United States General Accounting Office

GAO

Report to the Chairman, Committee on the Budget, House of Representatives

January 2000

SUPERFUND

Analysis of Costs at Five Superfund Sites

GAO/RCED-00-22

Contents

Abbreviations

EPA	Environmental Protection Agency
GAO	General Accounting Office
IFMS	Integrated Financial Management System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
ppm	parts per million

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United States General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-284098

January 28, 2000

The Honorable John R. Kasich
Chairman, Committee on the Budget
House of Representatives

Dear Mr. Chairman:

Since cleanups of hazardous waste sites under the Environmental Protection Agency's (EPA) Superfund program began in 1980, EPA has spent a total of about $17.7 billion addressing contamination at Superfund sites. Although EPA is responsible for overseeing cleanups of Superfund sites, private contractors perform the actual cleanup work, known as remedial actions. In response to congressional concerns about the Superfund program's costs and efficiency, GAO has issued a series of reports that describe, for the program as a whole, the portion of EPA's funds spent on remedial actions by contractors, as opposed to other activities such as studying conditions at sites, designing cleanup remedies, travel, and activities not directly related to cleaning up the sites.[1]

This report responds to your request that we complement these reports with an examination of the costs at a small number of Superfund sites. As agreed, we selected five Superfund sites–including two whose cleanups are among the most costly and three that were randomly selected–to determine for each site (1) what portion of the total funds EPA spent on each site[2] was used to pay contractors for remedial actions as opposed to other activities and how the contractors spent these funds and (2) whether the actual costs for remedial actions differed from the estimated costs and, if so, why. The two most expensive sites were the Raymark site in Stratford, Connecticut, and the Sharon Steel site in Midvale, Utah. The three randomly selected sites were the United Creosoting site in Conroe, Texas;

[1] *Superfund: Trends in Spending for Site Cleanups* (GAO/RCED-97-211, Sept. 1997), *Superfund: Analysis of Contractor Cleanup Spending* (GAO/RCED-98-221, Aug. 1998) and *Superfund: EPA Can Improve its Monitoring of Superfund Expenditures* (GAO/RCED-99-139, May 1999).

[2] At some sites, the Agency for Toxic Substances and Disease Registry, a unit of the U.S. Public Health Service, expended funds for health assessments. These funds were included in our analysis.

the NL Industries site in Granite City, Illinois; and the Newmark site in San Bernardino, California. Because these sites are not necessarily representative of all Superfund sites, the cost information presented in this report should not be generalized to all sites.

Results in Brief

Most of the funds that EPA spent as of May 1999 at each of the five Superfund sites went to contractors for implementing remedial actions at the sites. These contractors include the prime contractors that generally manage cleanups and the subcontractors that do the physical cleanup work. The costs for these prime contractors and subcontractors ranged from 53 percent to 86 percent of EPA's total spending at the sites we visited. The costs for site studies and remedial designs were the second largest portion of the total costs at three of the five sites, ranging from about 7 percent to about 33 percent. We further analyzed contractors' expenditures to determine what portion was associated with the actual physical implementation of the cleanup, as opposed to other activities, such as overhead costs. At three of the five sites, we found that the prime contractors spent the bulk of the funds they received from EPA either on subcontractors that performed the physical cleanup or on supplies, equipment, and in-house labor associated with the sites' cleanup. At two other sites, details on contractors' spending were not available because the sites were cleaned up under fixed-price contracts, which do not require contractors to report how they spend funds. Work at two of the five sites was still in progress at the time of our review; therefore, at these two sites, both total expenditures and expenditures on remedial actions will increase over time.

At the five sites we visited, for the remedial cleanup activities that had occurred as of May 1999, the relationship between the actual costs for these activities and the estimated costs varied: At three of the sites, the actual costs exceeded the estimated costs; at one site, the actual costs were lower than the estimated costs; and at the remaining site, a meaningful comparison was not possible because the full scope of the work and its costs were not known at the start of cleanup. At the three sites where actual costs exceeded estimated costs, the total cleanup costs ranged from less than 1 percent to 15 percent higher than estimated. These increases were attributable to various factors, including higher-than-anticipated quantities of materials and supplies. Costs were lower than estimated at one site because, although EPA spent about $30 million on an innovative cleanup method that failed, the actual amount of contaminated soil the

remedy had to address turned out to be only about one-fourth of the amount initially estimated.

Background

In 1980, the Comprehensive Environmental Response, Compensation, and Liability Act created the Superfund program to clean up highly contaminated hazardous waste sites. EPA places sites that pose a sufficiently serious threat to human health or the environment on the National Priorities List (NPL) for possible remedial action under the program. As of July 1999, about half (595) of the 1,231 sites on the NPL either were cleaned up or had the all methods—remedies—in place to achieve cleanup.[3]

EPA may compel the parties responsible for the contamination at a site to clean it up, or the agency may pay for the cleanup itself and later try to recover cleanup costs from the responsible parties. When EPA pays for the cleanup, the work is conducted by private contractors who are directly hired by (1) EPA or (2) a designated agency–either another federal agency, such as the Army Corps of Engineers, or a state environmental agency. EPA may designate another federal or state agency as the day-to-day manager of the site if, for example, the agency has particular expertise in addressing the problems posed by a site.

EPA employs a multistage process to address hazardous waste sites in the Superfund program. After a site is placed on the NPL, conditions at the site are studied, problems are identified, and alternative methods of cleaning up the site are considered in a phase known as the remedial investigation and feasibility study. The chosen remedy must ensure overall protection of human health and the environment, as well as comply with other applicable and relevant federal and state requirements. Other criteria used to evaluate possible remedies include short- and long-term effectiveness, cost, and community acceptance. Remedial actions must use permanent solutions and innovative treatment technologies to the maximum extent practicable. Following the remedial investigation and feasibility study, a final remedy is selected and documented in a published record of decision. Then, technical drawings and specifications for the selected remedy are developed in a phase called the remedial design. Finally, in the remedial action phase, a cleanup contractor begins implementing the remedy according to the

[3]Long-term efforts to clean up groundwater at some of these sites are continuing.

remedial design. To organize cleanup activities, EPA may divide a site into two or more "operable units" corresponding to different physical areas at the site or different environmental media, such as soil or groundwater. Before beginning work, EPA agrees with the contractor on the estimated cost of performing the remedial action. In some cases, the remedial action may be followed by a lengthy period of operations and maintenance, necessary to maintain the effectiveness of the remedy. In addition to remedial actions, EPA may conduct removal actions—generally short-term responses to imminent health or environmental threats. Typical removal actions include removing tanks, drums, or soil containing hazardous materials that present a high risk of human exposure.

When EPA administers a remedial action, it typically uses an architectural and engineering firm as a prime contractor to provide the professional services needed to direct the cleanup.[4] The prime contractor does not typically perform the cleanup. Instead, the prime contractor hires subcontractors to perform physical work, such as excavating soil or treating contaminated groundwater. EPA uses various contracting mechanisms to engage the prime contractor, including cost-reimbursable contracts—under which EPA agrees to reimburse the contractor for the costs of completing the work and, in addition, pay the contractor a fee–and fixed-price contracts–under which EPA defines a detailed scope of work and the contractor agrees to complete it for a set price. For a fixed-price contract, detailed financial information on the prime contractor's use of EPA funds is generally not available.

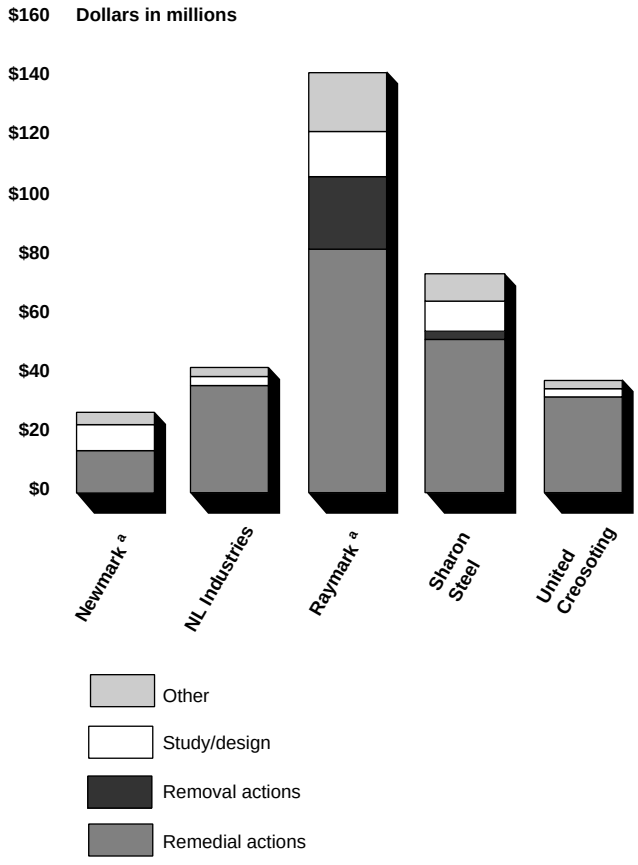
The five Superfund sites in our review include two whose cleanups are among the most expensive in the program and three that were randomly selected. The two most expensive sites were the Raymark Industries site in Stratford, Connecticut, and the Sharon Steel site in Midvale, Utah. The three randomly selected sites were the United Creosoting site in Conroe, Texas; the NL Industries site in Granite City, Illinois; and the Newmark site in San Bernardino, California. EPA paid for at least some of the remedial action at each site, although the agency may recover its costs from responsible parties at some of the sites. Cleanup is complete or nearly complete at three of the five sites, but considerable site study and remedial action work remain at two sites (Raymark and Newmark).

[4]At a site where EPA has delegated the responsibility for managing the cleanup to another federal or state agency, the agency awards the cleanup contract.

EPA Funds Were Used Primarily for Remedial Actions at All Five Sites

According to data obtained from EPA's financial management system, as of May 1999, the majority of the funds EPA spent at each of the five sites we selected went to the prime contractor for implementing the remedial actions. Figure 1 illustrates the distribution of costs at each site.

Figure 1: Federal Expenditures at Five Superfund Sites as of May 1999



Source: GAO's analysis of EPA data.

Notes: Other costs include the costs of salaries and travel for EPA staff overseeing cleanups, EPA's efforts to ensure that responsible parties pay their share of cleanup costs, and government administration and support, including such indirect costs as those for rent and utilities.

[a]Because substantial work remains to be done at the Raymark and Newmark sites, both the total expenditures and the expenditures for remedial action will increase in the future.

The percentage of EPA's total costs at each site that could be attributed to remedial actions ranged from 53 percent at the Newmark site to 86 percent at the NL Industries site.[5] The remedial action work accomplished at each site is described in more detail in appendixes I through V. Site study and remedy design—that is, assessing the hazards posed by a site, considering alternative remedies, and developing a detailed plan for the selected remedy—represented the second largest cost at three of the five sites. As a percentage of a site's total costs, the expenses for site study and remedy design ranged from about 7 percent at the NL Industries site to about 33 percent at the Newmark site. Other costs ranged from about 7 percent at the United Creosoting site to about 15 percent at the Newmark site. Because work was in progress at the Raymark and Newmark sites, the percentages of funds spent for the remedial actions at these sites will likely increase as the ongoing work is completed.

We further analyzed contractors' remedial action expenses to determine what portion was associated with the physical implementation of the cleanup effort, as opposed to other activities, such as the contractors' overhead, travel, and fees. We classified funds as spent for physical implementation if they went to a subcontractor that performed the physical work of implementing the remedy or were used by the prime contractor itself for labor and materials directly related to the remedy.[6] At three sites, the prime contractors spent a large majority of the remedial action funds they received from EPA to physically implement the remedies, while at two other sites, we were not able to obtain detailed information on the contractors' costs because these sites were cleaned up under fixed-price contracts, which do not require contractors to report how they spend funds. As table 1 indicates, the portion of the prime contractor's funding going to physically implement the remedy at each of the three sites ranged from 69 percent at the Raymark site to 88 percent at the NL Industries site.

[5]At the Raymark site, a $25 million removal action, involving the excavation and removal of contaminated soil at numerous residential properties, was the second largest cost category. If the costs of this action were included with the remedial action costs, about 75 percent of the total costs at the Raymark site would have been attributable to the remedial action.

[6]We considered the following prime contractor costs to be physical implementation costs: (1) any costs for labor pertaining to the on-site implementation of the remedy, including earth moving, well drilling, the construction and operation of treatment facilities, the installation of a cap or piping, and the transport and disposal of contaminated media and (2) the costs for equipment, supplies and materials directly related to the remedy's implementation, such as bulldozers and backhoes, hardware used in the construction of treatment facilities, wellhead parts, and piping. We excluded the contractor's costs for professional services.

The costs for other activities—that is, the costs not related to directly implementing the remedy–include those for the prime contractor's work, such as construction management and engineering services, associated travel costs, overhead expenses, and administrative costs and fees.

