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United States Government Accountability Office
Washington, DC 20548

February 18, 2011

The Honorable James M. Inhofe
Ranking Member
Committee on Environment and Public Works
United States Senate

Subject: *Superfund: Information on the Nature and Costs of Cleanup Activities at Three Landfills in the Gulf Coast Region*

Dear Senator Inhofe:

The Environmental Protection Agency (EPA) estimates that one in four Americans lives within 3 miles of a contaminated site, many of which pose serious risks to human health and the environment. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) provided the federal government with authority to respond to releases or threatened releases of hazardous substances and created a trust fund to provide for certain cleanup activities. Under CERCLA, EPA established the Superfund program to address the threats that contaminated sites pose. Although EPA has paid for the cleanup of many of these sites through the Superfund program, funding for these cleanups has diminished in recent years. In 2010, we reported that EPA's estimated costs to clean up existing contaminated sites exceed the Superfund program's current funding levels and that some sites have not received sufficient funding for cleanup to proceed in the most cost-efficient manner.[1] Additionally, in July 2009, we reported that EPA does not collect sufficient information on the cost of cleanup activities at Superfund sites and recommended, among other things, that EPA assess and improve the data it collects on the status and cost of cleanups.[2]

EPA coordinates the cleanup of Superfund sites by identifying sites potentially requiring cleanup action and placing eligible sites on its National Priorities List (NPL). EPA may compel the parties responsible for contaminating these sites to clean them up, or the agency may, using resources from the trust fund established by CERCLA, conduct cleanups itself and seek reimbursement from responsible parties. In some cases, EPA may not be able to obtain reimbursement because the agency cannot identify a responsible party or the responsible party or parties may be insolvent or may no longer exist.

[1]GAO, *Superfund: EPA's Estimated Costs to Remediate Existing Sites Exceed Current Funding Levels, and More Sites Are Expected to Be Added to the National Priorities List*, GAO-10-380 (Washington, D.C.: May 6, 2010).

[2]GAO, *Superfund: Litigation Has Decreased and EPA Needs Better Information on Site Cleanup and Cost Issues to Estimate Future Program Funding Requirements*, GAO-09-656 (Washington, D.C.: July 15, 2009). In July 2010, EPA officials said that they were studying how best to improve the comprehensiveness and reliability of their Superfund data and were considering options for aggregating and communicating Superfund cost data.

One category of contaminated sites—landfills and other waste disposal facilities—made up more than one-third of the 1,397 sites EPA placed on the NPL from 1983 through 2007, and EPA's expenditures at these 511 sites totaled about $3.6 billion through fiscal year 2007.[3] According to EPA, landfill sites on the NPL generally share similar characteristics and present similar threats to the environment. For example, these sites generally exhibit contamination in various media, such as soil, surface water, or groundwater, and many landfills at Superfund sites contain hazardous waste that may contaminate nearby soil or water.

Further, some have argued that landfills used for the disposal of debris created by disasters may also contain hazardous waste that could have long-term, negative environmental impacts. Consequently, concerns have been raised by various studies and environmental groups about the potential for such landfills to become Superfund sites. For instance, in the aftermath of Hurricane Katrina, a Louisiana emergency order authorized some potentially hazardous materials to be disposed of in landfills permitted to receive construction and demolition debris rather than in landfills with liners approved for such waste. Studies by a Louisiana State University research institute and an environmental engineering firm found that these categories of waste can introduce hazardous materials into landfills, increasing the likelihood of pollution.[4]

In this context, you asked us to review issues related to the cost to clean up the Agriculture Street Landfill Superfund site, which received debris from Hurricane Betsy in 1965, and other Superfund sites involving landfills in the Gulf Coast region where cleanup has been completed. Our objectives were to determine (1) what is known about the nature and costs of the cleanup activities at Superfund landfill sites and (2) the costs to clean up the Agriculture Street Landfill site and two additional selected Superfund landfill sites in the Gulf Coast region, and the key factors that influenced these costs.

To determine what is known about the nature and costs of the cleanup activities at Superfund landfill sites, we reviewed relevant statutes and EPA regulations, guidance, and studies. We also interviewed EPA officials and responsible parties' representatives. To determine the costs to clean up the three Superfund landfill sites in the Gulf Coast region and the key factors that influenced these costs, we first obtained data from EPA's Comprehensive Environmental Response, Compensation, and Liability Information System, and we also interviewed EPA officials to identify landfills (1) that are located within 10 miles of the Gulf of Mexico, (2) that have reached construction complete status or have been deleted from the NPL, and (3) for which cleanup cost data are available. In addition to the Agriculture Street Landfill in Louisiana, the Beulah and Taylor Road landfills in Florida met these criteria. Second, we obtained cleanup cost data from EPA and responsible parties and analyzed them to determine the total cleanup costs and the key factors that influenced those costs at each site. We also reviewed relevant documentation and interviewed EPA and responsible party officials to assess the reliability of the cleanup cost data for each site. We tried to obtain supporting explanations and documentation to verify these data but were unable to obtain complete information for all three sites. Consequently, we have varying confidence in the reliability of cost data from the three sites: while we believe that most of the data components are sufficiently reliable for the purposes of this report, we were unable to fully determine the reliability of some components of the Taylor Road Landfill cleanup cost data. Nevertheless, because these are the only available data, we included them in our estimated cleanup costs at the site. Finally, we interviewed EPA officials

[3]These numbers do not include NPL sites that are owned and operated by federal agencies, such as the Departments of Defense, Energy, and the Interior.

[4]EPA efforts to manage the disposition of hurricane debris included establishing a plan to segregate, collect, and properly dispose of debris such as household hazardous waste and electronic waste; working with local officials to establish collection and drop-off sites for debris that may contain hazardous materials; and establishing debris staging areas for sorting and categorizing household hazardous waste that EPA and its contractors had collected.

and responsible parties' representatives about the history, contamination, cleanup activities completed, and current status of each of the three landfills, and we visited each site. See enclosure I for a more detailed description of our scope and methodology.

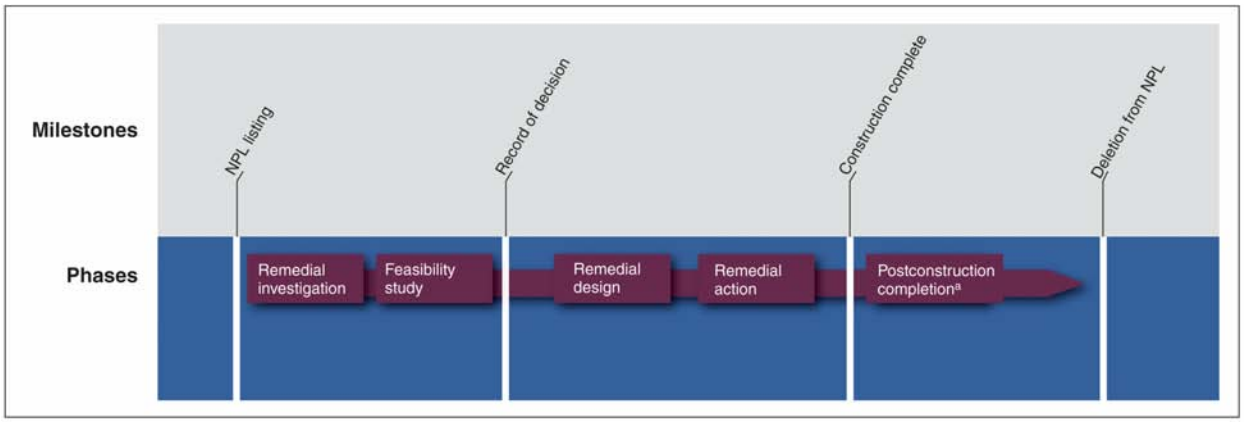
We conducted our work from April 2010 to February 2011 in accordance with all sections of GAO's Quality Assurance Framework that are relevant to our objectives. The framework requires that we plan and perform the engagement to obtain sufficient and appropriate evidence to meet our stated objectives and to discuss any limitations in our work. We believe that the information and data obtained, and the analysis conducted, provide a reasonable basis for any findings and conclusions in this product.

