response to hazardous materials emergencies, contact the Technical Support Division at (513) 569-7562.

National Technical Information Service (NTIS)

A self supporting agency of the U.S. Department of Commerce, NTIS serves as a repository for more than 1.6 million technical reports, summarizing government, university, and corporate research worldwide. In addition to providing public access to the entire Superfund bibliography, NTIS also maintains Superfund computer datafiles, providing up-to-date information including the names and locations of potential hazardous waste sites reported to EPA.

U.S. Department of Commerce
NTIS
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Regional Offices

EPA has ten Regional Offices to provide the public with both general and technical information about specific environmental issues in the States they oversee.

EPA Region 1: Connecticut, Massachusetts, Maine, Vermont, New Hampshire, Rhode Island
General Number: (617) 565-3715
Hazardous Waste Ombudsman: (617) 565-3394

EPA Region 2: New Jersey, New York, Puerto Rico, Virgin Islands
General Number: (212) 264-2657
Hazardous Waste Ombudsman: (212) 264-4711

EPA Region 3: Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia
General Number: (215) 597-9800
Hazardous Waste Ombudsman: (215) 597-0982

EPA Region 4: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
General Number: (404) 347-4727
(800) 282-0239 in GA; (800) 241-1754 in other Region 4 States
Hazardous Waste Ombudsman: (404) 347-3004

EPA Region 5: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
General Number: (312) 353-2000
(800) 572-2515 in IL; (800) 621-8431 in other Region 5 States
Hazardous Waste Ombudsman: (312) 353-5821

EPA Region 6: Arkansas, Louisiana, New Mexico, Oklahoma, Texas
General Number: (214) 655-6444
Environmental Emergency Hotline - 24 hours: (214) 655-2222
Hazardous Waste Ombudsman: (214) 655-6765

EPA Region 7: Iowa, Kansas, Missouri, Nebraska
General Number: (913) 551-7000
Hazardous Waste Ombudsman: (913) 551-7051

EPA Region 8: Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
General Number: (303) 293-1603; (800) 759-4372
Hazardous Waste Ombudsman: (303) 294-1111

EPA Region 9: Arizona, California, Hawaii, Nevada, American Samoa, Guam, Commonwealth of the Northern Mariana Islands, Republic of Palau, Federated States of Micronesia, the Republic of the Marshall Islands
General Number: (415) 744-1500
RCRA Hotline: (415) 744-2074
Superfund Hotline: (800) 231-3075
Hazardous Waste Ombudsman: (415) 744-1470

EPA Region 10: Alaska, Idaho, Oregon, Washington
General Number: (206) 442-1200
Hazardous Waste Ombudsman: (206) 442-2871

Glossary of Terms

Administrative Order on Consent (AOC): An administrative legal agreement between EPA and potentially responsible parties (PRPs) whereby PRPs agree to perform or pay the cost of a site response action. The agreement describes actions to be taken at a site and may be subject to a public comment period. Unlike a consent decree, an AOC does not have to be approved by a judge.

Administrative Record: A file that contains all information used by the lead agency to make its decision on the selection of a response action under CERCLA. This file is available for public review and a copy is established at or near the site, usually at one of the information repositories. Also, a duplicate file is held in a central location, such as a Regional or State office.

Affected Public: The people who live and/or work near hazardous waste sites.

Agency for Toxic Substances and Disease Registry (ATSDR): A Federal agency within the Department of Health and Human Services which, in conjunction with EPA, is responsible for implementing health-related authorities of CERCLA, including conducting site-specific health assessments.

Alternative Remedial Contract Strategy (ARCS) Contractors: Government contractors who provide project management and technical services to support remedial response activities at National Priorities List sites.

Applicable or Relevant and Appropriate Requirements (ARARs): ARARs include any State or Federal statute or regulation that pertains to protection of human health and the environment in addressing certain site conditions or using a particular cleanup technology at a Superfund site. A State law to preserve wetland areas is an example of an ARAR. EPA must consider whether a remedial alternative meets ARARs as part of the process for selecting a cleanup alternative for a Superfund site.

Availability Session: An informal meeting in a public location where interested citizens can talk with EPA and State officials on a one-to-one basis.

Bench-Scale Tests: Laboratory testing of potential cleanup technologies (also known as treatability studies).