Table 1: Prime Contractors' Costs at Three Sites

Dollars in millions

	Raymark		NL Industries		Newmark	
Cost category	**Amount**	**Percent**	**Amount**	**Percent**	**Amount**	**Percent**
Physical implementation of remedy	$53.9	69	$34.6	88	$12.6	84
Other activities	24	31	4.7	12	2.4	16
Total	**$77.9**	**100**	**$39.3**	**100**	**$15.0**	**100**

Relationship Between Actual and Estimated Costs Varied

At three sites in our review—Newmark, Raymark, and Sharon Steel–the actual costs of performing the remedial activities that had been performed as of May 1999 were higher than the estimated costs EPA and the contractor had agreed to at the start of work. The increases at these sites ranged from less than 1 percent to 15 percent.[7] At one site—United Creosoting—the actual cost for these activities was less than the estimated cost by about 9.5 percent. We identified various reasons for the differences between actual and estimated costs. At the fifth site—NL Industries—we were not able to compare actual and estimated costs because the scope of the work at the beginning of the remedial action was too uncertain to prepare a meaningful estimate.

At the Raymark site, the actual cost of the remedial action was about $77.9 million–$4.6 million, or 6 percent, higher than the estimated cost of $73.3 million. Two factors accounted for a significant portion of this increase–the cost of clean fill for a cap covering contaminated soil and higher indirect

[7]According to the American Society of Civil Engineers, the actual costs of a construction project can be expected to exceed the estimated costs because of unknown conditions or other factors. It is common to assume that the final costs will exceed the costs estimated at the time construction bids are obtained by about 5 percent. Larger or more complex projects may require higher contingencies.

costs than those estimated by the contractor. These factors accounted for about $3.8 million of the cost increase.

At the Sharon Steel site, the actual cost of the remedial action, $49.2 million, exceeded the estimated cost, $42.7 million, by about $6.5 million, or 15 percent. There were a number of reasons for this increase. One part of the remedy at this site involved installing a cap over contaminated material, in part to prevent future human exposure. The remedy required more water than expected to suppress airborne dust at the site and therefore cost about $2 million more than planned. Expenses for additional materials needed at the site accounted for another $3.6 million in unanticipated costs. At this site, the owner of the portion of the site where a milling operation formerly occurred also claimed that the cleanup costs were excessive because EPA required that lead-contaminated soil be cleaned more thoroughly than the owner thought necessary. According to the owner, other Superfund sites located near the Sharon Steel site contained lead-contaminated soil that was cleaned to a less stringent standard than the 500-parts-per-million-(ppm) standard established for Sharon Steel. The owner was not able to estimate how much would have been saved by applying the less stringent standard. EPA maintains that the 500 ppm standard was consistent with the scientific model the agency uses to determine the safe level of lead in soil. According to EPA's best scientific information, a less stringent cleanup standard might not have adequately protected public health. An EPA official also noted that if the less stringent standard had been applied and then found inadequate to protect public health, additional cleanup work would have been required, entailing higher costs.

Two of EPA's offices–the Office of Pollution Prevention and Toxic Substances, which publishes guidance on lead contamination at residential properties, and the Office of Solid Waste and Emergency Response, which administers the Superfund program–have developed policies for cleaning up lead in soils. According to EPA, the offices do not differ in their assessments of the health effects of lead in soil. However, the two offices can apply different approaches to managing the risks posed by lead in soil. The Superfund program uses a quantitative risk assessment model that takes into account site-specific conditions and can recommend lead concentrations of 500 ppm or lower. On the other hand, EPA's Office of Pollution Prevention and Toxic Substances has general guidance for homeowners and others to address lead in soil. For example, the office has proposed a rule which recommends a variety of lower-cost actions to address lead concentrations between 400 and 2,000 ppm, such as planting

grass over bare soil in areas where children play. The proposed rule recommends that homeowners remove lead from soil if concentrations exceed 2,000 ppm. EPA officials also said that the office's guidance takes into account the limited ability of many property owners to pay for permanent cleanup solutions.

At the Newmark site, the actual cost of addressing the first operable unit–$14.8 million–was about 1 percent over the estimated cost of $14.7 million.

At the United Creosoting site, the actual cost of the remedial action, about $40.9 million, was about $4.3 million (9.5 percent) less than the total estimated cost of about $45.2 million. However, much of this decrease related to the discovery that the actual volume of contaminated soil needing remediation was a fraction—about one-fourth–of that initially assumed for the estimate. In considering this apparent saving, it should be noted that EPA spent about $30 million on an innovative treatment remedy that failed. The selection of the remedy was preceded by a study that estimated that about 115,000 tons of soil were contaminated. EPA proposed using a largely untried, innovative technology that would chemically remove contaminants from the soil. This remedy ultimately proved ineffective, and a subsequent study found that only 30,000 tons of soil were contaminated at the site. According to a Texas official, a less costly remedy might have been selected had the actual quantity of contaminated soil been known. Moreover, the cost of the failed remedy could have been substantially reduced had the state or EPA terminated its use earlier, when, according to the Texas officials, it became clear that the problems with the treatment process could probably not be corrected. In the end, the contaminated soil was excavated and removed at a cost of about $5.1 million.

At NL Industries, we could not compare actual and estimated costs because a meaningful total cost estimate was not prepared before the cleanup work began. Instead, the prime contractor was directed to determine if residential properties and alleys in an area were contaminated and to excavate any that were to whatever depth was necessary to achieve cleanup. However, at this site, as at the Sharon Steel site, the businesses responsible for paying for the cleanup disagreed with EPA about the appropriate level of cleanup for lead-contaminated soil. EPA required that the soil be cleaned up to a standard of 500 ppm, while the responsible parties argued that a standard of 1,000 ppm would be sufficient to protect public health. If EPA had chosen the 1,000-ppm standard, about 250 residences would have required cleanups at an estimated cost of $7 million,

while under the 500-ppm standard, 1,300 residences required cleanups at an esitmated cost of $30 million. According to EPA, the 500-ppm cleanup standard was derived using the Superfund program's quantitative risk assessment model. As noted, this model takes site-specific conditions into account.

Agency Comments and Our Evaluation

We provided a draft of this report to EPA for its review and comment. EPA's written comments, which appear in appendix VI, primarily provided additional information on the agency's policies on the cleanup of lead-contaminated soil. We revised our report to reflect these comments. For example, we added the statement from EPA that its Office of Pollution Prevention and Toxic Substances and its Office of Solid Waste and Emergency Response, which administers the Superfund program, do not differ in their assessments of the health effects of lead. We further noted, as EPA pointed out, that the offices may use different strategies for managing this risk. EPA also provided technical clarifications, which we incorporated as appropriate.

Scope and Methodology

Of the five Superfund sites we selected for our review, two were among those on which EPA had recently spent substantial amounts of funds, and three were randomly selected. We used EPA's data to compile a list of sites where (1) EPA had spent a total of at least $1.5 million from fiscal year 1996 through fiscal year 1998 and (2) its spending in these years accounted for at least 50 percent of its total spending at the sites in all years. From this list, we then selected two of the most expensive sites. We also randomly selected three other sites from the list in order to include a variety of other sites.

To determine what portion of the total funds EPA spent on each site was used to pay contractors for actual cleanup work and what portion was used for other purposes, we obtained data from EPA's Integrated Financial Management System (IFMS) as of May 1999 and categorized costs according to whether payments were made to contractors for remedial actions, remedial investigations and feasibility studies, or other purposes. Because not all federal expenditures on Superfund sites are captured by IFMS, we supplemented this information with data from an EPA cost-tracking system. This system compiles Superfund expenditures not reported by IFMS, such as those of some other federal agencies and those of EPA that are not associated with specific sites, such as the costs of

headquarters and regional office space and of utilities. We further analyzed the portion of the total funds that went to the remedial action prime contractor to determine what portion was used for actual physical work at the site. To do this, we examined vouchers submitted by contractors to EPA or other financial reports, which provided details on how the prime contractors spent federal funds. In general, we classified funds that the prime contractors paid to "pool" subcontractors—the subcontractors that physically implement work such as excavating soil, installing wells, and building treatment facilities—as funds spent for physical implementation. At two sites—the Newmark and NL Industries sites–however, the prime contractors were also responsible for substantial physical implementation, and we counted the costs of this work as expenditures for physical implementation.

To determine whether actual cleanup costs differed from estimated cleanup costs at each site, we compared the cost estimates agreed to by EPA and the contractor following the remedy design with the best data available on actual costs at the time of our site visit. The sources of data on estimated and actual costs varied among our selected sites. At the Sharon Steel site, for example, the remedial action report contained a summary of estimated and actual remedial action costs. At three other sites, we compared agreed-upon estimates from sources such as contractors' work plans or contract bids with data from the contractors' most recent vouchers. At a fifth site, we were unable to conduct this analysis because meaningful cost estimates had not been prepared. After identifying the cost changes, we spoke with EPA or contractor officials and reviewed appropriate documents to determine the causes of significant cost differences.

We conducted our work from February through December 1999 in accordance with generally accepted government auditing standards.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to appropriate congressional committees; interested Members of Congress; the Honorable Carol M. Browner, Administrator, EPA; managers of the state programs mentioned in our report; and other interested parties. We will also make copies available to others upon request.

Please call me at (202) 512-6111 if you or your staff have any questions. Key contributors to this report are listed in appendix VII.

Sincerely yours,

David G. Wood

David G. Wood
Associate Director, Environmental
Protection Issues

Summary of Remedial Action Work at the Newmark Superfund Site

Background

The Newmark Groundwater Contamination Superfund site (Newmark site) involves the cleanup of groundwater contaminating a municipal water supply in San Bernardino, California. EPA has implemented the first phase of a three-phase remedy by building facilities to pump groundwater and remove contaminants before the water is used by the city.

Site Background and History

The Newmark site consists of two streams, or "plumes," of contaminated groundwater as well as a common source area lying beneath about 8 square miles of the city of San Bernardino, California. The groundwater contamination was discovered in 1980, when the California Department of Health Services found that water from wells providing drinking water to San Bernardino contained excessive concentrations of two toxic chemicals—perchloroethylene and trichloroethelyne. Both chemicals are widely used in a variety of industries, including dry cleaning, metal plating, and machinery degreasing. In sufficient concentrations, both chemicals can damage the central nervous system and cause dizziness and headaches. Both chemicals can also damage the kidneys and liver and may increase the risk of cancer. The wells, which supplied approximately 25 percent of San Bernardino's water supply, were contaminated above state and federal drinking water standards. To address the immediate problem, the state constructed several water treatment plants to remove contaminants and maintain the city's water supply. In subsequent years, additional testing revealed that the contaminated groundwater continued to flow southwards, threatening additional wells in San Bernardino and the drinking water sources of other communities.

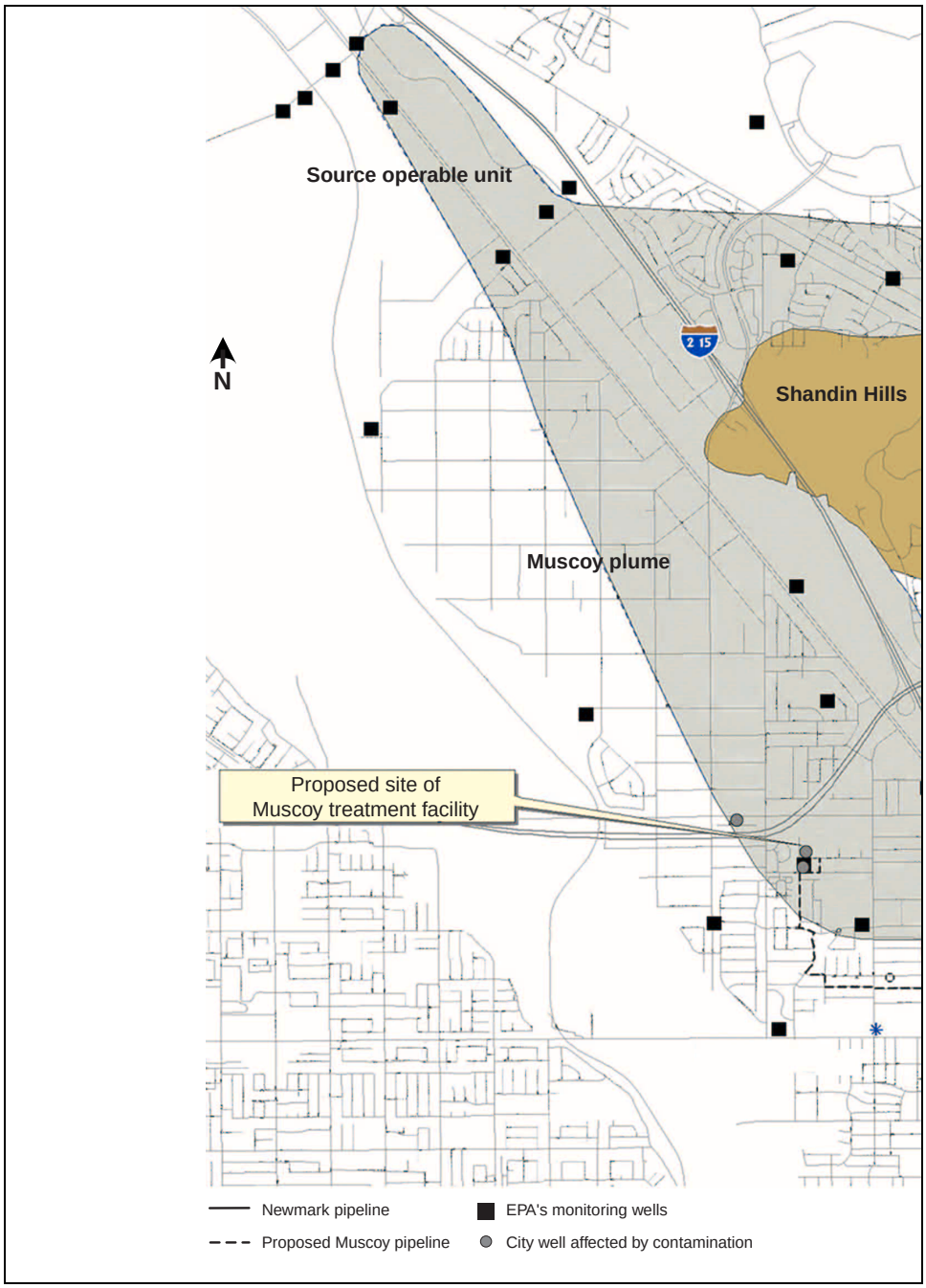
After almost a decade of state-and city-financed efforts to protect the city's water supply, the state of California asked that EPA add the Newmark site to the National Priorities List, and EPA did so in March 1989. To both address the imminent threats and devise a long-term solution to the groundwater contamination, EPA divided the site into three operable units : (1) the Newmark operable unit to the east; (2) the Muscoy operable unit to the west; and (3) the source operable unit–that is, the area suspected to be the source of the contamination in both the Newmark and Muscoy operable units–which lies northwest of the two plumes. EPA has not pinpointed the origin of the contamination but believes that it lies on or near an abandoned Army base known as Camp Ono.