Background

Under the Resource Conservation and Recovery Act of 1976, as amended, (RCRA), EPA regulates hazardous solid wastes from cradle to grave and may authorize a state's hazardous waste program to operate in lieu of the federal RCRA program. Specifically, EPA regulations provide standards for the generation; transportation; and treatment, storage, and disposal of hazardous wastes. EPA monitors compliance through, among other things, facility inspections, and may exercise a number of administrative and civil actions to bring a facility into compliance. However, under RCRA, nonhazardous solid waste is predominantly regulated by state and local governments. Specifically, states develop state solid waste programs and ensure compliance through permits and other approval systems. EPA promulgates guidelines for state solid waste management plans and has established minimum design and operating criteria for municipal solid waste disposal facilities (generally referred to as landfills). For instance, EPA regulations generally provide that landfills must comply with groundwater monitoring and other requirements. Although RCRA authorizes EPA to require facility owners or operators to address certain environmental problems at their facilities, in general, RCRA provides EPA with limited authority to address environmental problems at solid waste landfills.

When landfills and other contaminated sites release or threaten to release hazardous substances into the environment, EPA may use its authorities under CERCLA to clean up such sites under the Superfund program. Contaminated sites may result from a number of activities, including when a facility does not comply with EPA regulations or when a facility was active before RCRA was enacted in 1976. The Superfund cleanup process begins when a potentially contaminated site is discovered or EPA is notified of possible releases of hazardous substances that may threaten human health or the environment. Citizens, state agencies, and others may alert EPA to such threats. EPA uses a screening system, called the Hazard Ranking System, to numerically assess the relative potential of sites to pose a threat to human health and the environment. Those sites with sufficiently high scores are eligible for inclusion on the NPL. EPA assesses sites for possible listing on the NPL on the basis of a variety of factors, including the availability of alternative state or federal programs that may be used to clean up the site. As a matter of policy, EPA also seeks concurrence from the governor of the state in which a site is located. When EPA decides that a site warrants being listed on the NPL, the agency proposes the listing in the *Federal Register*. After a period of public comment, EPA reviews the comments and decides whether to list the site. In general, once EPA formally lists a site, it initiates a process to investigate the extent of the contamination, decide on the actions that will be taken to address contamination, and implement those actions. This process can take many years—or even decades. Figure 1 shows the process EPA typically follows, from listing a site on the NPL through deleting it from the list.

Figure 1: Milestones and Phases of Superfund Cleanups



Source: GAO analysis of EPA data.

Note: Phases of Superfund cleanups may overlap, and multiple phases may be concurrently under way at a site.

[a]Postconstruction completion includes activities such as operation and maintenance, long-term response actions, and 5-year reviews, which ensure that Superfund cleanup actions provide for the long-term protection of human health and the environment.

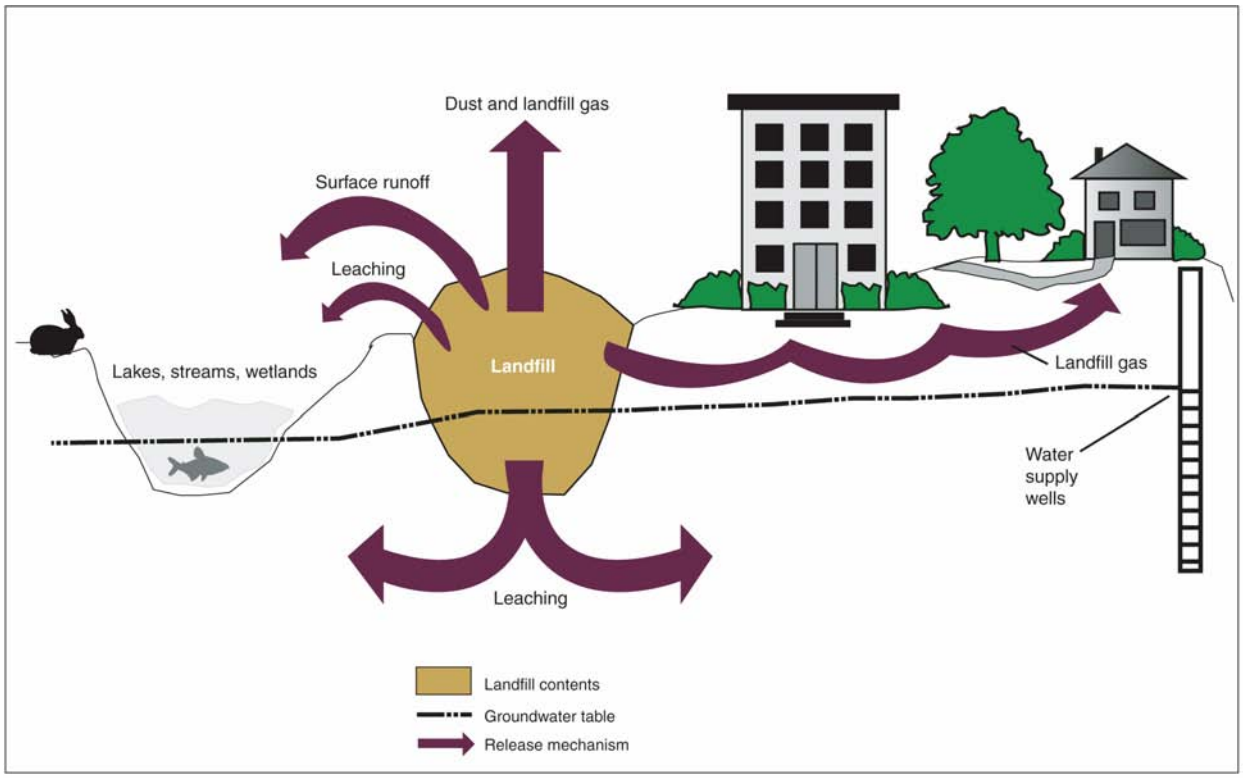
Specifically, EPA or a responsible party begins the remedial process by conducting a two-part study of the site: (1) a remedial investigation to characterize site conditions and assess the risks to human health and the environment, among other things, and (2) a feasibility study to evaluate various options to address the problems identified through the remedial investigation. The culmination of these studies, which include public participation, is a record of decision that identifies EPA's selected remedy for addressing the site's contamination and contains a cost estimate for implementing the remedy. According to EPA guidance, this cost estimate is to be within an accuracy range of minus 30 to plus 50 percent of the actual costs.[5] The selected remedy is then designed during remedial design and implemented with remedial actions when actual cleanup of the site begins. When all physical construction at a site is complete, all immediate threats have been addressed, and all long-term threats are under control, EPA generally considers the site to be construction complete. Most sites then enter into the operation and maintenance phase, when the responsible party or the state maintains the remedy and EPA ensures that the remedy continues to protect human health and the environment. However, for certain remedial actions, additional work at a site may be required after construction is completed, such as continuing groundwater restoration efforts or monitoring the site to ensure that the remedy remains protective. Eventually, when EPA and the state determine that no further site response is needed, EPA may delete the site from the NPL.