Bioremediation: The use of living organisms, such as bacteria and fungi, to treat hazardous substances.

Brine Mud: A waste material, often associated with well drilling or mining, composed of mineral salts and other inorganic compounds.

Cap: A layer of clay or other highly impermeable material installed over the top of a closed landfill to prevent entry of rainwater and minimize leakage.

Carbon Tetrachloride: A colorless liquid used in refrigerants, metal degreasers, agricultural fumigants, and as a dry-cleaning agent. Exposure to it can cause damage to the central nervous system, liver, and kidneys.

Clean Water Act: Federal law regulating the discharge of pollutants into surface waters.

Cleanup: Actions taken to deal with a release or threatened release of hazardous substances to protect human health and/or the environment.

Community Relations: EPA's program to inform and involve the public in the Superfund process and respond to community concerns.

Community Relations Coordinator (CRC): The EPA official responsible for overseeing and directing community relations activities.

Community Relations Plan (CRP): The document that outlines specific community relations activities that occur during a remedial response at a site. The CRP outlines how EPA will keep the public informed of work at the site and the ways in which citizens can review and comment on decisions that may affect the final actions at the site.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A Federal law passed in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act. CERCLA created a special tax that goes into a Trust Fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can either:

- Perform site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work; or
- Take legal action to force parties responsible for site contamination to clean up the site or pay back the Federal government for the cost of the cleanup.

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS): The official information system for the Superfund program, it contains site-specific and general program data, such as site location, technical cleanup process, scheduled activities, and costs to date.

Consent Decree: A legal document, approved and issued by a State or Federal district court, that formalizes an agreement between a State or EPA and potentially responsible parties (PRPs) whereby PRPs will perform all or part of a Superfund site cleanup. The consent decree describes actions that PRPs are required to perform and is subject to a public comment period.

Cooperative Agreement (CA): An assistance agreement whereby EPA transfers money, property, services, or anything of value to a State for the accomplishment of certain activities or tasks as authorized by CERCLA.

Core Program Cooperative Agreement (CPCA): An assistance agreement whereby EPA provides support funds to States and Indian Tribes to help defray the cost of non-site-specific activities, such as administrative and clerical salaries, computer resources, and training.

Cost Recovery: A legal process through which potentially responsible parties can be required to pay back the Federal government for money it spends on any cleanup actions.

Covenant Not to Sue: A written agreement that releases settling potentially responsible parties from present or future liability.

De Minimis Settlements: Settlements that are smaller agreements separate from the larger settlement for the chosen cleanup remedy. Under de minimis settlements, contributors of a relatively small amount of waste to a site, or landowners who bought the site but did not contribute wastes to it, may resolve their liability.

Department of Defense (DOD): The U.S. Army Corps of Engineers within DOD has specialized equipment and personnel available to assist in removal actions. The Corps serves as EPA's primary agent for Federal-lead remedial designs and remedial actions.

Department of Energy (DOE): DOE provides special assistance when radioactive substances are involved at Superfund sites.

Department of Justice (DOJ): DOJ assists EPA in enforcement activities and legally represents EPA when cases go to court.

Emergency Preparedness and Community Right-to-Know Act (EPCRA): A Federal law that established a four-part program to define an emergency planning structure at the State and local levels; require emergency notification of hazardous chemical releases; require notification of chemical use, storage, or production activities; and define annual emissions reporting requirements.

Enforcement: EPA's efforts, through legal action if necessary, to force potentially responsible parties to respond to information requests or perform or pay for a Superfund site cleanup.

Fact Sheet: A document prepared and distributed by EPA to inform the public of Superfund site or program activities.

Feasibility Study (FS): See Remedial Investigation/ Feasibility Study.

Future Liability: Refers to potentially responsible parties' obligations to pay for additional response activities beyond those specified in the Record of Decision or consent decree.

Gas Chromatograph/Mass Spectrometer: A highly sophisticated instrument that identifies the molecular composition and concentrations of the various chemicals in water and soil samples.

General Notice Letter: A letter, issued by EPA, advising potentially responsible parties of their potential liability at a Superfund site.

Ground Water: Water found beneath the earth's surface that fills pores between materials such as sand, soil, or gravel. Ground water can occur in sufficient quantities that it can be used for drinking water, irrigation, and other purposes.