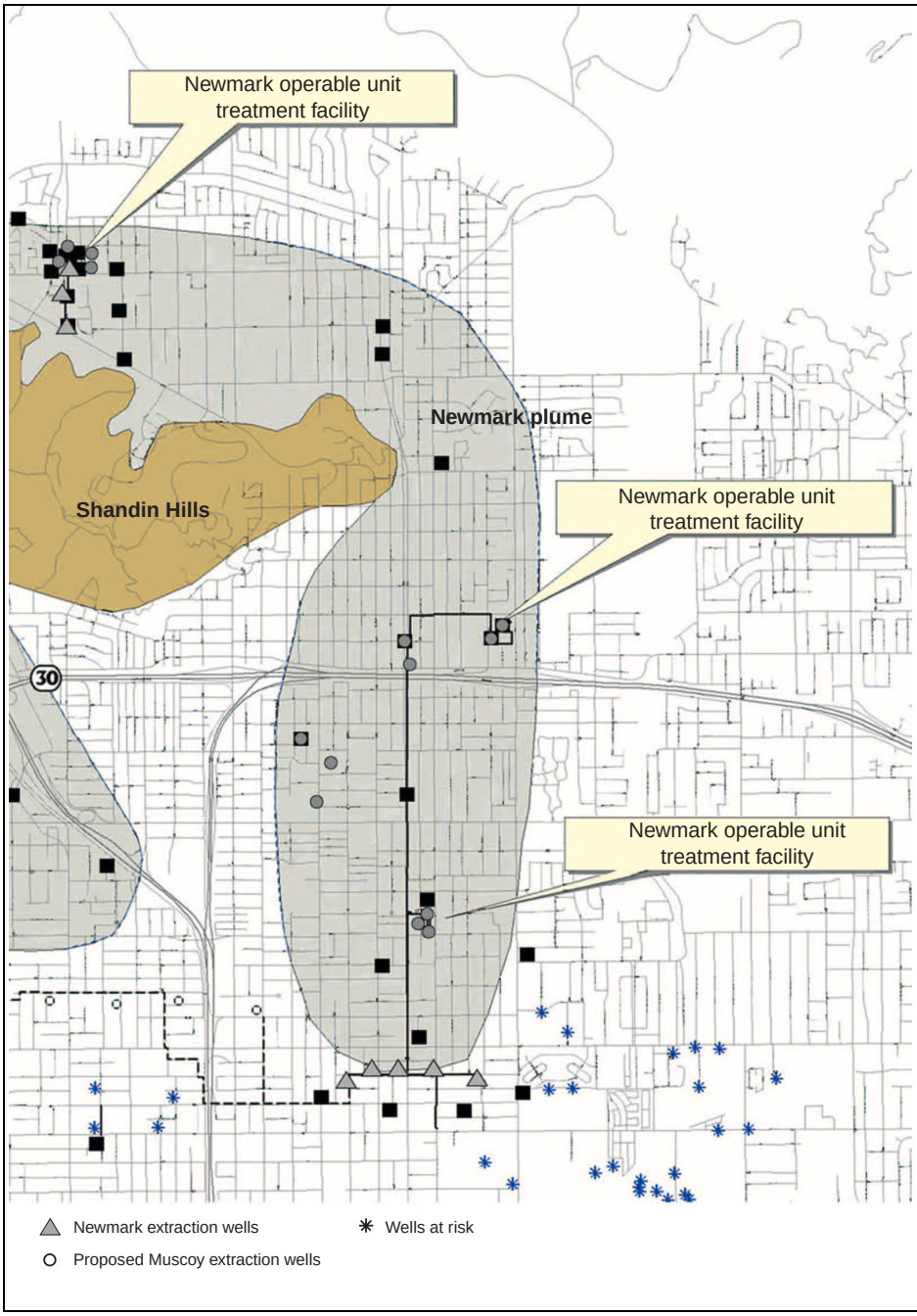
EPA's Approach to Remedying the Contamination

At both the Newmark and the Muscoy operable units, EPA considered a range of remedial actions, each of which would have extracted the contaminated water and treated it to remove contaminants. The chosen remedies consist of extracting and decontaminating water by pumping it through large vessels filled with contaminant-attracting granular activated carbon and then delivering the treated water to San Bernardino's water distribution system for use by the general public. Other remedies would have either used different treatment technologies or reinjected the treated water into the ground. At both operable units, the chosen remedy was not the most expensive one considered. The remedy for the Newmark operable unit, selected from possible remedies whose estimated costs ranged from $47.9 million to $61 million, is projected to cost $49.9 million, including the costs of operations and maintenance for 30 years. The remedy for the Muscoy operable unit, selected from possible remedies whose estimated costs ranged between $21.5 million and $32 million, is expected to cost $26 million. The projected costs of operations and maintenance for the Muscoy treatment system over 30 years are $33 million. EPA is not responsible for operations and maintenance costs after the first 10 years at either system.

As implemented, the remedy for the Newmark operable unit is designed to prevent additional contaminants from entering the plume, prevent the plume's advance to the south and east, and treat water for delivery to residents. As indicated in figure 2, EPA installed five wells at the leading edge of the plume. Each of these wells extracts contaminated water from the plume's leading edge at a rate of about 2,000 to 2,500 gallons per minute, thereby preventing the contaminated water from flowing farther south. EPA installed another set of wells in the northern part of the plume, where contaminants flow between the impermeable rock of the Shandin Hills on the south and the San Bernardino Mountains to the northeast. These wells are intended to "pinch off" the flow of contaminants at the point where groundwater from the suspected source flows into the rest of the plume. Water drawn from both groups of wells is piped to treatment plants, where it is decontaminated using granular activated carbon technology. EPA plans to construct a similar remedy to address the Muscoy operable unit. (See fig. 2)

Figure 2: Remedial Action at The Newmark Superfund Site





Source: CIty of San Bernadino Municipal Water Department.

At the Newmark operable unit, EPA arranged for the remedy's construction through a contract with a private construction firm—URS Greiner–and a cooperative agreement with the San Bernardino Municipal Water Department.[1] URS Greiner was contracted to build the granular-activated carbon treatment facilities and to install monitoring wells to ensure that the contaminated plume was halted at the extraction wells. The cooperative agreement, between the San Bernardino Municipal Water Department and EPA, provided for installing the extraction wells and laying the water pipes that would carry extracted water to the treatment facilities. Under the agreement, the San Bernardino Municipal Water Department pays for the cost of pumping to extract the contaminated water.

Table 2 summarizes the major events during EPA's involvement with the site.

Table 2: Major Events in the Cleanup of the Newmark Site

Date	Event
Mar. 1989	EPA adds the Newmark site to the National Priorities List.
Sept. 1992	On the basis of additional investigations indicating that the Newmark and Muscoy plumes have a common source, EPA expands the Newmark site to include the Muscoy component.
Mar. 1993	EPA completes the remedial investigation of the Newmark operable unit.
Aug. 1993	EPA issues the record of decision selecting a remedy for the Newmark operable unit.
Dec. 1994	EPA completes the remedial investigation of the Muscoy operable unit.
Mar. 1995	EPA issues the record of decision selecting a remedy for the Muscoy operable unit.
Feb. 1996	EPA issues a memorandum stating that a former U.S. Army depot is a likely source of contamination.
Aug. 1998	The U.S. Army agrees to conduct a remedial investigation at the source unit.
Oct. 1998	Construction of the remedial action for the Newmark operable unit is completed.

[1]Another firm, CH2M Hill, became EPA's prime contractor in early 1999, although URS Greiner remains at the site as a subcontractor.

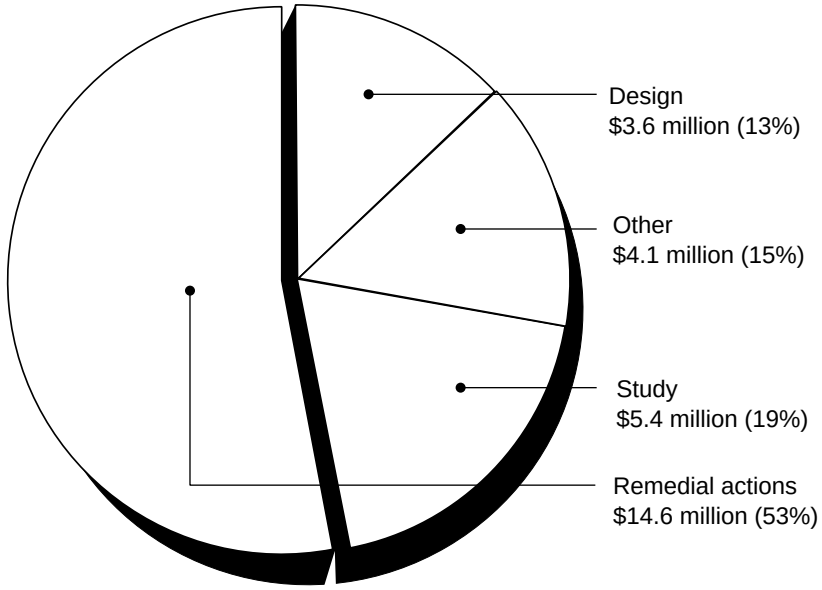
Cleanup Costs and Major Components

EPA spent almost $28 million on the Newmark site as of May 1999, mostly on remedial actions, including drilling groundwater wells and constructing facilities for pumping, treating, and transporting the water.

Costs Attributable to Remedial Action Work

EPA's Integrated Financial Management System indicated that through May 1999, EPA had spent $27.7 million to clean up the Newmark site. As figure 3 shows, about $14.6 million, or 53 percent of this amount, was spent for remedial actions. Because EPA's efforts at the site are ongoing, figure 3 should be taken as snapshot of an ongoing story. According to EPA officials, the percentage of the project's total costs applied to remedial actions is likely to increase in the coming years as the preliminary study and design work are completed and the remedial work progresses.

Figure 3: Federal Expenditures at the Newmark Superfund Site



Source: GAO's analysis of EPA data.

Data submitted by the contractor and the city of San Bernardino indicate that of the roughly $15 million[2] spent on remedial actions at the Newmark site, about $7.3 million was spent by the prime contractor and about $7.7 million by the San Bernardino Municipal Water Department. GAO's analysis

of these data indicates that the majority of funds were spent on items directly related to the physical work of implementing the remedy.[3] For example, about $5.8 million—or 79 percent of the total paid to the prime contractor–went to subcontractors that actually performed the physical work. Other significant expenditures by the prime contractor include $446,000—6.1 percent –for the prime contractor to manage and oversee the remedial action and $533,000—7.3 percent—for costs such as rent and utilities for on-site space.

Under the cooperative agreement with EPA, the city's water department spent about $7.7 million on remedial actions at the Newmark operable unit, including about $6.8 million, or 88 percent, to physically implement the remedy. Of this $6.8 million, the city spent about $3.2 million, or 47 percent, for contractors involved in the implementation; about $813,000, or 12 percent, for in-house personnel involved in physically implementing the remedy; and $2.7 million, or 40 percent, for supplies directly related to the remedy.