In addition to remedial actions, the Superfund program conducts removal actions—often short-term cleanups—to mitigate time-sensitive threats to human health or the environment at both NPL sites and unlisted sites. Because these actions typically address immediate threats, they may occur at NPL sites before EPA issues a record of decision that identifies its selected remedy for the site. Examples of removal actions include excavating contaminated soil, erecting a security fence, or taking abandoned drums to a proper disposal facility to prevent the release of hazardous substances into the environment. CERCLA limits EPA removal actions paid for with trust fund money to actions lasting 12 months or less and costing $2 million or less, although these limits can be exceeded if EPA determines that conditions for such an exemption are met.

[5]EPA, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, Office of Solid Waste and Emergency Response Directive 9355.0-75 (Washington, D.C., July 2000).

Landfill sites that are placed on the NPL are generally large and contain a variety of contaminants, which may interact with the environment in three main ways. First, precipitation or liquid waste in a landfill can interact with other materials in the landfill to form a liquid called leachate, which can travel through soils and into groundwater. Second, surface water, such as rainfall, can run through a landfill and carry chemicals from the landfill contents into nearby lakes, streams, or wetlands. Third, the degradation of landfill contents produces landfill gas, which generally contains methane—sometimes in potentially explosive concentrations—carbon dioxide, nitrogen, and other toxic contaminants. Figure 2 shows how landfill sites can present such threats to human health and the environment.

Figure 2: Threats Landfill Sites Can Present to Human Health and the Environment



Source: GAO analysis.

In addition, many landfills listed on the NPL began operating before the publication of RCRA regulations that govern the disposal of hazardous (1980) and nonhazardous (1979) waste. As a result, these landfills generally accepted and codisposed of nonhazardous wastes—including household yard and food waste and commercial plastics, glass, and metals—and hazardous wastes, but EPA officials said that records documenting the various materials that were disposed of in these landfills are limited. Further, according to EPA officials, these landfills generally did not meet current federal landfill requirements, such as location restrictions and the inclusion of systems and other features to prevent contamination.

Further, because the emergency nature of disaster response efforts may result in the disposal of hazardous products into landfills that are not equipped to safely receive them, concerns have been raised by academic studies as well as community and environmental groups about the potential for landfills containing disaster debris to contaminate the surrounding environment and become Superfund sites. For instance, in the aftermath of Hurricane Katrina, a Louisiana emergency order authorized some potentially hazardous materials, including furniture, carpeting, painted or stained lumber from demolished buildings, and "incidental asbestos-contaminated waste that cannot be extracted from demolition debris," to be disposed of in "construction and

demolition" debris landfills rather than in landfills with liners approved for such waste. Studies by a Louisiana State University research institute and an environmental engineering firm found that these categories of waste can introduce hazardous materials into landfills, increasing the likelihood of pollution.[6] In 2007, we also reported that EPA conducted a technical analysis of one of these landfills, the Gentilly Landfill, in response to concerns that federal agencies could become liable to pay cleanup costs if the landfill were to become a Superfund site. EPA's report concluded that there is no way to protect against Superfund liability absolutely—particularly for a landfill—and that the use of the landfill appeared to be consistent with the types and volumes of wastes for which it was designed and permitted by the state.

Cleanup Activities at Superfund Landfill Sites Depend Largely on the Nature and Extent of Contamination, and Limited Data Are Available on the Costs of These Activities

While cleanup activities at Superfund landfills depend largely on the nature and extent of the contamination at each site, these activities generally include extraction, treatment, and containment. Extraction is the removal of contaminated substances from a site. At landfill sites, extraction may involve excavating contaminated soil and other landfill contents from the site and disposing of these materials at an off-site facility that is permitted to receive such products. According to EPA, extraction is the most expensive cleanup approach used at Superfund landfill sites. Treatment is the reduction of contaminated substances at a site and involves processing contaminated media, either on- or off-site, to reduce the toxicity, mobility, or volume of contamination. For example, EPA and responsible parties may remove groundwater from a Superfund site and chemically process it to remove contaminants at an off-site facility, or they may install a system at the site to treat the contaminated water in place. While treatment is a lower-cost alternative to extraction, it is a high-cost cleanup approach. Finally, containment involves leaving contaminated media on-site and installing measures to prevent human exposure to hazardous substances. For instance, containment at a Superfund landfill site may include installing a cover over landfill contents and establishing institutional controls, such as legal access restrictions, to limit exposure to the contaminated material. Containment is generally the least expensive method of addressing Superfund landfills.

EPA selects the appropriate cleanup activities for each Superfund landfill site based on the nature and extent of contamination at the site. Generally, EPA selects extraction when low to moderate volumes of highly mobile or highly toxic contamination exist at the site.[7] For example, EPA may identify severely contaminated soil or landfill contents that must be removed from the site to eliminate threats they pose to human health and the environment. EPA generally selects treatment when low to moderate volumes of contaminated material exist in a discrete, accessible location at the site. For example, treatment may be used to clean up small bodies of surface water, including on-site ponds or lagoons, but treatment is not a practical cleanup activity for contamination in large bodies of surface water, such as rivers or streams. Containment is generally used when contaminants at the site pose a low-level, long-term threat. According to EPA guidance, containment is often the most appropriate cleanup activity for contamination at Superfund landfill sites because landfills generally cover large areas and include a variety of contaminants, which often make extraction and treatment impractical.

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[6]GAO, *Hurricane Katrina: EPA's Current and Future Environmental Protection Efforts Could Be Enhanced by Addressing Issues and Challenges Faced on the Gulf Coast*, GAO-07-651 (Washington, D.C.: June 25, 2007).

[7]EPA describes "low to moderate volumes of waste" as waste masses smaller than 100,000 cubic yards. See EPA, *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*, Office of Solid Waste and Emergency Response Directive 9355.3-11 (Washington, D.C., February 1991).