Hazard Ranking System (HRS): A scoring system used to evaluate potential relative risks to human health and the environment from releases or threatened releases of hazardous substances. EPA and States use the HRS to calculate a site score, from 0 to 100, based on the actual or potential release of hazardous substances from a site through air, surface water, or ground water .

Hazardous Substance: Any material that poses a threat to human health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.

Hazardous Waste: By-products or wastes that are toxic, corrosive, ignitable, explosive, or chemically reactive. Although the legal definition of hazardous waste is complex, the term more generally refers to any waste that EPA believes could pose a threat to human health and the environment if improperly treated, stored, transported, or disposed.

Health Assessment: A study, required by CERCLA and performed by the Agency for Toxic Substances and Disease Registry (ATSDR), that determines the potential risks to human health posed by a site.

In-situ Stripping: A treatment system that removes or "strips" volatile organic compounds from contaminated ground water or surface water by forcing an airstream through the water and causing the compounds to evaporate.

Information Exchange: A phase that occurs early in the negotiation process through which EPA and potentially responsible parties exchange information and knowledge about past activities at a Superfund site.

Information Repository: A file containing current information, technical reports, and reference documents regarding a Superfund site. The information repository is usually located in a public building that is convenient for local residents, such as a public school, library, or city hall.

Innovative Technologies: New or inventive methods to treat effectively hazardous waste and reduce risks to human health and the environment.

Inorganic Compounds: Compounds composed of mineral materials, including elemental salts and metals such as iron, aluminum, mercury, and zinc.

Local Governments Reimbursement (LGR) Program: An EPA program that provides up to $25,000 directly to local governments to help ease the financial burden of conducting temporary emergency measures in response to a hazardous substance threat.

Long-Term Contracting Strategy: Refers to EPA's efforts to analyze the long-term contracting needs of the Superfund program and design or realign contracts to meet those needs.

Management Review of the Superfund Program (90-Day Study): An EPA report, commissioned by the EPA Administrator and published in May 1989, that provides an assessment of the Superfund program and suggests a practical strategy for realizing the greatest environmental benefit possible, given the long-term, incremental nature of Superfund.

Media: Components of the environment, including surface water, ground water, soil, and air, which are the subject of regulatory concern and activities.

Mercury: A silver, liquid metal that is highly toxic and can be absorbed through the skin. It is used in thermometers, batteries, fluorescent light bulbs, pharmaceuticals, and many other products.

Metals: Compounds such as chromium and lead that can be toxic at relatively low concentrations.

Mixed Funding: Settlements in which potentially responsible parties and EPA share the costs of the response action.

Monitoring Wells: Special wells drilled at specific locations on or off a hazardous waste site where ground water can be sampled at selected depths and studied to determine such things as the direction of ground water flow and the types and amounts of contaminants present.

Moratorium: During the negotiation process, a period of 60 or 90 days during which EPA and potentially responsible parties may reach settlement but no site response activities can be conducted.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The Federal regulation that provides a blueprint for Superfund program operations.

National Priorities List (NPL): EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using money from the Trust Fund. The list is based primarily on the score a site receives from the Hazard Ranking System. EPA is required to update the NPL at least once a year.

National Response Center (NRC): The center operated by the U.S. Coast Guard that receives and evaluates reports of oil and hazardous substance releases into the environment and notifies the appropriate agency(ies). The NRC can be contacted 24 hours a day, toll-free at 800-424-8802.

National Response Team (NRT): Representatives of 14 Federal agencies that coordinate Federal responses to nationally significant pollution incidents and provide advice and technical assistance to the responding agency(ies).

Negotiations: After potentially responsible parties (PRPs) are identified for a site, EPA coordinates with them to reach a settlement. Negotiated settlements result in PRPs paying for or conducting cleanup activities under EPA supervision. If negotiations fail, EPA can order the PRPs to conduct the cleanup or EPA can pay for the cleanup using Superfund monies and then sue the PRPs to recover costs.

No Further Remedial Action Planned (NFRAP): A determination made by EPA following a preliminary assessment that a site does not pose a significant risk and so requires no further activity under CERCLA.

Non-Binding Allocations of Responsibility (NBAR): Process for EPA to propose a way for potentially responsible parties to allocate costs among themselves.

Non-compliance: If a potentially responsible party (PRP) does not meet the agreement set forth in a negotiated settlement, the PRP is in "non-compliance" and EPA can invoke penalties, usually in the form of fines.