Selected Remedial Action Tasks and Costs

The remedial action at the Newmark operable unit consisted of four major tasks, two implemented by the San Bernardino Municipal Water Department and two by the prime contractor.

First, the San Bernardino Municipal Water Department constructed a total of seven extraction wells, two at the north end where the contaminants enter the plume and five at the leading, southern edge of the plume, for about $3.4 million.[4] Ranging in depth from 1,200 to 340 feet deep, the majority of these wells are designed to pump about 2,500 gallons of water per minute, 24 hours a day. These wells will remove contaminated water and prevent further migration of the contaminated plume. Major cost elements of the well installation included $1,095,000 for a subcontractor to drill the wells and $683,000 to provide materials such as the well shafts, pumps, and well housing. In addition, the water department spent $362,000

[2]Because of a lag between when vouchers are submitted and when data are entered into EPA's Integrated Financial Management System, spending totals derived from these two sources may differ, as they do in this case.

[3]Because remedial action work had not yet begun at the Muscoy operable unit at the time of our review, the following discussion pertains to the Newmark operable unit only.

[4]In addition, the contractor modified an existing well at the north end for extraction.

to purchase properties in residential neighborhoods where the wells were to be installed.

Second, the San Bernardino Municipal Water Department installed pipelines to transmit the contaminated water from the extraction wells to the treatment facilities. About 23,000 feet of water mains, predominantly 24-inch pipe, were laid beneath city streets, at a cost of $2.5 million, to transport contaminated water from the wells to treatment plants.

Third, EPA's prime contractor installed granular activated carbon treatment vessels at three sites over the Newmark plume, at a cost of about $4.25 million. The major components of this effort included the procurement of 30 vessels and modification of 6 vessels, each containing 20,000 pounds of the granular activated carbon that will attract contaminants in the water, and the construction of the facilities themselves, which was performed by a pool subcontractor.

Finally, the prime contractor installed six monitoring wells,[5] designed to monitor contaminant levels in groundwater downstream from the extraction wells, to measure the effectiveness of the remedy. The depth of these wells ranged from 400 feet at the north end of the plume to about 1,000 feet just below the plume's leading edge. The total cost of these wells was about $1 million, the largest component of which was the cost for a subcontractor to drill the wells. Periodically, according to the sitewide monitoring plan, water will be drawn from these wells and tested to ensure that the contaminated plume has not spread beyond the extraction wells.

Significant Cost Changes

Overall, the actual costs of constructing the remedy at the Newmark operable unit, $14.8 million, were less than 1 percent over the originally estimated costs of about $14.7 million. Although the San Bernardino Municipal Water Department's costs were about $1.3 million—or about 21 percent—higher than estimated, the prime contractor's actual costs were about $1.2 million—or 14 percent—lower than expected. According to San Bernardino Municipal Water Department officials, the additional cost covered a 1-year performance evaluation task—which began in October 1998—that was not included in the initial cooperative agreement.

[5]EPA also used other, preexisting wells for monitoring.

EPA's formal assessment of the contractor, as well as EPA officials' comments to us, indicate that both the contractor and the city performed well in implementing this remedial action. In formal evaluations covering the period from November 1, 1997, through October 31, 1998, EPA gave the contractor high marks for project management and cost control. A report for the 6 months ending April 30, 1998, praised the contractor's effectiveness in subcontracting major construction activities, including the installation of the granular activated carbon treatment vessels, and in overseeing the construction of the north and south treatment plants. The contractor successfully planned around heavy rainfall and unanticipated field conditions to keep the project on schedule. During the 6-month period, EPA gave the contractor a score of 4 out of a possible 5—indicating that the contractor exceeded expectations in all rated areas, including cost control and project planning.

We did not review formal assessments of the San Bernardino Municipal Water Department's performance. However, EPA officials said the city performed well and effectively coordinated its work with that of the contractors.

Current Status of Cleanup

The construction of the remedial action at the Newmark operable unit is completed, and a 1-year testing and evaluation period ended in October 1999. However, EPA faces significant additional costs at this Superfund site. For example, EPA will fund operations and maintenance costs at the Newmark operable unit for 10 years, at an estimated annual cost of $850,000. After this period, the state will be responsible for these costs.

In November 1999, the remedial action began at the Muscoy operable unit, and officials estimated this work would cost a total of $22 million. Operations and maintenance at this unit are expected to cost $10 million over 10 years.

At this time, the remedial investigation and feasibility study is being conducted at the source operable unit, and the costs of remedial action, if any, are not known.

Enforcement and Cost Recovery Issues

EPA has not yet definitively identified the sources of the groundwater contamination and has not formally named potentially responsible parties. As a result, it is not clear whether EPA will ultimately recover the costs of

cleaning up groundwater at the site. According to EPA officials, three areas are the most likely sources. These are (1) Camp Ono, a former U.S. Army base that lies to the north and west of the two plumes;[6] (2) the Cajon Landfill, a county-owned facility that lies north of Camp Ono; and (3) the site of the former San Bernardino Airport, which lies farther south, within the Newmark plume. According to EPA officials, there is no known financially viable entity associated with the former airport to cover cleanup costs if it is found to be one of the sources.

Although EPA has not named the U.S. Army as a potentially responsible party liable for response costs, the Army is currently conducting an investigation of the source operable unit, under an agreement with EPA. This investigation consists of testing soil and groundwater at locations at Camp Ono where solvents are most likely to have been used. Army officials told us that although it is possible that the Army is partly responsible for the contamination, the Army's responsibility has not been proved.

[6]In a separate action, the city of San Bernardino and the state of California have filed a lawsuit against the U.S. Army in an effort to recover the costs of past efforts to address the contamination.

Summary of Remedial Action Work at the NL Industries Superfund Site

Background

The NL Industries Superfund site is a 16-acre industrial facility located in Granite City, Illinois. It operated as a lead-smelting facility from about 1903 to 1983, during which time it generated an on-site pile of lead-contaminated slag and debris from a battery casing breakup operation. The industrial activities caused extensive lead contamination in Granite City and several surrounding communities. First, airborne emissions from the smelting operation contaminated an extensive area to the south and west of the facility, and second, lead-contaminated material from the crushed battery casings were sold off-site and used to fill low-lying areas and alleys—known as remote fill areas–throughout the surrounding communities. Lead contamination from the site was evident over an area of about 100 blocks, affecting an estimated 1,600 residences. The remote fill activities affected about 100 locations, including residences and alleys. The industrial site also had significant contamination, including piles of soil and debris weighing about 250,000 tons and about 35 drums of contaminated solid waste from the smelting operations. Because of concerns over lead contamination in the Granite City area and documented risks to public health from exposure to high levels of lead, the state of Illinois, in 1982, denied an application to continue operating the smelter, and all operations at the site were discontinued in 1983. A blood study indicated that 16 percent of the children in the surrounding areas, and 25 percent of those living nearest the site, had blood lead levels above 10 micrograms per deciliter.[1]

In 1985, EPA directed NL Industries to assess the site's contamination and identify possible remedies. Through this investigation, NL Industries identified seven potential cleanup remedies for the site, including a $475,000 no action remedy, which involved monitoring air quality and groundwater and placing restrictions on the site's use. Five of the remaining remedies involved removing drums off-site, excavating lead-contaminated soil and battery chips from residential properties and alleys and placing them on the industrial site's slag pile, capping the pile, moving some of the most contaminated soil to an approved landfill, and installing deep groundwater-monitoring wells. The estimated costs of these remedies ranged from about $6 million to about $67 million. The major difference among them was the type of cap that would have been used to cover the site. The seventh and most expensive remedy would have moved all of the

[1]According to the Illinois Department of Health, any blood level above 10 micrograms suggests exposure that is greater than normal and requires action. A level of 30 micrograms indicates blood poisoning.

contaminated soil to a suitable landfill. For all of the remedies requiring soil cleanup, the potentially responsible parties (PRP) proposed that soil from both the residential properties and the industrial site be cleaned up to a standard of 1,000 parts per million (ppm) of lead. They estimated that about 250 residential properties would require remediation under this standard. In addition to these alternatives, EPA asked NL Industries to develop an alternative using a 500-ppm cleanup standard, but NL Industries declined to do so. Subsequently, EPA developed such an alternative. EPA's alternative was similar to one of the remedies that would have consolidated and capped contaminated material at the industrial site, but it applied a standard of 500 ppm to the residential areas.

In March 1990, EPA issued a record of decision selecting the alternative it had developed, thus applying the 500-ppm standard to the residential areas. The estimated cost of this remedy was $30 million, compared with $7 million for a comparable remedy using the 1,000-ppm standard, because the estimated number of properties to be cleaned increased from 250 to about 1,300. The responsible parties considered this standard more stringent than necessary to protect public health and too costly. Even though EPA issued a unilateral administrative order[2] directing the responsible parties to implement the selected remedy, they did not cooperate. In addition, in response to information disclosed during the remedy design, EPA later amended the remedy to protect groundwater. EPA determined that the contaminated soil and battery casings excavated from residential properties and alleys would be disposed of off-site in an approved landfill, instead of being added to the waste piles at the industrial site. This change, as well as other factors, such as larger-than-expected numbers of remote fill sites, increased the estimated cost of the remedial action from $30 million to about $55 million.

Because the responsible parties refused to comply with EPA's administrative order, EPA, in February 1993, entered into an interagency agreement with the U.S. Army Corps of Engineers (the Corps) to design and implement the remedy. The Corps, in turn, contracted with OHM Remediation Services Corporation (OHM) to conduct the remedial work under a cost-plus-fixed-fee contract. Under this arrangement, EPA, through the Corps, paid the contractor for all costs incurred, as well as a fixed fee.

[2]A unilateral administrative order is an enforcement tool EPA uses to compel responsible parties to perform and pay for cleanup when negotiations fail.

Table 3 summarizes major events in EPA's cleanup effort.

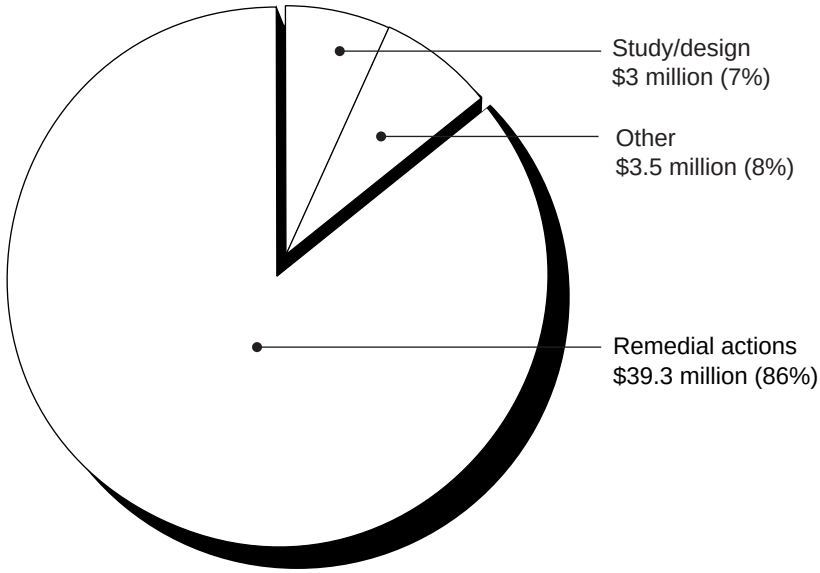
Table 3: Major Events in the Cleanup of the NL Industries Site

Date	Event
May 1985	NL Industries officials sign a consent order to conduct a remedial investigation.
June 1986	EPA places the NL Industries site on the National Priorities List.
Jan. 1990	NL Industries completes a remedial investigation/feasibility study.
Mar. 1990	EPA issues a record of decision specifying the selected remedy.
Nov. 1991	EPA issues a unilateral administrative order directing the responsible parties to implement the remedy.
Feb. 1993	EPA signs an agreement with the Corps to design and implement the remedy.
Apr. 1993	The Corps starts residential cleanup action.
Apr. 1994	The responsible parties seek a court order to halt EPA's cleanup activity.
July 1998	The responsible parties agree to take over the cleanup and enter into cost recovery negotiations.
Sept. 2000	All cleanup activity at the NL Industries site is scheduled for completion.

Cleanup Costs and Major Components

According to EPA's financial management system, EPA has spent about $45.8 million to clean up the NL Industries site. Of this amount, the largest portion, about $39.3 million (86 percent), went directly to the contractors that implemented the cleanup remedy. Figure 4 illustrates the costs associated with the site's cleanup, by its major components.

Figure 4: Federal Expenditures at the NL Industries Superfund Site



Note: Removal costs, which are less than 1 percent of EPA's total spending, are included with remedial action costs. Percentages do not add up to 100 due to rounding.

Source: GAO's analysis of EPA data.