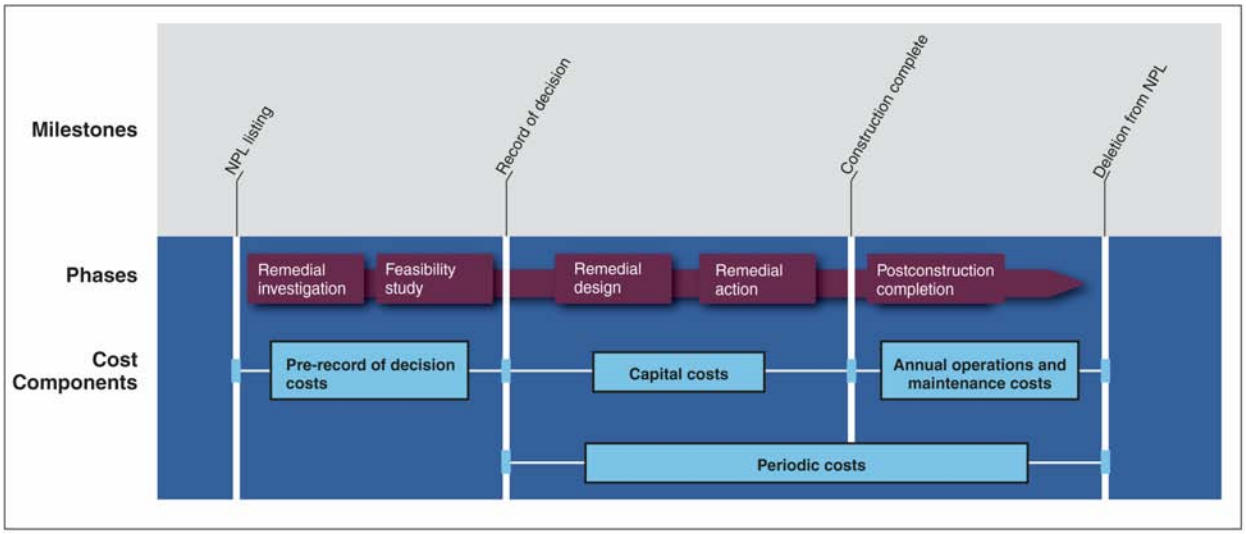
Limited data are available on the actual costs of cleanup activities conducted at Superfund landfill sites for two main reasons. First, EPA does not maintain a central tracking system for the costs of such cleanup activities. While EPA tracks its expenditures at Superfund sites, this information does not include the cost associated with each cleanup activity conducted at a site. Rather, EPA's Superfund cost information focuses on the total cost of each contract under which multiple cleanup activities may have been conducted. EPA collects and maintains this information for use as evidence of the agency's expenditures when seeking reimbursement from a responsible party at a particular site. Further, we have previously reported on weaknesses in EPA's data on the cost of cleanups at Superfund sites.[8] In 2009, we found that EPA's data on the status and cost of Superfund cleanups were not consistently comprehensive, reliable, or capable of being aggregated to provide clear program-wide information, and we recommended, among other things, that EPA assess and improve the data it collects on the status and cost of cleanups. In July 2010, EPA officials said they were studying how best to improve the comprehensiveness and reliability of their Superfund data and were considering options for aggregating cost and other data that would be of most use to the Congress as well as how to best communicate that data. Second, cost data are limited because no requirements exist for responsible parties—including private companies, states, and local governments—to maintain or disclose their cleanup costs at Superfund sites. Private companies generally consider their cleanup costs as information that they have a right to keep confidential. While state and local governments are generally required to collect cleanup cost data under public accounting standards, these standards generally do not address maintenance of the data. According to EPA officials, the agency obtains limited information on the costs of cleanup activities that responsible parties fund at Superfund sites. Specifically, EPA obtains cost information from responsible parties on (1) estimated costs to conduct the remedy selected in the record of decision, (2) annual costs to maintain the selected remedy after construction completion, and (3) the costs of any fines or payments made to the federal government.

Although cost data are limited, we identified several major components of Superfund landfill site cleanup costs: pre-record of decision costs, capital costs, annual operations and maintenance costs, and periodic costs.[9] As shown in figure 3, the major components of the costs to clean up Superfund landfill sites correspond with the phases and milestones of the Superfund cleanup process. More specifically, pre-record of decision costs are costs associated with early activities that occur before the record of decision is issued, such as the costs of certain studies and investigations as well as any removal actions that occur during this time. Capital costs are costs for activities required to implement the selected remedy. These costs include all labor, equipment, materials, and professional and technical services associated with construction activities, such as installation of a groundwater treatment system. Annual operations and maintenance costs are costs for postconstruction activities, such as soil or groundwater monitoring, that ensure or verify the continued effectiveness of the selected remedy. The costs of these activities are generally estimated on an annual basis. Finally, periodic costs are costs for activities that occur only every few years after the remedy has been selected and documented in the record of decision. Periodic costs may be incurred for either construction activities, such as equipment replacement, or periodic operations and maintenance activities, such as occasional site reviews.

[8]GAO-09-656.

[9]According to EPA guidance, capital, annual operations and maintenance, and periodic costs are the major components of the costs to construct and maintain the selected remedy for a site. See EPA Directive 9355.0-75.

Figure 3: Milestones, Phases, and Major Cost Components of Cleanups at NPL Sites



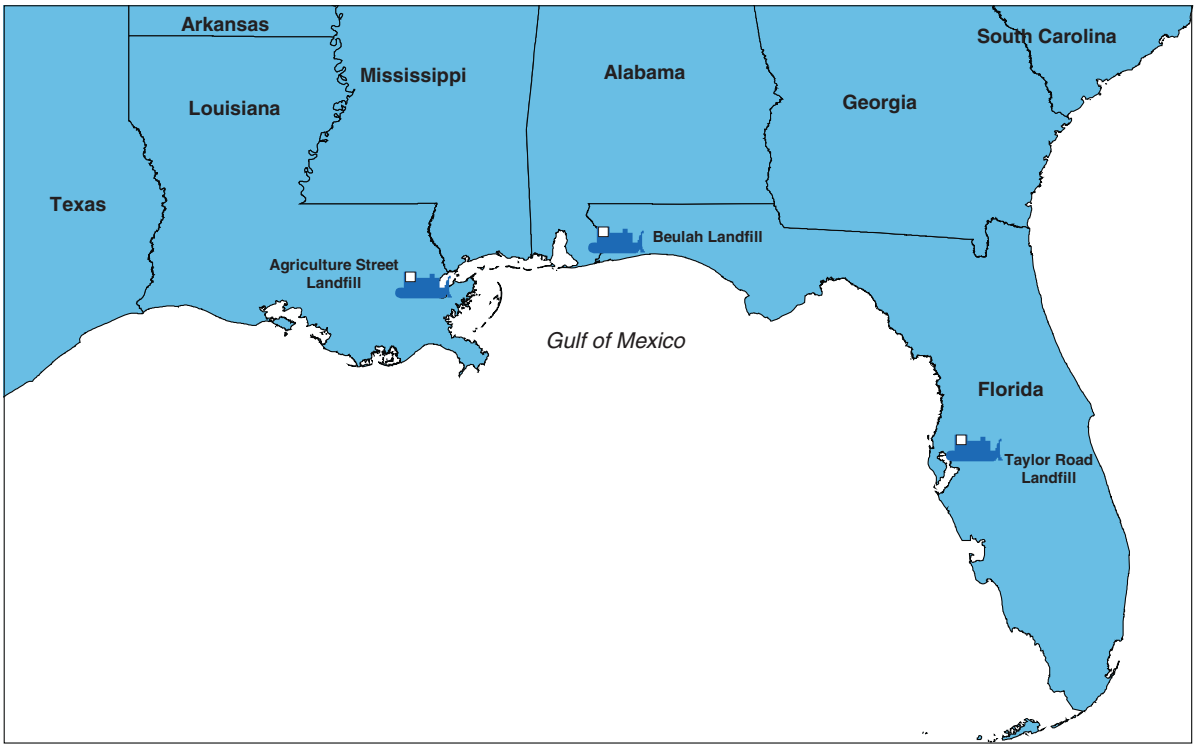
Source: GAO analysis of EPA data.