On-Scene Coordinator (OSC): The Federal official who coordinates and directs Superfund removal actions.

Operable Unit (OU): An action taken as one part of an overall site cleanup. For example, a carbon absorption system could be installed to halt rapidly spreading ground water contaminants while a more comprehensive and long-term remedial investigation/feasibility study is underway. A number of OUs can be used in the course of site cleanup.

Operation & Maintenance (O&M): Activities conducted at a site after a response action has concluded, to ensure that the cleanup or containment system is functioning properly.

Organic Compounds: Chemical compounds composed of carbon and hydrogen, including materials such as oils, pesticides, and solvents.

Pilot Tests: Testing of a cleanup technology, performed under actual site conditions, to identify potential problems prior to full-scale implementation.

Political Subdivision: The definition of political subdivision varies from State to State, so each State determines what units of government meet its legislative definition. A political subdivision can participate in Superfund cleanup as a lead or support agency when EPA and the State agree that this enhances the cleanup process and results in an efficient, economical, and well-coordinated use of resources.

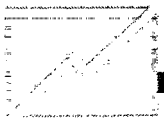
Polychlorinated Biphenyls (PCBs): A family of organic compounds used since 1926 in electric transformers as insulators and coolants, in lubricants, carbonless copy paper, adhesives, and caulking compounds. PCBs do not break down into new and less harmful chemicals and are stored in the fatty tissues of humans and animals. EPA banned the use of PCBs in 1979.

Potentially Responsible Party (PRP): An individual(s) or company(ies) (such as owners, operators, transporters, or generators) potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated.

Potentially Responsible Party (PRP) Search: An investigation, conducted by a State or EPA, into the parties who may be liable for the cleanup at a site. The PRP search enhances EPA's success in negotiating with PRPs to conduct a response action under EPA's supervision.

Preliminary Assessment (PA): The process of collecting and reviewing available information about a known or suspected hazardous waste site or release. EPA or States use this information to determine if the site requires further study. If further study is needed, a site inspection is undertaken.

Present Liability: Refers to a potentially responsible party's obligation to pay response costs already incurred by the government and to complete remedial activities set forth in the Record of Decision or consent decree.



Glossary of Terms

Proposed Plan: A plan for site cleanup that is available to the public for comment. It highlights key aspects of the remedial investigation/feasibility study report, provides a brief analysis of remedial alternatives under consideration, identifies the preferred alternative, and provides members of the public with information on how they can participate in the remedy selection process.

Public Comment Period: A time period during which the public can review and comment on various documents and EPA actions. For example, a comment period is provided when EPA proposes to add sites to the National Priorities List. Also, a minimum 30-day comment period is held to allow community members to review and comment on a draft feasibility study and Proposed Plan.

Record of Decision (ROD): A public document that explains which cleanup alternative(s) will be used at a National Priorities List site. The ROD is based on information and technical analysis generated during the remedial investigation/feasibility study and consideration of public comments and community concerns.

Records of Decision System (RODS): A detailed data base of ROD information used to promote national consistency of remedies chosen at similar sites.

Remedial Action (RA): The actual construction or implementation phase that follows the remedial design of the selected cleanup alternative at a site on the National Priorities List.

Remedial Design (RD): An engineering phase that follows the Record of Decision when technical drawings and specifications are developed for the subsequent remedial action at a site on the National Priorities List.

Remedial Investigation/Feasibility Study (RI/FS): Investigative and analytical studies usually performed at the same time in an interactive process, and together referred to as the RI/FS. They are intended to:

- Gather the data necessary to determine the type and extent of contamination at a Superfund site;
- Establish criteria for cleaning up the site;
- Identify and screen cleanup alternatives for remedial action; and
- Analyze in detail the technology and costs of the alternatives.

Remedial Project Manager (RPM): The EPA or State official responsible for overseeing remedial response activities.

Removal Action: A fast track action taken over the short-term to control immediate threats to people and/or the environment from a release or threatened release of hazardous substances.

Removal Site Evaluation (RSE): A document that determines if a removal action is necessary; the evaluation is composed of the preliminary assessment and the site inspection.

Reportable Quantities (RQs): The quantity of a hazardous substance that, if released into the environment, may present substantial danger to the human health or welfare or the environment and must be reported to the National Response Center or EPA.