Our analysis of the prime contractor's financial data revealed that of the $39.3 million in remedial action costs, $34.6 million (88 percent) went to the remedial action contractors for costs generally associated with physical cleanup activities. Of the $34.6 million, about $2 million (6 percent) went to subcontractors that performed various on-site work, and the prime contractor, OHM, retained about $32.6 million (94.2 percent) for the physical cleanup activities it performed. The other $4.7 million in remedial action costs went for overhead and administrative support activities, such as travel, insurance, and laboratory services.

The cleanup of the NL Industries site was separated into two distinct phases: (1) a rapid response activity—comparable to a removal action–managed by the Corps' Omaha office and (2) a longer-term remedial action managed by the Corps' Chicago office. OHM performed the cleanup activities for both phases. For the rapid response activity, the contractor designed the remedy, moved drums of contaminated material off-site, and cleaned up about 109 residential properties and/or alleyways that required immediate attention. The costs of individual rapid response components could not be determined because the Corps' records did not provide this

level of detail. However, the total amount paid for these rapid response efforts was about $11 million. For the remedial action, OHM cleaned up another 960 residential lots and alleyways, at a cost of about $28 million. In general, the contractor was directed to identify the extent of contamination at each property and to eliminate exposure to the contamination. The scope of work was determined property by property. According to a Corps official, the costs to sample, excavate, and backfill a residential property ranged from about $1,400 to about $69,900 and averaged about $24,000 per property. As discussed below, in 1998 some of the responsible parties reached a settlement with EPA under which they agreed to take over the cleanup. At that time, the Corps became responsible for overseeing the parties' work for EPA.

Significant Cost Changes and Other Remedy Implementation Issues

We were unable to assess cost changes at this site because uncertainties about the scope of cleanup needed prevented full cost estimates from being developed at the start of the work. Instead, the prime contractor was directed to determine if residential properties and alleyways in an area were contaminated and to excavate and remove any contaminants to whatever depth was necessary, as well as to implement the groundwater and industrial site remedies. Therefore, it was impossible to accurately estimate the cost to remediate a property until the work was under way. The Corps' estimates of costs were based on worst-case scenarios.

The Corps did estimate the costs of capping the site, about $6 million, and of installing the groundwater-monitoring wells, about $3 million. However, these tasks had not been finished at the time of our review and have now been taken over by the responsible parties.

Under its agreement with EPA, the Corps was responsible for overseeing the performance of the remedial action contractors. According to Corps officials, the prime contractor did a good job of staying on schedule and received payments as planned.

EPA and Responsible Parties Disagree Over Lead Cleanup Standards

Both the responsible parties and Granite City officials opposed using the 500-ppm cleanup standard for lead in soil. About a year after the residential cleanup actions started, Granite City officials and the responsible parties sought a court order halting EPA's cleanup efforts. They believed the 500-ppm standard imposed by EPA was unnecessarily expensive. In August 1994, in accordance with a negotiated agreement, EPA suspended residential cleanup actions and reconsidered the standard. To do so, EPA

used a quantitative model that incorporated site-specific data to assess the risk posed by lead contamination. After about a year's delay, EPA reaffirmed its decision to use the 500-ppm standard, and the court allowed the cleanup work to resume. In 1996, a federal district court rejected an attempt by Granite City officials and some responsible parties to halt the cleanup.

While the court decision was pending during the early residential excavation and removal work, Granite City officials refused to give the Corps' cleanup contractor access to city-owned easements–strips of land between the streets and sidewalks. By the time the city gave the contractor access, the soil had been excavated from about 325 residential yards but not from the associated easements. The Corps estimates that EPA had to spend about $650,000 for the contractor to return to excavate the easements.[3] In addition, an EPA official said the litigation helped extend the cleanup period from 2.5 years, as initially estimated, to 7 years, thereby increasing EPA's and the Department of Justice's overhead costs.

EPA's 500-ppm standard was based on interim guidance, in effect at the time the remedy was chosen at the site, establishing a cleanup level for lead in soil within residential areas. This guidance referred to a range of 500 to 1,000 ppm. While the guidance suggested that blood lead levels, especially in children, appear to be affected by lead concentrations in soil that range from 500 to 1,000 ppm, it did not specifically recommend that lead-contaminated soil be cleaned up to a standard of 500 ppm. Instead, it stated that site-specific factors should be included in decisions to determine the actual cleanup level. According to the responsible parties, EPA did not provide definitive evidence to show that the 500-ppm standard would be more protective of human health than the 1,000-ppm standard. According to EPA, the 500-ppm level was consistent with the quantitative model it uses to determine the safe level of lead in soil. A less stringent cleanup level would not, according to EPA's best scientific information, have been adequate to protect public health. An EPA official also said that if the less stringent standard had been applied and found inadequate to protect public health, the cleanup costs would have been higher because of the need to mobilize a second cleanup.

[3]While there would have been some cost to remediate these easements during the earlier work, EPA officials believe a significant portion of these funds could have been saved.

Current Status of Cleanup

Effective July 1998, six of the major responsible parties that had generated the contaminated waste agreed to take joint responsibility for cleaning up the lead contamination at the industrial site, as well as for completing the remedial actions that were under way at the residential properties. These responsible parties have contracted with another firm to complete the cleanup actions initiated by the Corps and OHM. According to November 1999 cleanup figures, over 1,540 residential properties have been excavated, backfilled, and resodded–about 836 by the Corps' contractor and about 708 by the responsible parties. In addition, another 125 residential properties and alleyways were excavated because they were contaminated with battery chip debris.

As of December 1999, substantially all of the cleanup activities specified in the record of decision were completed, except for the groundwater remedy. The total cleanup costs for the site are estimated to be about $63.5 million. The remainder of these costs will be picked up by the responsible parties.

Enforcement and Cost Recovery Issues

NL Industries officials did not join six other responsible parties in their decision to settle with EPA and complete the site's cleanup actions. EPA has reached a verbal agreement with NL Industries to enter into a consent decree, but the agreement has not been finalized. The other six responsible parties agreed in July 1998 to complete the cleanup actions (then estimated to cost about $21 million), reimburse EPA about $9 million of its already expended funds, and pay about $400,000 in penalties for failing to comply with the unilateral administrative order, as well as pay about $2 million to abate lead-based paint problems in the cleanup area.

Summary of Remedial Action Work at the Raymark Superfund Site

Background

The Raymark Superfund site is centered on the 33-acre Raymark facility, located in Stratford, Connecticut. Raymark manufactured brake pads, clutch parts, and other automotive products from 1919 to 1989. The facility generated wastes containing over 60 different contaminants, including lead, asbestos, and polychlorinated biphenyls (PCBs). Raymark's waste disposal practices resulted in two main environmental hazards. First, the company's on-site disposal of wastes and chemical spills contaminated soil at the facility. The contaminated soil formed a layer underlying nearly all of the facility and ranged in thickness up to 24 feet. These disposal practices also contaminated groundwater underlying the facility, particularly in the vicinity of previous chemical disposal and spill areas. Second, Raymark periodically dredged contaminated sludge from the site and provided it to property owners throughout the town of Stratford to fill areas of their properties. Investigations revealed over 70 properties with elevated levels of lead, asbestos, and PCBs, including playing fields at a local school, recreational parks, and residential and commercial properties.

Health assessments concluded that on-site and off-site contamination presented an imminent health threat to workers, residents, and others who might inhale, ingest, or touch the contaminants. Several potential health effects are associated with the contaminants at the site. Asbestos can cause lung cancer and scarring of lung tissue. Lead can cause brain and nervous system damage, especially among children. PCBs have been linked to cancer and reproductive effects.

The Raymark site currently consists of eight operable units. The first, the former site of the Raymark facility, is the only unit where remedial work has been conducted to date.[1] The other operable units are areas off the industrial facility that were contaminated by material from the facility. After considering four remedies (other than a “no action” remedy) to clean the first operable unit, EPA selected the least expensive remedy, estimated at $62 million. A major feature of the selected remedy was the construction of a multilayered, impermeable cap over the entire facility, designed to prevent (1) people from coming in contact with contaminated soil and (2) rainwater from leaching contaminants into groundwater. (See fig. 5.) The remedy also involved removing highly contaminated pockets of solvents and decontaminating and demolishing all on-site buildings. A second

[1]As discussed later in this appendix, EPA has also implemented a removal action at this site, separate from remedial action measures.

remedy, estimated to cost $131 million, would have been similar to the first but would also have excavated, treated, and provided for the off-site disposal of approximately 21,000 cubic yards of highly contaminated soil. The third and fourth remedies would have excavated all contaminated materials above the water table for treatment and disposal either on-site (estimated to cost $351 million) or off-site (estimated to cost over $1 billion).

Figure 5: Construction of the Raymark Cap

Source: U.S. Army Corps of Engineers.

EPA and the U.S. Army Corps of Engineers (the Corps) oversaw the management of the cleanup and hired private contractors to conduct the prescribed cleanup actions at the site. Through an interagency agreement between EPA and the Corps, EPA provided the funding to the Corps for the cleanup actions. The Corps used a cost-reimbursable contract with the primary contractor at the site.

Table 4 shows the major events that occurred during the cleanup.

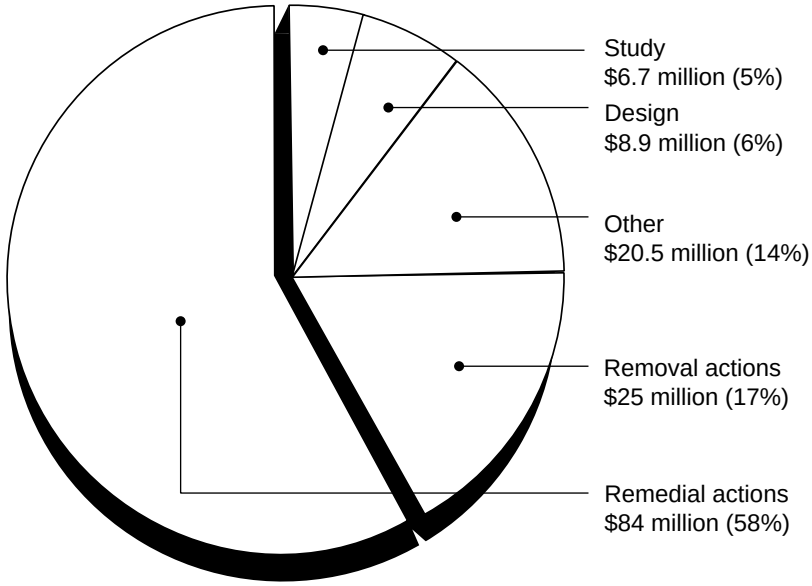
Table 4: Major Events in the Cleanup of the Raymark Site

Date	Event
June 1993	EPA starts a removal action to excavate contaminated fill from residential properties.
June 1995	EPA proposes Raymark for the National Priorities List.
Aug. 1994	EPA begins a remedial investigation/feasibility study.
Apr. 1995	EPA adds Raymark to the National Priorities List.
June 1995	EPA issues a record of decision for on-site work at the Raymark facility.
Sept. 1995	The remedial action begins.
Sept. 1996	The removal action ends.
Nov. 1997	The remedial action is completed.

Cleanup Costs and Major Components

As of May 1999, EPA had spent about $145 million cleaning up the Raymark Superfund site. The costs for remedial action work have been the largest component of the site's costs, accounting for about 58 percent ($84 million) of the spending to date. Figure 6 shows the amount and share of spending for the various cost categories involved in cleaning up the Raymark site. The percentages will change as work continues at this site.

Figure 6: Federal Expenditures at the Raymark Superfund Site



Source: GAO's analysis of EPA data.

Foster Wheeler Environmental Corporation, the contractor hired by the Corps to design and implement the Raymark cleanup, received approximately $77.9 million of the $84 million spent on remedial action. In addition, approximately $5 million was paid to the Corps. Of the $77.9 million, about 69 percent went to physically implementing the cleanup while the remaining 31 percent went to expenses related to managing and overseeing the cleanup—professional work, such as construction management and engineering services, and the associated travel, overhead, and administrative costs and fees.

Major components of the remedial action included (1) decontaminating and demolishing all on-site structures and (2) placing an impermeable cap over the entire facility and preventing pockets of solvents from further contaminating groundwater. The first major component—decontaminating and demolishing approximately 16 acres of industrial buildings—cost $17.9 million. Most of the debris from the demolition was disposed of on-site for eventual placement under the cap. Wood, which could decompose and affect the integrity of the cap, was disposed of off-site, and metal materials, such as steel girders and heavy machinery, were decontaminated and recycled.

A second major component of the cleanup—placing an impermeable cap over the entire facility and removing pockets of solvent contamination from groundwater—cost approximately $52 million. The cap was designed with multiple layers to prevent rainwater from infiltrating the waste beneath the cap and leaching into groundwater. One layer—a polyethylene liner—provided protection because of its low permeability to water vapor, high chemical resistance, and resistance to weathering and puncturing. In addition, a sand layer with a system of pipes was installed to collect volatile gases building up from the waste soils and convey the gases to treatment buildings constructed above the cap.