Although Available Cleanup Cost Data Are Limited, Estimated Cleanup Costs for Three Gulf Coast Superfund Landfill Sites Varied Largely on the Basis of Site-Specific Factors

While only limited cleanup cost data are available, we estimated that the costs to clean up three Superfund landfill sites in the Gulf Coast region—the Agriculture Street, Beulah, and Taylor Road landfill sites—ranged from about $13 million to about $55 million (see fig. 4).[10] This range is largely the result of differences among the sites in such factors as site geology and proximity to residential areas.

[10]Unless otherwise noted, all cleanup costs are in constant 2010 dollars. In addition, we have varying confidence in the reliability of cost data from the three sites: while we believe that most of the data components are sufficiently reliable for the purposes of this report, we were unable to fully determine the reliability of some components of the Taylor Road Landfill cleanup cost data. Nevertheless, because these are the only available data, we included them in our estimated cleanup costs at the site.

Figure 4: Locations of Three Gulf Coast Superfund Landfills



Source: MapInfo (map).

Emergency Removal Actions Represented Almost One-Half of the $55 Million Cleanup Costs at the Agriculture Street Landfill Superfund Site

EPA spent about $55 million to clean up the Agriculture Street Landfill Superfund site in New Orleans, Louisiana. Because EPA found that extensive lead contamination in soil at the site posed an immediate risk to nearby residents, the agency completed most of its cleanup activities as removal actions. We estimated that these actions—which included removing contaminated playground equipment, excavating contaminated soil, placing a landfill cap, and installing clean soil—represented approximately 50 percent of EPA's cleanup costs at the site. Available documentation shows that the remaining costs were related to litigation and community relations activities, among other things.

The City of New Orleans operated the Agriculture Street Landfill as a disposal area for household and commercial waste from about 1909 until the late 1950s. Elevations at the landfill range from 5 feet below to 10 feet above sea level, and a layer of clay serves as the base of the landfill. While little information exists regarding what early operators deposited in the landfill, available information suggests that the landfill received municipal garbage, construction debris, and incinerator ash. In addition, the area was routinely sprayed with DDT, a persistent organic chemical—and a probable human carcinogen according to EPA—from the 1940s until 1957, when the city constructed new incinerators to manage its waste and ended operations at the Agriculture Street Landfill. The landfill was reopened after Hurricane Betsy in 1965 for 1 year to receive debris from destroyed buildings and ash from municipal incinerators. In the 1970s and continuing into the late 1980s, portions of the site were developed with private and public housing units, an elementary school, a community center, a small business complex, and a recreational building. Following health concerns among residents in the area, EPA initiated investigations at the site in 1986, ultimately identifying elevated levels of lead, arsenic, and

carcinogenic polycyclic aromatic hydrocarbons.[11] Analyses of the health effects of these contaminants led EPA to place the site on the NPL in 1994.

While assessing the site for placement on the NPL, EPA initiated emergency removal actions to prevent exposure to the contaminants found at the site. Specifically, EPA installed a fence to restrict public access to an undeveloped portion of the site and removed contaminated playground equipment and soil from a children's play area located at the on-site community center. EPA's site investigations found that lead concentrations in soil at the children's play area were well above the current screening level—an EPA-defined level of contamination that is protective of public health—for lead in soil. Figure 5 shows where, prior to EPA's cleanup activities, lead concentrations existed above this screening level in surface soil at the site.

Figure 5: Lead Concentrations in Surface Soil at the Agriculture Street Landfill

Source: GAO analysis.

[11]Acute exposure to polycyclic aromatic hydrocarbons can cause red blood cell damage and may suppress immune system function.

While performing these emergency removal actions, EPA conducted additional site investigations and determined that the following cleanup activities were necessary to address remaining threats at the site: excavation of contaminated soil from residential and undeveloped areas; addition of clean soil; placement of a landfill cap and grass; and replacement of fences, driveways, and sidewalks. Additionally, EPA determined that removal actions, rather than remedial actions, were the appropriate mechanism for conducting the remaining cleanup activities at the site because contamination at the site posed an immediate risk to those living and working nearby.[12] EPA completed these cleanup activities at the Agriculture Street Landfill Superfund site in 2001 and designated the site as construction complete in 2002. In 2003 and 2008, EPA conducted reviews of the site and found that the cleanup actions were functioning as intended and that EPA's actions at the site remained protective of human health and the environment. When we met with EPA officials in September 2010, they said the agency had recently initiated the process to delete the Agriculture Street Landfill Superfund site from the NPL.

EPA officials identified the presence of a residential community on-site as a key factor affecting the Agriculture Street site's cleanup costs for three main reasons. First, human health risks are one of the major factors EPA considers when evaluating a Superfund site to determine what cleanup actions are necessary at the site, and EPA's initial investigations found that lead in the soil posed an unacceptable risk to residents and workers at the site. While EPA guidance identifies the less costly alternative of containment as the preferred remedy to address contamination at Superfund landfills, EPA concluded that excavation of the contaminated soil was necessary to protect those living and working on the site. Second, the presence of residences on-site required EPA to obtain permission from homeowners to access their properties to conduct soil tests; remove contaminated soil and replace it with a landfill cap; and add clean soil, grass, and other landscaping. According to EPA officials, some homeowners were reluctant or unwilling to allow EPA and its contractors access to their properties, and EPA incurred legal fees for activities aimed at gaining access to these properties. Finally, the presence of a residential community at the site required EPA to use removal actions to address contamination in a timely manner. According to EPA officials, because removal actions are performed before site investigations have fully identified the extent of contamination at the site, the time frames and scope of these actions often change, resulting in changes to the costs of the actions. As shown in table 1, almost 50 percent of the cleanup costs at the Agriculture Street site were related to time-critical and non-time-critical removal actions.

[12]According to EPA guidance, removal actions are typically used where a site presents a relatively time-sensitive, noncomplex problem that can and should be addressed relatively inexpensively, and remedial actions are typically used to address complex site problems that will likely require a costly, complicated response. However, decisions regarding the use of removal or remedial actions are based on site-specific issues, including time sensitivity, complexity, and cost.

Table 1: Total Estimated Costs to Clean Up Agriculture Street Landfill Superfund Site, by Major Cost Component

Major cost component	Actual cost (nominal dollars)	Adjusted cost (constant 2010 dollars)
Pre-record of decision costs		
Time-critical playground equipment removal and fence installation	$303,895	$405,840
Non-time-critical contaminated soil removal and landfill cap placement	20,981,215	25,492,749
Community relations	778,620	989,688
Litigation	248,035	315,065
Site investigation and testing[a]	5,408,063	7,343,909
Other support activities[b]	13,586,695	19,041,284
Capital costs	0	0
Annual operations and maintenance costs	0	0
Periodic costs[b]	1,509,237	1,690,854
Total cleanup costs	**$42,815,760**	**$55,279,391**

Source: GAO analysis of EPA data.