Responsiveness Summary: A summary of oral and/or written public comments received by EPA during a comment period on key EPA documents, and EPA's responses to those comments. The responsiveness summary is a key part of the Record of Decision, highlighting community concerns for EPA decisionmakers.

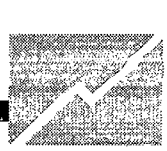
Revised Hazard Ranking System (rHRS): Modifications to the HRS, as required by the Superfund Amendments and Reauthorization Act, that became effective March 15, 1991.

Risk Assessment: An evaluation performed as part of the remedial investigation to assess conditions at a Superfund site and determine the risk posed to human health and the environment.

Risk Reduction: EPA's efforts to reduce, control, or eliminate human health, welfare, and ecological risks posed by environmental problems.

Site Assessment Program: A means of evaluating hazardous waste sites, through preliminary assessments and site inspections, to develop a Hazard Ranking System score that is used to determine if a site should be placed on the National Priorities List.

Site Inspection (SI): A technical phase that follows a preliminary assessment designed to collect more extensive information on a hazardous waste site. The information is used to score the site with the Hazard Ranking System to determine whether a remedial action is needed.



Site Safety Plan: A crucial element of all removal actions and the remedial design/remedial action phase of remedial actions, it includes information on equipment being used, precautions to be taken, and steps to take in the event of an emergency situation at the site.

Sludge: A generic term that describes a thickened semi-solid waste byproduct of an industrial or recycling process.

Special Notice Letter: A letter, sent by EPA, that initiates the process of formal enforcement negotiations, and invokes a negotiation moratorium between PRPs and EPA.

Strict, Joint and Several Liability: Strict liability means that the Federal government can hold a potentially responsible party (PRP) liable without showing that the PRP was at fault. Joint and several liability means that any one PRP can be held liable for the entire costs of site cleanup, regardless of the share of waste contributed by that PRP.

Superfund Amendments and Reauthorization Act (SARA): Modifications to CERCLA enacted on October 17, 1986.

Superfund Innovative Technology Evaluation (SITE): An EPA program designed to promote the development and use of innovative treatment technologies to clean up Superfund sites.

Superfund Memorandum of Agreement (SMOA): An optional agreement that specifies the procedures that EPA and a State or Indian Tribe will use to implement CERCLA and the National Oil and Hazardous Substances Contingency Plan (NCP). These procedures then serve as the basis for site-specific Cooperative Agreements or Superfund State Contracts.

Superfund State Contract (SSC): A contract between EPA and a State that is legally binding on both parties. The SSC is used to document EPA and State responsibilities and to obtain any necessary State assurances for response actions.

Superfund: The common name used for the Comprehensive Environmental, Response, Compensation, and Liability Act. Also referred to as the Trust Fund.

Technical Assistance Grant (TAG) Program: A program that provides grants of up to $50,000 per Superfund site so citizens can hire independent technical advisors to help them understand information related to cleaning up a site.

Thermal Treatment: The use of elevated temperatures to treat hazardous waste by changing the chemical and/or physical composition of the waste.

Total Quality Management (TQM): The application of management techniques and statistical controls to a process in order to improve any product "constantly and forever."

Toxicological Profile: An examination, summary, and interpretation of a hazardous substance to determine levels of exposure and associated health effects.

Treatability Studies: Tests of potential cleanup technologies conducted in a laboratory (also known as bench-scale tests).

Treble Damages: CERCLA provides that EPA can sue potentially responsible parties (PRPs) for up to three times the cost of cleanup, if the PRPs consistently do not comply with a negotiated settlement.

Unilateral Administrative Order (UAO): An administrative legal document issued unilaterally by EPA directing a potentially responsible party to perform site cleanup. UAOs are typically issued when negotiations between PRPs and EPA have broken off. It sets forth the liability of the party for the cleanup, describes actions to be taken, and subjects the recipient to penalties and damages for noncompliance. Unilateral orders may be enforced in court through judicial action.

U.S. Coast Guard (USCG): The USCG is responsible for managing responses to oil spills and other hazardous releases in coastal waters and inland waterways. The USCG operates the National Response Center.

Volatile Organic Compounds: Carbon-containing chemical compounds that evaporate (volatilize) readily at room temperature.