The cap was designed and built so as to facilitate future commercial use of the site. EPA worked with a potential developer who had plans to build a shopping center on the site. For example, the cap included areas that served as "building pods" that could support the weight of the shopping mall. In one area, approximately 270 steel pipes were driven into the ground to depths of up to 100 feet and filled with concrete, and a 2-foot steel-reinforced concrete slab was placed over the pipes.

Another segment of this component of the cleanup was designed to prevent pockets of solvent contamination from further spreading into groundwater. The contamination is captured by extraction wells, and a piping system that sends the contamination to a treatment facility and prevents it from moving further into groundwater.

A removal action was conducted at the residential off-site locations where Raymark historically disposed of its waste. The removal action involved excavating contaminated soil and waste from 46 residential properties and placing the contaminated soil and waste under the cap on the industrial facility. An estimated 100,000 cubic yards of contaminated material was removed from the properties and the school playing field. The cost of the removal action for the residential properties was $25 million.

Significant Cost Changes

The actual costs incurred by the contractor to implement the Raymark remedial action were about $77.9 million, or 6 percent over the $73.3 million estimate originally negotiated between the Corps and Foster Wheeler. Decreases in the cost of some elements were offset by increases in the costs of others. Two cost categories accounted for a significant portion of the cost increase. These were (1) higher-than-expected costs for clean fill material for the cap and (2) increases in the contractor's indirect costs. The costs for these categories increased by $3.8 million.

The cost of clean fill used at the site increased by about $2.2 million, from about $10.8 million to $13 million. The increase occurred because more clean fill was needed than originally estimated and additional costs were incurred for labor and equipment related to handling the material. According to the contractor, so much fill was brought onto the site that its grade was 10 feet higher after the remedial action than it had been before. Adverse weather conditions and unanticipated difficulties in placing the material on the site also increased the costs of the remedial action.

Increases in the contractor's indirect costs raised the cost of the work at the Raymark site by $1.6 million. These costs—for rent, employee benefits, utilities, and other operations—were estimated annually. The contractor billed the indirect costs on a provisional basis during each accounting year. After the contractor's accounting year was completed, the Defense Contract Audit Agency performed an audit of the indirect cost rate. A final indirect cost rate was established, and adjustments were made in the amount that was billed.

Current Status of Cleanup

The remedial action at the first operable unit, the industrial site, is complete. However, EPA faces significant future costs at this site. According to EPA's current estimate, completing all remedial action work will require another $80 million. This estimate includes the costs of cleaning up seven additional operable units, which encompass about 20 commercial properties, a ball field that used Raymark waste as fill, wetlands, and groundwater throughout the town of Stratford. The estimate does not cover any other costs, such as those for the remedial design or EPA's oversight. Because EPA has not yet completed studies at all of the remaining operable units, it has not decided how it will clean up the remaining areas. Therefore, EPA's current estimate is not final and is only for planning purposes.

Enforcement and Cost Recovery Issues

EPA expects to recover some of the costs of cleaning up the Raymark site and surrounding areas through several sources. For example, the agency expects to receive funds from the sale of the Raymark property. In addition, EPA may be able to collect funds from Raymark insurance policies.

Summary of Remedial Action Work at the Sharon Steel Superfund Site

Background

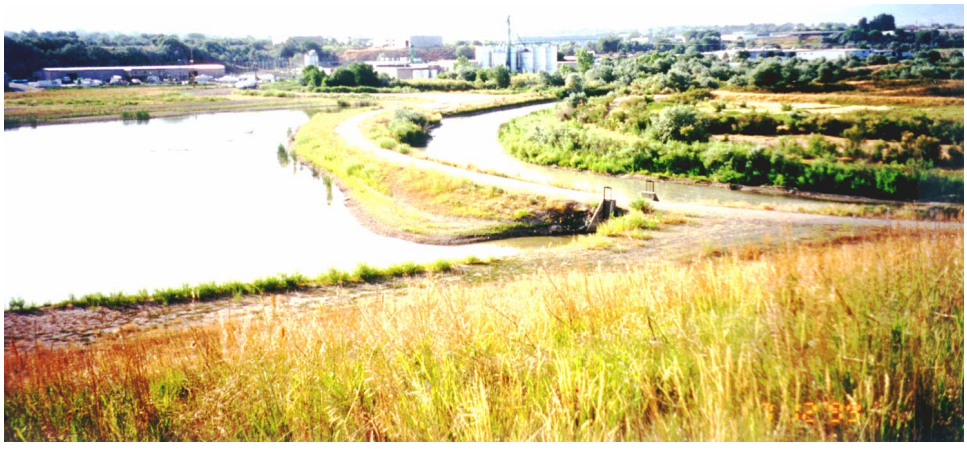
The 570-acre Sharon Steel Superfund site, located in Midvale, Utah, consists of a former metal ore milling area that operated from 1906 to 1971 and approximately 600 commercial, residential, and public properties in the vicinity of the milling operation. During the milling process, lead, zinc, copper, and other metals were extracted from ore. The operation created an estimated 10 million tons of mine tailings, which are sandlike deposits, piled 40 to 50 feet deep on the site. The tailings, which contained high levels of lead, cadmium and arsenic were blown by the wind, contaminating the soil in the city of Midvale.

According to EPA's record of decision for the site, exposure to high levels of lead can result in lead poisoning that can lead to coma, mental retardation, or seizures. Chronic ingestion of arsenic can damage the nervous and cardiovascular systems. In addition, the ingestion of cadmium is associated with kidney disease, bone damage, high blood pressure, and suppression of the immune system.

EPA divided the Sharon Steel Superfund site into two operable units. The first operable unit included the tailings pile and the former milling operation. EPA considered five cleanup remedies for this unit. The estimated cost of the five remedies ranged from about $1.6 million to approximately $2.3 billion. The remedy chosen for the site consisted of constructing a multilayered cap of soil and other materials over the tailings pile and repairing a wetland area on the site, at an estimated cost of about $54 million. The wetland area was rehabilitated by removing contaminated soil from the wetland, placing the soil on the tailings pile, and contouring and planting vegetation in the wetland. (See fig. 7.) Excluding a "no further action" remedy, which was determined not to be protective of human health and the environment, the chosen remedy was the second least expensive one EPA considered. The other remedies considered included using controls, such as land-use restrictions and dust suppression technologies, to limit exposure to the contamination; transporting tailings off-site; or mixing soil with a chemical compound to immobilize the contamination and prevent it from leaching into groundwater.

Figure 7: Cap and Wetland Area at the Sharon Steel Site

View of cap



View of wetland area

At the second operable unit—the properties that had become contaminated by wind-blown tailings—EPA considered five remedies ranging in cost from about $1.4 million to $98 million. The chosen remedy consisted of removing contaminated soil with lead concentrations of 500 ppm or more and arsenic concentrations of 70 ppm or more from the properties and placing it on the tailings pile at the first operable unit at an estimated cost of $23 million. Excluding a "no further action" remedy, which EPA

determined would do nothing to limit exposure to contaminants, the chosen remedy was the second least expensive one considered, given the estimates available at the time. The other remedies considered included constructing a cap over soil on contaminated properties or adding chemicals to soil to prevent contaminants from moving into groundwater.

In addition to these two remedial actions, EPA oversaw three removal actions at the site. Under the first removal action, a fence was constructed around the site, and a chemical was sprayed on the tailings pile to stabilize it and reduce the amount of tailings blown by the wind. During the second removal action, chemicals were removed from buildings left on the site. A third removal action was conducted to demolish buildings on the site.

EPA entered into a cooperative agreement with the Utah Department of Environmental Quality (a state environmental agency), under which the state oversaw the management of the cleanup actions at the site. EPA provided the state with funds to manage these actions and pay contractors to perform the cleanup work. EPA obtained the funds it paid to the state from a settlement entered into with responsible parties at the site.

The state entered into contracts with private firms to conduct the remedies. At the first operable unit, the state used a type of fixed-price contract under which the contractor charged the state at an agreed-upon rate per unit of work. For example, the contractor charged the state a price per cubic yard of soil excavated. At the second operable unit, the state used fixed-price contracts under which several contractors charged the state lump sum amounts to conduct cleanup actions.

Table 5 summarizes the major events that occurred during the site's cleanup.

Table 5: Major Events in the Cleanup of the Sharon Steel Site

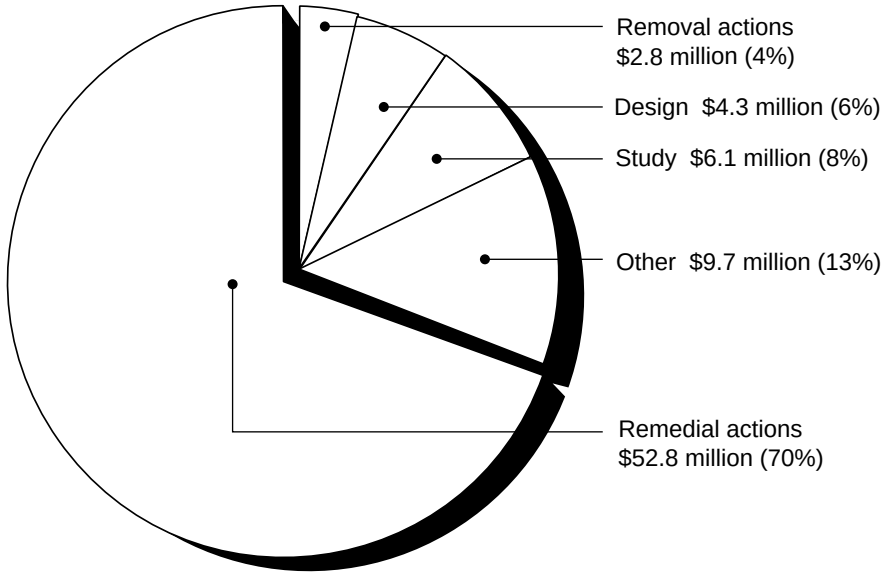
Date	Event
Dec. 1984	EPA begins the remedial investigation/feasibility study at the site.
Jan. 1989	The first removal action is started—excavating tailings, erecting a fence around the site, and stabilizing the tailings pile.
Aug. 1990	EPA places the site on the National Priorities List.
Sept. 1990	A record of decision is issued for the second operable unit—residential and other properties.
Mar. 1991	The second removal action is started—removing chemicals located in buildings on the site.
Oct. 1991	The remedial action begins at the second operable unit—residential and commercial properties.
Sept. 1992	The third removal action—demolition of buildings on-site—begins.
Dec. 1993	A record of decision is signed for the tailings pile and milling area (first operable unit).
June 1995	The remedial action begins at the first operable unit.
Oct. 1998	The remedial action for the second operable unit is completed.
Mar. 1999	The remedial action for the first operable unit is completed.

Cleanup Costs and Major Components

Through May 1999, EPA spent $75.8 million on the Sharon Steel site's cleanup. About 70 percent of this amount ($52.8 million) was spent on remedial actions at the site, and 4 percent ($2.8) was spent on removal actions as shown in figure 8. Of the funds spent on remedial actions, about $49 million was paid to contractors to conduct remedial action work and about $4 million was paid to the state of Utah to oversee the management of the cleanup and to the Bureau of Reclamation[1] to oversee the contractors and other work related to the remedial actions. EPA entered into a settlement with responsible parties—former owners and operators of the site—under which these parties paid funds towards the cost of cleaning up the site. According to the EPA remedial project manager for the site, the majority of the costs of the cleanup of the Sharon Steel site were paid out of the settlement.

[1]The Bureau of Reclamation, an agency within the Department of the Interior, manages, develops, and protects water and related resources.

Figure 8: Federal Expenditures at the Sharon Steel Superfund Site



Note: Percentages do not add up to 100 due to rounding.

Source: GAO's analysis of EPA data.

We were unable to determine what portion of the prime remedial action contractors' costs was attributable to physical cleanup at the site. This information was unavailable because the fixed-price contracts used to accomplish remedial action work at the site did not require the prime contractors to break down their costs.

Contractors at the two operable units received a total of about $49 million for remedial action work. The cost of the remedial action for the first operable unit—the tailings pile and milling area—was $29.6 million. A cap was constructed over the tailings pile to prevent further airborne spread of contaminants and keep rainwater from seeping through the pile and then contaminating groundwater. To construct the cap, layers of dirt and other materials were placed on top of the tailings pile. One layer of the cap, designed to be as protective as 2 feet of clay, consisted of over 7.3 million square feet of material and took 3 months to install. Another layer, a flexible liner, consisted of 6.7 million square feet of material. The cap's materials and installation cost $17.9 million. In addition, at least 2.3 million cubic yards of tailings and contaminated soil were excavated at the first operable unit. The cost of this work and of spraying water to reduce dust

and compact soil, was $7.6 million. Other costs were incurred at the operable unit to repair wetlands, construct an interceptor trench to capture rainwater and guide it away from the tailings pile, and construct monitoring wells.

The total cost of the remedial action work at the second operable unit was about $19.6 million. This operable unit consisted of about 600 properties surrounding the tailings pile and milling area that were contaminated with windblown tailings. To clean up these properties, contractors removed soil contaminated with lead in concentrations of over 500 ppm and soils with arsenic in concentrations of over 70 ppm. Contractors removed a total of about 188,800 cubic yards of soil from the properties, replaced it with clean soil, and relandscaped the area. The contaminated soil was placed at the first operable unit to be capped.