Note: Component costs may not add to totals because of rounding. See enclosure I for additional information on the reliability of the available cost data for the Agriculture Street Landfill.

[a]This amount includes the costs of site investigations that EPA conducted in 1986 prior to listing the site on the NPL because EPA considers these costs as part of its total site cleanup costs.

[b]This amount includes EPA's indirect costs, which are costs for general administrative, management, and support activities that indirectly support site-specific cleanup activities.

Because EPA did not conduct remedial actions or operations and maintenance activities at the site, the agency did not incur any capital costs or annual operations and maintenance costs. Rather, EPA spent the remaining 50 percent of its cleanup costs on other activities, such as site investigations, community relations, and litigation, to support the removal actions, and periodic activities, such as reviews of the site and legal actions to seek reimbursement from the parties responsible for contaminating the landfill. According to EPA documents, because the responsible party for the site—the City of New Orleans—was unable to reimburse EPA for these cleanup activities, EPA used funds from the CERCLA-established trust fund to pay for cleanup of this site.

Cleanup of the Beulah Landfill Superfund Site Cost About $12.5 Million, in Part, because It Included Costs to Formally Close the Landfill

We estimated that cleanup of the Beulah Landfill Superfund site near Pensacola, Florida, cost Escambia County—the responsible party for the site—about $12.5 million.[13] The cleanup activities we identified included formally closing two landfill areas that lacked caps to prevent storm water from mingling with the landfill contents. According to Escambia County officials, a major component of the closure costs was the clay and synthetic material needed to adequately cap these landfill areas. Available county documents show that these cap materials cost approximately $4 million; the county spent the remaining $8.5 million on, among other things, management and oversight of the landfill closure as well as annual operations and maintenance activities.

The Beulah Landfill Superfund site operated as an unlined, municipal landfill from 1966 through 1984, when the state of Florida raised concerns about contamination and ordered the county to

[13]See enclosure I for information on the limitations of available cleanup cost data for the Beulah Landfill.

close the landfill. A creek divides the site into northern and southern waste disposal areas and merges with another creek that empties into Perdido Bay and, eventually, the Gulf of Mexico, as shown in figure 6. During the municipal landfill's operation, the southern area received domestic septage and wastewater treatment sludges in addition to municipal waste.[14] These wastes were deposited as much as 35 feet below the surface, and surface elevations at the landfill range from 25 to 65 feet above sea level. After the county ended all landfill operations in 1984, it covered the northern area with a layer of soil but left the southern area uncovered. EPA conducted testing at the site in 1985, discovered that some contaminants exceeded regulatory standards for soil and groundwater, and placed the Beulah Landfill on the NPL in 1990.

Figure 6: Bodies of Water Located Near the Beulah Landfill

Source: GAO analysis.

EPA identified Escambia County as one of several parties responsible for contaminating the site, and under an agreement among these parties, the county was responsible for cleaning up the site. In 1992, the county initiated its remedial investigation and feasibility study, which included

[14]Domestic septage is liquid or solid material removed from a septic tank cesspool, portable toilet, or similar system that receives household, noncommercial, or nonindustrial sewage.

testing samples from various media across the site. These tests found low levels of soil and surface water contamination and identified pentachlorophenol in groundwater as a contaminant of concern.[15] However, the site risk assessment found that the contaminants did not pose an unacceptable risk to human health or the environment because, among other things, no one lived in the immediate vicinity of the landfill and animals had limited exposure to the contaminants. As a result, EPA issued a record of decision in 1993 that only required Escambia County to perform regular groundwater monitoring to ensure the site risks remained below regulatory standards and to proceed with its plans to formally close the landfill in accordance with Florida's state regulations.

In 1994, Escambia County initiated activities to close the Beulah Landfill. In an effort to save money, the county used inmate labor to conduct activities such as clearing the landfill areas of trees and other vegetation and constructing a berm to prevent surface water from running into the northern section of the landfill. However, the county realized it lacked the labor and equipment resources to complete the closure of the landfill in a timely manner and hired a contractor to conduct the remaining closure activities—installing a landfill gas management system, capping the northern and southern landfill areas, and constructing a storm water management system for the southern area. In April 1998, EPA determined that no further actions were necessary at the site, and in June 1998, after a period of public comment, it formally deleted the landfill from the NPL. Currently, a model airplane park, including runways and a covered area with picnic tables, occupies the northern portion of the site. Upon learning of the landfill's deletion from the NPL, local model airplane enthusiasts began working with EPA and Escambia County to design the recreational facility, and these groups continue to collaborate today to ensure the recreational activities do not affect the integrity of the cleanup activities conducted at the site.

According to county officials, a key factor contributing to the costs to clean up the Beulah Landfill Superfund site was the clay and synthetic material needed to adequately cap the northern and southern landfill areas. These officials said that the county had initially planned to use clay and other soils located on-site to cap the landfill; however, testing of on-site soils revealed that they did not meet the state of Florida's requirements for landfill cap materials. As a result, the county paid over $1.5 million for clay and other materials to cap the northern landfill area—the costs of which included its transportation to the site—and about $2.5 million for a synthetic cover and related materials to cap the more severely contaminated southern area. Escambia County spent the remaining $8.5 million on, among other things, landfill gas and storm water management systems, management and oversight of the landfill closure, and annual operations and maintenance activities. Table 2 shows the allocation of these cleanup costs—in nominal dollars and adjusted for inflation—across the major Superfund cost components.

[15]Drinking water containing pentachlorophenol may lead to liver and kidney problems and may increase cancer risk.

Table 2: Total Estimated Costs to Clean Up Beulah Landfill Superfund Site, by Major Cost Component

Major cost component	Actual cost (nominal dollars)	Adjusted cost (constant 2010 dollars)
Pre-record of decision costs	$380,810	$538,055
Capital costs		
Closure permit fees	750	992
Site assessment and engineering services	699,962	911,313
Closure activities conducted by county inmate labor	1,472,275	1,923,964
Closure activities conducted by contractor	6,189,212	7,966,441
Other testing and monitoring during closure	382,929	509,268
Annual operations and maintenance costs[a]	64,500	75,738
Periodic costs	580,137	769,957
Total cleanup costs	**$9,770,575**	**$12,695,729**

Source: GAO analysis of Escambia County data.

Note: Component costs may not add to totals because of rounding. See enclosure I for additional information on the limitations of the available cleanup cost data for the Beulah Landfill.

[a]Escambia County completed closure of the Beulah Landfill in 1999, after EPA deleted the site from the NPL. As a result, these costs represent the county's estimated costs to operate and maintain the site for 1 year after its closure.

Since EPA deleted the site from the NPL in 1998, the county has spent almost $700,000 on activities that ensure the site remains protective of human health and the environment. For instance, a 2003 EPA review of the site identified contamination in a nearby creek, and the state required the county to conduct studies to determine whether Beulah Landfill was the source of the contamination. These studies cost the county approximately $50,000 and concluded that the most likely source of contamination in the creek was an industrial site located upstream of the landfill.