Significant Cost Changes and Other Remedy Implementation Issues

The $49.2 million paid to contractors for implementing the remedial action at both operable units of the Sharon Steel site was about 15 percent greater than the $42.7 million estimate originally agreed to by the state and the contractors. Most of this increase was attributable to increases in the cost of work at the first operable unit, including the cap's construction. Utah entered into a contract with the contractor, Ogden Remediation Services Company, Incorporated, to construct the cap for about $24 million. While the cleanup work was being done, the state and the contractor negotiated revisions to the contract that increased the cost of the work by a net amount of $5.6 million (a 23.5-percent increase at the first operable unit). Two of the revisions—for increases of $2 million and $3.6 million—accounted for most of the cost increases at the operable unit.

According to state officials, the $2 million cost increase was due primarily to a need for more water to control dust and compact soil. Originally, the Bureau of Reclamation, which conducted the design and oversight work at the site, estimated that about 2.5 million gallons would be needed. The actual amount needed—71 million gallons—was nearly 30 times greater than originally estimated. According to Utah officials, the state would not have been able to pay for the additional water at the original price per gallon. Through negotiations, the price was reduced to a level that the state could afford to pay.

The $3.6 million cost increase occurred because the quantities of various materials used at the site were higher than estimated. For example, according to state officials, the contractor needed more earth to mix with

or cover the tailings. In this instance, the price the contractor charged per unit of earth moved did not change, and the state was required to pay the full additional cost.

The current owner of the first operable unit at the site had concerns about the 500-ppm cleanup standard for lead in soil at the Sharon Steel site because other nearby Superfund sites had been cleaned up to less stringent standards. Although the owner had not estimated how much the cleanup of the second operable unit would have cost if the cleanup standard for lead had been less stringent, he noted that the 500-ppm standard entailed cleanups of more properties and, therefore, higher costs. According to EPA, the 500-ppm level was consistent with the scientific model it uses to determine the safe level of lead in soil.

According to state officials, the contractor that conducted work at the first operable unit performed very well, and the contractors that worked at the second operable unit met the state's minimum performance standards or performed well.

Current Status of Cleanup

All planned cleanup work has been completed at the Sharon Steel site. EPA and the state of Utah have determined that the cleanup remedies at the site are operational and functional. However, operations and maintenance work remains. This work includes periodically examining the soil layer in the cap, drain systems, fences, and monitoring wells, as well as mowing the area and controlling weeds. State officials estimate that operations and maintenance will cost $50,000 to $100,000 per year.

Currently, there are no firm plans for redeveloping the site for future use. According to state officials, development options are limited at this site, because a development plan for the site was not created before the remedy was constructed. The state did take some actions, such as evening out the level of the cap, so the site could better accommodate redevelopment. The owner of the first operable unit noted that, in its current state, the site is not suitable for some redevelopment options, such as those that require large buildings. Some redevelopment proposals the owner has received would require additional dirt to be placed on the site to accommodate underground drainage systems.

Enforcement and Cost Recovery Issues

EPA entered into a settlement with the responsible parties at two Superfund sites—Sharon Steel and a nearby site called Midvale Slag—to pay funds toward the cleanup of the sites. Under this settlement, the responsible parties—former owners and operators of the sites—paid EPA $62 million for cleanup actions. Relying on its initial estimate of the work needed at the Midvale Slag site after the settlement was reached, EPA reserved $5 million of the settlement funds for use at the Midvale Slag site and allocated the remainder for the Sharon Steel site.

Summary of Remedial Action Work at the United Creosoting Superfund Site

Background

The United Creosoting Superfund site is located in Conroe, Texas, about 40 miles north of Houston, and is approximately 100 acres in size. It operated as a wood-preserving facility from 1946 until 1972, where pentachlorophenol (PCP) and creosote were applied under pressure to formed lumber, such as telephone poles and railroad ties. During the treatment process, the facility became scarred by the black, oily treatment chemicals, and the ground was contaminated when wastewater from rinsing the pressure cylinders was routed to two waste ponds located on-site. After the facility was closed in 1972, the site was redeveloped for light industrial use, and a residential area was built adjacent to the site.

In 1980, the county excavated soil from the site and used it as fill along various roads in the area. Afterwards, citizens living near these roads complained of headaches, burns, respiratory problems, and damage to the vegetation. Subsequent investigations revealed that as a result of the wood treatment operations, the soil at the site was contaminated with PCP, polycyclic aromatic hydrocarbons (PAH), and to a lesser extent, chlorinated dioxins. Many of the residential properties adjacent to the treatment facility were also contaminated with these chemicals, possibly from wastewater runoff or property redevelopment activities. The possibility of human exposure to these chemicals, whether through ingestion or contact, posed a significant health threat. All of the chemicals are thought to be human carcinogens, and exposure to PAHs can irritate the eyes and skin. PCP is extremely toxic, potentially leading to circulatory system damage and heart failure even in small doses.

In August 1982, the Texas Natural Resources Conservation Commission, a state environmental agency, referred the United Creosoting site to EPA as a candidate for the National Priorities List. EPA proposed the site for the National Priorities List in September 1983 and directed the owner of the industrial portion of the site to conduct an immediate response action, regrading soil and diverting water from the residential area, capping the soil with a synthetic membrane and clay, and restricting access to the site. EPA entered into a cooperative agreement with the state in 1984 that made the state responsible for contracting for, and providing day-to-day oversight of, the site study and remedial action. The state contracted with various private entities to conduct this work. Roy F. Weston, Inc. (Weston), was chosen to conduct the remedial investigation and feasibility study. Weston's May 1986 final investigation report substantiated the presence of PCP, PAHs, and dioxin compounds and estimated that about 115,000 tons of soil required remediation.[1]

In a 1986 record of decision, EPA selected the following cleanup remedies for the site: (1) purchase and demolition of seven residential properties adjacent to the waste pond area, (2) excavation and consolidation of residential property soils contaminated above health-based levels, (3) construction of a temporary cap over the pond area, and (4) natural attenuation of the groundwater contamination. EPA decided to defer a decision on how to clean up soil on the site. At that time, EPA's rules required dioxin-contaminated soil to be incinerated prior to disposal, and no off-site facility had a permit to incinerate this type of waste. On-site incineration was not considered feasible because of nearby residences. EPA decided to evaluate the feasibility of using innovative technologies for treating the contaminated soil.

EPA issued a second record of decision in 1989, proposing a permanent remedy for the soil that would use critical fluid extraction, an approach that uses a chemical process to separate contaminants from soil. The treated soil would then be returned to the industrial site. The cost of this approach, estimated to be $22 million, was in the middle of the costs for the five remedies considered, which ranged from $2 million to $190 million. The other remedies included building a cap over the untreated soil to prevent human exposure, incinerating and replacing soil, treating the soil

[1]The report estimated about 72,000 cubic yards of contaminated soil. This figure was converted to 115,000 tons by applying Weston's conversion factor of about 1.6 tons per cubic yard.

with microbes that would break down the contaminants, and excavating soil for incineration off-site.

As discussed later in this appendix, the critical fluid extraction technology proved ineffective and was abandoned. When another study of the site determined that 30,000 tons of soil—instead of 115,000 tons as originally estimated—needed to be addressed and regulatory changes allowed soil containing dioxin to be disposed of on land, EPA amended the 1989 record of decision to allow for excavating and disposing of the soil off-site. This remedy was completed in August 1999.

Table 6 summarizes the major events at the site since it was added to the National Priorities List.

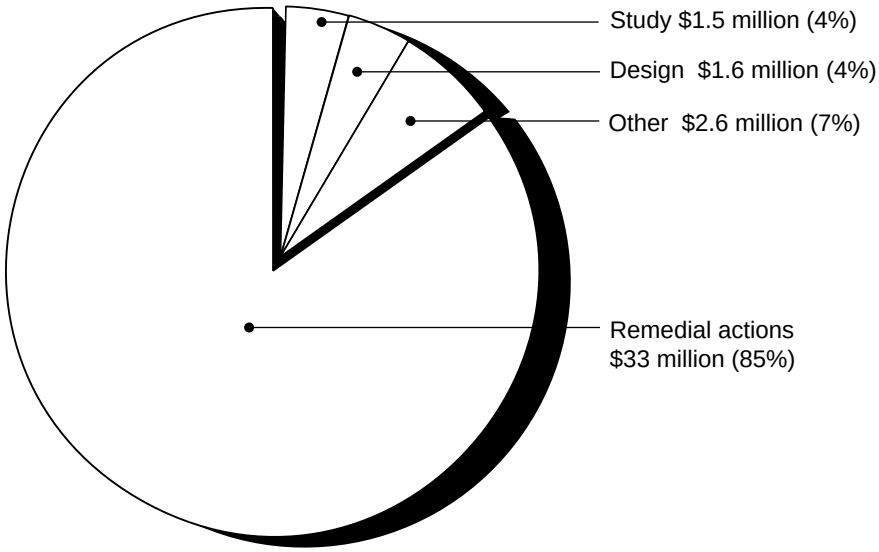
Table 6: Major Events in the Cleanup of the United Creosoting Site

Date	Event
Sept. 1983	EPA proposes the site for the National Priorities List
Dec. 1984	The remedial investigation is begun to estimate the extent and magnitude of the contamination.
Sept. 1986	EPA issues a record of decision for a temporary remedy.
Sept. 1989	EPA issues a second record of decision, calling for the use of fluid extraction to separate and remove contaminants from soil.
Oct. 1990	Remedial action work on the residential properties begins.
Jan. 1993	Remediation of these residential properties is considered substantially complete.
Dec. 1994	Remedial action—fluid extraction—begins on the industrial property
Feb. 1998	The contract for fluid extraction is terminated for failure to perform.
Sept. 1998	EPA amends the record of decision to revise the remedy for the industrial site.
Aug. 1999	All remedial action at the site is completed.

Cleanup Costs and Major Components

As of May 31, 1999, about $38.7 million in federal funds had been spent at the United Creosoting site. As figure 9 illustrates, about $33 million (85 percent) went to the remedial action contractors that implemented the cleanup remedy.

Figure 9: Federal Expenditures at the United Creosoting Superfund Site



Note: The cost of removals which is less than 1 percent of EPA's total spending is included in remedial actions.

Source: GAO's analysis of EPA data.

Although EPA's financial reporting system indicated that $33 million had been spent on remedial action costs as of May 1999, as of August 1999, remedial action costs had grown to $40.9 million. About $33 million (81 percent) of this amount went to contractors generally associated with physical cleanup activities. The other $7.9 million (19 percent) went to the engineering and oversight contractor and to the Texas Natural Resources Conservation Commission (a state environmental agency), both of which performed oversight and technical functions but did not generally do on-site cleanup.

Remedial action at the United Creosoting site occurred in three major phases.[2] First, EPA and the state addressed the contaminated residential properties, incurring costs of about $1.8 million to purchase 7 contaminated residential properties and relocate the residents of 61 properties to rental housing for about 6 months. In addition, the state contracted with a private firm—Qualtec, Inc.—to clean up the

[2]The dollar figures for these remedial action components do not include about $700,000 paid to the Texas Natural Resource Conservation Commission for oversight and management.

contaminated residential properties. Qualtec excavated soil from these properties and moved it to the United Creosoting site, backfilled the properties with clean soil, and restored the landscaping. Excavation at some residential properties went to depths of 5 feet before contaminant concentrations were considered safe. Figure 10 illustrates the excavation work at one of these properties. The costs for Qualtec's work totaled about $2.8 million.