Cleanup of the Taylor Road Landfill Superfund Site Cost at Least $19.7 Million, and Site Geology Influenced These Costs

According to available documents, Hillsborough County, Florida, spent at least $19.7 million to clean up the Taylor Road Landfill site outside Tampa.[16] The county official responsible for the landfill said that the site's geology influenced these cleanup costs because the landfill is located above an aquifer that residents in the area were using for drinking water when it became contaminated. Hillsborough County documents show that cleaning up the aquifer contamination cost approximately $6.1 million and that the remaining $13.6 million paid for the design and installation of a landfill cap and landfill gas management system, as well as regular monitoring and maintenance of the site.

Hillsborough County began operating the Taylor Road Landfill in 1976 as the main landfill in the county for residential, commercial, and industrial waste. The landfill was constructed without a liner or leachate collection system, and it is located directly above the Floridan Aquifer, which was a primary source of drinking water for area residents. A layer of sand serves as the base of the landfill, and this permeable layer allows landfill contents to seep into the underlying aquifer. EPA documents show that the landfill received a total of 620,000 tons of waste, including an unknown quantity of hazardous waste. According to one Hillsborough County official, the landfill

[16]Because we were unable to obtain complete data on Hillsborough County's 1994 through 1998 expenditures at the Taylor Road Landfill Superfund site, we estimated that the county spent a minimum of $19.7 million to clean up the site. See enclosure I for more information on the limitations of the cleanup cost data.

received medical waste from nearby hospitals and medical clinics, and, at one point, the body of a circus elephant was disposed of in the landfill.

In 1979, EPA tested water samples from wells on-site and nearby the Taylor Road Landfill as part of a nationwide groundwater sampling program and found concentrations of some metals and volatile organic compounds that exceeded regulatory standards. In early 1980, the county ended operations at the landfill and began delivering bottled water to 180 homes and businesses in the immediate vicinity of the landfill. In October 1980, according to EPA documents, EPA filed suit against Hillsborough County alleging that groundwater contamination at the landfill site violated RCRA and the Safe Drinking Water Act, and EPA amended the lawsuit in April 1983 adding a complaint under CERCLA. The lawsuit resulted in a consent decree between EPA and Hillsborough County that required the county to perform specific cleanup activities—upgrade the landfill cap, construct ditches to manage storm water, install a methane gas control system, monitor groundwater, and offer to connect nearby residents to county water lines—at the site.[17] While finalizing the consent decree, EPA was in the process of establishing the newly created Superfund program, and the agency began collecting the information it needed to pursue a Superfund cleanup of the site. In September 1983, EPA placed the Taylor Road Landfill on the original NPL and, eventually, identified Hillsborough County as the responsible party for the site.

While completing the cleanup activities required by its 1983 consent decree with EPA, Hillsborough County initiated the remedial investigation and feasibility study for the site, which found that additional cleanup activities were necessary to prevent contaminated groundwater from migrating to nearby areas. Consequently, EPA issued a record of decision in 1995 describing the remedial actions Hillsborough County would take, including (1) restricting property owners from constructing drinking water wells that would extract water affected by the landfill, (2) increasing the frequency of groundwater monitoring for wells on-site and nearby, (3) extending county water lines to about 20 additional residences near the site, (4) installing additional groundwater monitoring wells as needed, and (5) collecting and treating contaminated groundwater if testing showed an increase in contaminant levels. Hillsborough County completed the required cleanup activities during the next few years, and in 1999 EPA designated the Taylor Road Landfill Superfund site as construction complete. Although, as of January 2011, EPA had not deleted the site from the NPL, the agency selected Hillsborough County for the 2010 Excellence in Site Reuse award for its creative reuse of the site, which currently houses county offices, a recycling center, and a flying field for a local model airplane club, among other things.

According to the Hillsborough County official responsible for cleanup of the site, the Taylor Road Landfill site's geology largely influenced its cleanup costs because a significant portion of cleanup activities conducted at the landfill were related to contamination of the Floridan Aquifer. Specifically, Hillsborough County spent approximately $2 million on studies of groundwater contamination, about $1.8 million to design and construct water lines to provide county water to residents affected by the contaminated aquifer, about $2.3 million on water bills for those residents, and about $75,000 to install groundwater monitoring wells. Hillsborough County spent about $5.5 million to install and maintain a landfill cap, storm water management system, and landfill gas management system. According to county documents, the remaining $8.1 million paid for activities such as the remedial investigation and feasibility study and regular monitoring and maintenance of the site. Although we were unable to fully determine the reliability and completeness of some of the data we used to estimate the Taylor Road Landfill cleanup costs, we included them in our analysis because these are the only available data. See table 3 for the

[17]Consent decrees are court-approved settlement agreements between EPA and responsible parties arising from EPA enforcement actions.

allocation of these estimated costs—in nominal dollars and adjusted for inflation—across the major components of Superfund cleanup costs.

Table 3: Total Estimated Costs to Clean Up Taylor Road Landfill Superfund Site, by Major Cost Component

Major cost component	Actual cost (nominal dollars)	Adjusted cost (constant 2010 dollars)
Pre-record of decision costs		
Water for affected residents	$703,396	$1,096,371
Studies of water quality	873,274	2,019,691
Design and construction of new water lines	866,654	1,713,890
Design and construction of landfill cap and methane gas system	1,187,469	2,203,946
Improvements to landfill gas and storm water management systems	1,147,314	1,661,284
Payroll, equipment, and other supplies	1,985,493	3,191,176
Litigation	508,000	973,572
Remedial investigation and feasibility study	1,126,266	1,526,333
Capital costs		
Installation and repair of groundwater monitoring wells	58,947	75,069
Design and construction of water lines to additional homes	35,108	44,710
Annual operations and maintenance costs	1,112,328	1,282,764
Periodic costs		
Water for affected residents	998,626	1,181,482
Improvements to landfill gas and storm water management systems	1,373,896	1,613,274
EPA reimbursement for response and oversight costs	673,186	869,907
Miscellaneous professional services and supplies	215,042	265,036
Total cleanup costs	**$12,864,999**	**$19,718,504**

Source: GAO analysis of Hillsborough County documents.

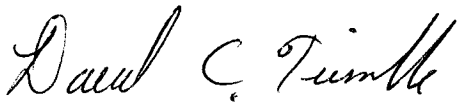
Note: Component costs may not add to totals because of rounding. See enclosure I for additional information on the limitations of the available cleanup cost data for the Taylor Road Landfill.

We provided relevant sections of this report to EPA, Escambia County, and Hillsborough County for review and incorporated their technical comments, as appropriate.

We are sending copies of this report to appropriate congressional committees, the Administrator of EPA, and other interested parties. In addition, this report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or trimbled@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report include Vince Price (Assistant Director), Avrum Ashery, Kevin Bray, Shareea Butler, Nancy Crothers, Barbara El Osta, Kristin Hughes, and Kirsten Lauber.

Sincerely yours,



David C. Trimble
Acting Director,
Natural Resources and Environment

Enclosure I: Objectives, Scope, and Methodology

This enclosure provides information on the scope of work and methodology used to determine (1) what is known about the nature and costs of the cleanup activities at Superfund landfill sites and (2) the costs to clean up the Agriculture Street Landfill site and two additional selected Superfund landfill sites in the Gulf Coast region, and the key factors that influenced these costs. It also provides information on the limitations of the cost data presented in this report.