Figure 10: Residential Excavation Work at United Creosoting Site

Residential Yard During Excavation

Residential Yard Before Excavation

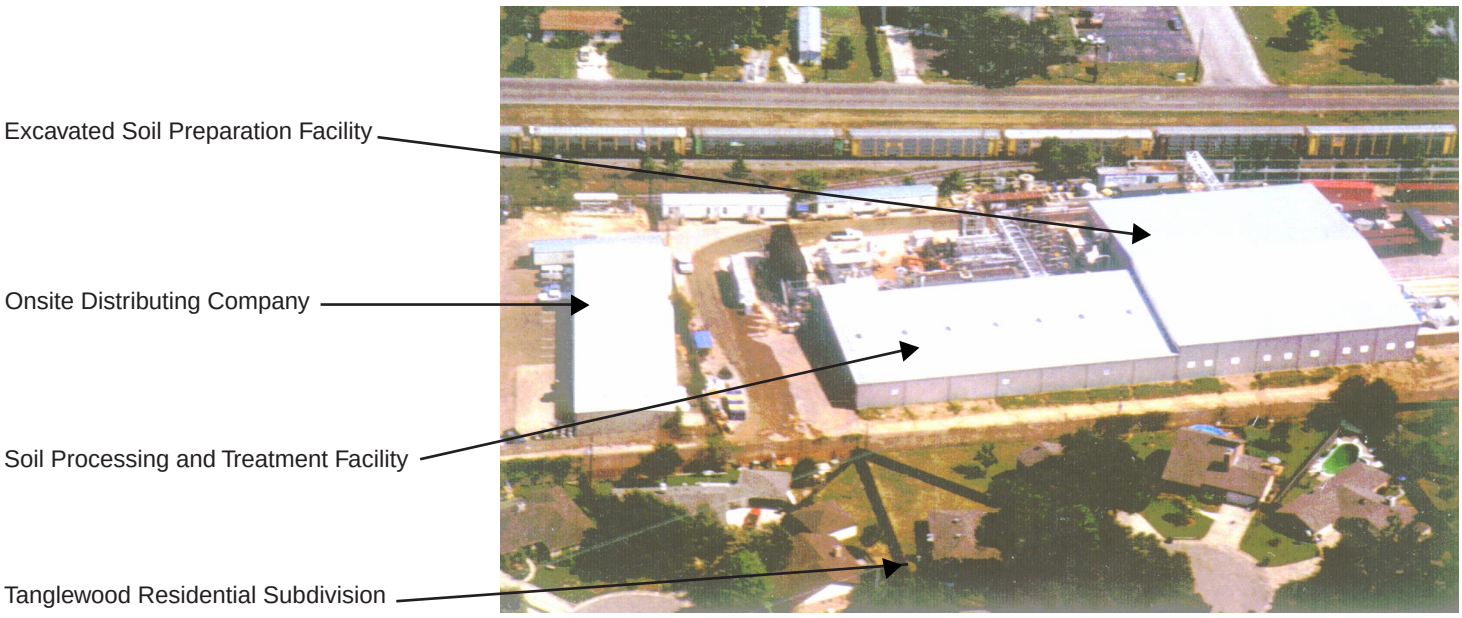
Excavation levels went to depths of five feet.

Source: Texas Natural Resources Conservation Commission

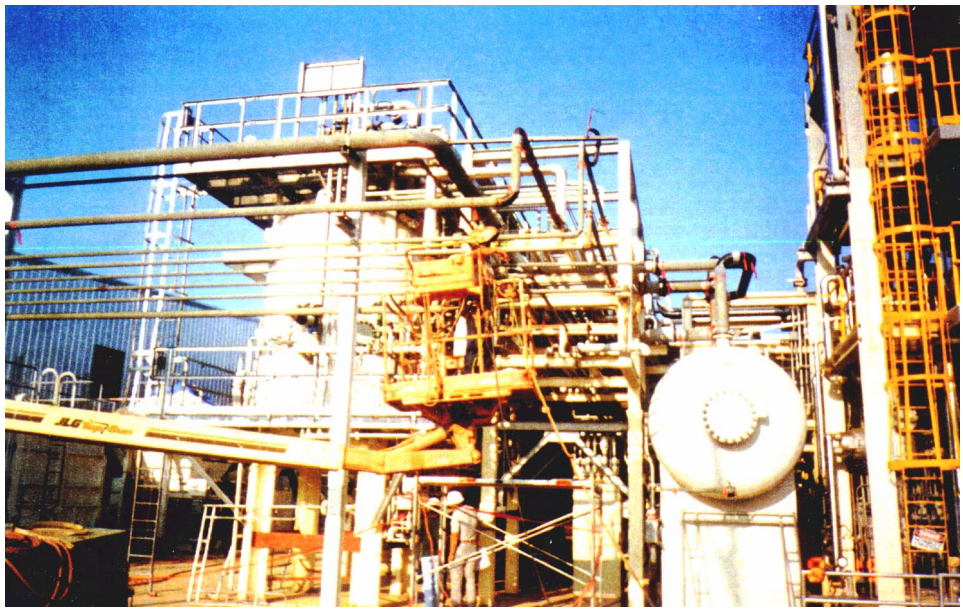
The second major phase included cleaning up the contaminated soil at the industrial property using the critical fluid extraction technology. The total costs of this phase amounted to about $30.2 million and can be broken down into several major components. First, the state contracted with CF Environmental Corporation, the firm that developed the treatment technology, to construct and operate the treatment plant. The total cost of designing the facility, fabricating the equipment, and erecting the plant was about $12.6 million. Figure 11 presents both aerial and close-up views of the completed treatment plant. The facility was expected to clean about 115,000 tons of contaminated soil, but after more than a year of repeated efforts, it proved unable to clean soil in the volumes required, and the state terminated the contract. The total cost of the contractor's efforts, including the $12.6 million spent for the plant, was about $14.1 million. The state had also contracted with another firm—Anderson Columbia Environmental—to excavate contaminated soil and deliver it to the treatment facility. Because the treatment facility could not process the contaminated soil in the volumes expected, Anderson was substantially idle during much of the 10-month period that CF Environmental tried to operate its facility. Nonetheless, the state was contractually obligated to pay Anderson Columbia Environmental for its work crew while the crew was on stand-by

status. The total costs for working and standing by amounted to about $11.2 million. In addition, Weston was paid about $4.7 million for its engineering and site management efforts during this phase of the remedial work.

Figure 11: Soil Treatment Plant at United Creosoting Site



Chemical Extraction Plant



Chemical Extraction Plant

View From North to South End of Processing Plant

Source: Texas Natural Resources Conservation Commission.

The third major phase of the remedial action occurred after the state terminated the contract for the treatment facility and a follow-up site study revealed that the quantity of contaminated soil at the site (about 30,000 tons) was much smaller than originally estimated (115,000 tons). This phase involved the excavn and off-site disposal of contaminated soils from the industrial facility, an approach that became (1) possible because of a regulatory change and (2) financially feasible with a smaller volume of contaminated soil. The state, in January 1999, competitively awarded a lump-sum contract to Remedial Construction Services, Inc. (ReCon), for about $4.7 million. There was one amendment to the contract, valued at about $340,000, which reflected negotiated increases in the original estimate for several required tasks that the state had omitted in the original contract. The total costs for excavation and removal under this third phase was $5.1 million.

Significant Cost Changes and Other Remedy Implementation Issues

The United Creosoting site was cleaned up for less than the estimated cost. The total estimated cost of the cleanup was about $45.2 million, or $4.3 million more than the cost of the cleanup as of August 1999, then about $40.9 million. However, the total estimated cost of the fluid extraction remedy was $36.5 million. If EPA had obtained better information about the extent of the site's contamination when it selected the extraction treatment remedy, the site's total estimated cleanup cost would likely have been much lower than $45.2 million. Furthermore, if the extraction remedy had been terminated sooner, the cost of implementing the failed remedy would have been lower.

Overestimate of Contaminated Soil Quantities May Have Increased Project's Costs

EPA's selection in 1989 of the critical fluid extraction technology was based on the assumption that 115,000 tons of contaminated soil would have to be cleaned. This assumption, derived from the remedial investigation and feasibility studies that Weston conducted at a cost of $1 million from 1984 to July 1990, proved to be greatly overstated. While the extraction remedy was being implemented, the state of Texas and EPA directed Weston to conduct additional studies of soil contamination after testing showed that supposedly contaminated soil was not contaminated. These studies concluded that about 30,000 tons of contaminated soil would require excavation—about one-fourth as much as estimated earlier. According to Weston, the original estimate was based on a study that used fewer samples per volume of soil than the later studies. Because the later studies included more samples per unit of soil, they produced a more detailed picture of the actual level of contamination. According to Weston, its earlier actions, which were approved by Texas and EPA, were consistent with the policies, guidelines and procedures used to investigate cleanup sites and its estimates of soil volume were sound, given the data available at that time. According to the state's project manager, if the second estimate had been available at the start, the same remedy might have been selected but a smaller, less expensive treatment facility might have been constructed to clean the soil at a slower pace.

An Earlier Decision to Terminate the Failed Remedy Could Have Lowered Costs

Under its contract with the state, CF Environmental was required to clean about 6,800 tons of soil per month. However, the facility was never able to clean soil at this rate. During the 10 months from April 1997 to February 1998, CF Environmental successfully treated only about 8,700 tons of soil. Even though project officials believed that the treatment remedy was probably irreparably flawed, the state gave the contractor a series of extensions and contract amendments.

As early as May 1997, the state's project manager and construction engineer concluded that CF Environmental would not be able to significantly improve the system's performance. The state considered terminating the contract but did not do so because the contractor strongly asserted that its problems could be overcome and the Executive Director of the Texas Natural Resources Conservation Commission urged that the contractor be allowed to continue its efforts to resolve the problems. The system continued to operate erratically through 1997, with no significant improvement. In January 1998, the Executive Director recommended to the state's environmental commissioners that the process continue. They tabled action pending public comment. During an open meeting, the public and local government officials voiced overwhelming support for terminating the remedy. Soon thereafter, the state commenced actions to terminate the contracts with CF Environmental and Anderson Columbia Environmental. From May 1997 through June 1998, the state paid these contractors a total of about $6.3 million, much of which might have been avoided if the contracts had been terminated earlier.[3]

According to EPA officials, under the terms of the agency's cooperative agreement with the state, the state and EPA project managers meet continuously to monitor technical and contractual issues related to the site. However, because EPA is not a party to contracts between the state and cleanup contractors, it does not get involved in day-to-day contract management decisions. According to the Texas project manager, EPA decided to take a hands-off approach and leave the decision on contract termination up to the state. According to EPA and state officials, there was reluctance to terminating the contracts because innovative technologies were highly favored at the time and they did not want to terminate the contracts too quickly in light of CF Environmental's strong assertions that solutions to the major problems were imminent.

Current Status of Cleanup

Under the third phase of the remedial action at the United Creosoting site, contaminated soil was excavated and transported off-site for disposal as required by May 12, 1999. The Texas Natural Resources Conservation Commission then issued a certificate of substantial completion in June 1999. In total, about 29,754 tons of contaminated soil were excavated and hauled off-site in about 1,400 dump truck loads. All cleanup activities were

[3]According to a state official, contract termination costs and payments for the limited work that was done would still have been incurred.

completed as of August 1999, and there were no associated operations and maintenance costs.

Enforcement and Cost Recovery Issues

Because there were no viable responsible parties for this site, EPA and the state assumed all cleanup costs.

Comments From the Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 10 2000

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

Mr. David G. Wood
Associate Director, Environmental Protection Issues
General Accounting Office
Washington, DC 20548

Dear Mr. Wood,

We are enclosing our comments on your recent GAO report "Superfund: Analysis of Costs at Five Superfund Sites", (GAO/RCED-00-22). We offer the following comments to improve the accuracy of the report. The first discussion involves the approaches used to address lead risks under TSCA 403 and Superfund. Second, we are concerned with including sensitive information which may be enforcement confidential. In addition, we include detailed comments in the enclosure relating to the description of events for the NL Industries/Taracorp Superfund Site.

Addressing Lead Risks

The discussion on page 9 regarding a description of the approaches used to address lead risks under TSCA 403 and Superfund states that "Depending on site conditions, this requirement can mandate a cleanup to 500 ppm."

There are two issues with this statement. First, the identification of a lower limit for cleanups here is not related to permanent cleanups, but to protection of health. Second, cleanup levels as low as 400 ppm have been selected using our current Superfund lead guidance, which is available on our Homepage (http://www.epa.gov/superfund/programs/lead/prods.htm).

Regarding the health impact of soil lead levels between 400 and 2,000 ppm, both the Office of Pollution Prevention and Toxic Substances and the Office of Solid Waste and Emergency Response jointly issued a memorandum (December 1, 1998) concluding that there is no difference on the issue of assessing health impacts. The 2000 ppm level is used as a trigger to require cleanup under the TSCA 403 program. The TSCA 403 proposal also identifies a lower contamination level of 400 ppm, which is consistent with the screening level of 400 ppm used by the Superfund program. The 403 proposal recommends a number of actions that are appropriate for residential housing if soil lead levels are between 400 and 2000 ppm. The recommendations

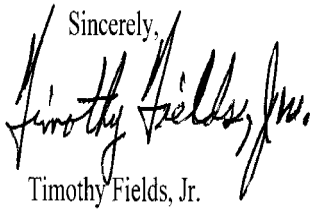
for "lower cost" actions are expected to be taken by homeowners that may not have the resources to permanently address the lead problems that they face. The actual cost to implementing these "lower cost" actions may, in the long term, be more expensive than permanent remedies, for which the Superfund program has a preference.

Discussion of NL Industries Site

Second, in the description of the NL Industries/Taracorp Superfund Site on pages 28-35, we are concerned that some information may be considered enforcement confidential and should be removed from the report. Finally, we recommend modifications, as suggested in the enclosure, to improve the accuracy of the site history included in this report.

Thank you for the opportunity to comment on this report. If you have any questions, please contact Carrie Hawkins at (202) 260-0137.

Sincerely,



Timothy Fields, Jr.
Assistant Administrator

Enclosure

GAO Contacts and Staff Acknowledgments

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Acknowledgments

In addition to those named above, Willie Bailey, Joseph Cook, and Stephen Jones made key contributions to this report.

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