To determine what is known about the nature and costs of the cleanup activities at Superfund landfill sites, we reviewed relevant statutes and EPA regulations, guidance, and studies. We also interviewed officials from EPA's Office of Solid Waste and Emergency Response and representatives of responsible parties about cleanup activities that occur at Superfund landfill sites. In addition, we conducted a literature review to identify available information on the costs of cleanup activities at Superfund landfill sites. Specifically, we reviewed government agency publications, academic research databases, and news media articles.

To determine the costs to clean up the three Superfund landfill sites in the Gulf Coast region and the key factors that influenced these costs, we analyzed data from EPA's Comprehensive Environmental Response, Compensation, and Liability Information System and interviewed officials from EPA's Region 4 Superfund Division in Atlanta, Georgia, and EPA's Region 6 Superfund Division in Dallas, Texas, to identify landfills (1) that are located within 10 miles of the Gulf of Mexico, (2) that have reached construction complete status or have been deleted from the National Priorities List (NPL), and (3) for which cleanup cost data are available.[1] We found that, in addition to the Agriculture Street Landfill in New Orleans, Louisiana, the Beulah and Taylor Road landfills in Florida met these criteria.

We obtained cleanup cost data from EPA Region 6 for the Agriculture Street Landfill; from Escambia County, Florida, for the Beulah Landfill; and from Hillsborough County, Florida, for the Taylor Road Landfill. We analyzed the available data to determine the cost to clean up each site as follows.

Agriculture Street Landfill. To determine the costs to clean up this site, we used data from EPA's Superfund Cost Recovery Package Imaging and On-Line System (SCORPIOS) for site costs incurred from 1986 through May 14, 2010. The SCORPIOS data provided specific dates of when EPA incurred costs, but for some costs, especially those related to cleanup activities performed by contractors, the data did not provide detailed information on why EPA incurred the costs. As a result, we used EPA project status reports and contactor-generated project summary reports to obtain more detailed information on the reasons for incurring certain costs. To determine site costs in constant 2010 dollars, we applied the Bureau of Economic Analysis's Fiscal Year Chain-Weighted Gross Domestic Product Price Index to SCORPIOS data for the particular fiscal year in which EPA incurred the costs.

Beulah Landfill. We primarily used data from a county-generated summary report to determine the costs to clean up the site. To determine the completeness and reasonableness of the data in this report, we compared it with information from multiple sources. Specifically, we used documents from the state of Florida for cost data on permit fees; contractor-generated documents for cost data on site assessments, closure activities, and site testing and monitoring; EPA documents, including the 5-year review reports for the site, for cost data on annual operations and maintenance costs; and county and EPA documents for cost data on fines the county paid to EPA. We found that these sources corroborated the information in the county-

[1]For the purposes of this review, we defined the Gulf Coast region as the portions of Alabama, Florida, Louisiana, Mississippi, and Texas that are within 10 miles of the Gulf of Mexico.

generated summary report. We applied the Bureau of Economic Analysis's Calendar Year Chain-Weighted Gross Domestic Product Price Index for the particular calendar year in which the county incurred the costs for each activity to determine site costs in constant 2010 dollars.

Taylor Road Landfill. To determine the costs to clean up this site, we primarily used data from Hillsborough County's Financial Accounting and Management Information System (FAMIS) for site costs incurred from 1980 through September 30, 2010. However, FAMIS data from fiscal years 1980 through 1994 were aggregated to include costs for activities at the Taylor Road Landfill and a separate landfill nearby—the Hillsborough Heights Landfill. To determine the portion of these aggregated costs that could be allocated to the Taylor Road Landfill, we multiplied each annual cost figure by the percentage of total acreage represented by the Taylor Road Landfill.[2] In addition, the 1980 through 1994 FAMIS data included costs related to payroll, professional services, equipment, and other supplies but did not include costs for construction activities that occurred at the site during that time. Consequently, we used county-generated site summary reports for data on costs incurred for construction activities that occurred from 1980 through the end of fiscal year 1994. Because of changes in the county accounting system, we were unable to obtain FAMIS data for costs incurred from fiscal year 1995 through August 1998.[3] However, EPA and county documents indicate that few cleanup activities occurred during that time. We also used data from EPA 5-year review reports to identify some of the annual operations and maintenance costs for the site, and we used data from legal documents for fees the county paid EPA to reimburse the agency for its response and oversight costs at the site. To determine these estimated site costs in constant 2010 dollars, we applied the Bureau of Economic Analysis's Fiscal Year Chain-Weighted Gross Domestic Product Price Index for the particular fiscal year in which the county incurred the costs.

To allocate the total cleanup costs for each site across the major Superfund cost components, we used the date of the particular cleanup activity for which costs were incurred. For example, we identified costs for activities performed after NPL listing and before record of decision issuance as pre-record of decision costs. To distinguish periodic costs from capital costs and annual operations and maintenance costs, we analyzed the nature of the activity for which the costs were incurred. Finally, we interviewed EPA and responsible party officials and analyzed the cleanup costs to identify the key factors that influenced costs at each selected site.

We also reviewed relevant documentation and interviewed EPA and responsible party officials to assess the reliability of the cleanup cost data for each site. We tried to obtain supporting explanations and documentation to verify these data but were unable to obtain complete information for all three sites. On the basis of these efforts, we have varying confidence in the reliability of cost data from the three sites. More specifically, to assess the reliability of the cost data for the Agriculture Street Landfill, we interviewed EPA Region 6 officials about data quality control procedures and reviewed relevant documentation, such as the SCORPIOS user manual, and determined that the cost data were sufficiently reliable for the purposes of this report. Next, to assess the reliability of the cost data for the Beulah Landfill, we reviewed Escambia County documents that contained cleanup cost data and compared the information in these documents with EPA- and contractor-generated documents and with information we obtained from

[2]According to Hillsborough County officials and documents, the county used this same methodology to determine the amount owed to the county by other parties EPA identified as responsible for contamination of the Taylor Road Landfill Superfund site. However, the officials said that this approach may result in an over- or underestimate of costs incurred at the Taylor Road Landfill from 1980 through 1994.

[3]Hillsborough County officials told us that the county moved to a new version of FAMIS in 1998 and did not maintain complete records from the older version. According to the county official responsible for managing the Taylor Road Landfill, no requirements exist for the county to maintain such records.

Escambia County officials to determine data consistency and reasonableness, but we were unable to use these documents to determine the completeness of the cost information from Escambia County. As a result, the potential exists for our estimated cleanup costs for the site to be incomplete. However, based on these efforts, we believe the information we obtained is sufficiently reliable for this report. Last, to assess the reliability of cost data for the Taylor Road Landfill, we interviewed Hillsborough County officials and reviewed relevant documentation from the county. On the basis of our efforts, we were unable to fully determine the reliability of the data on costs for payroll, professional services, equipment, and other supplies for fiscal years 1980 through 1994. In addition, we were unable to fully determine the reliability or completeness of data from county-generated reports on costs incurred during fiscal years 1995 through 1998 because we were unable to obtain corroborating documentation. Nevertheless, because these are the only available data, we used them to estimate the minimum amount that Hillsborough County spent to clean up the site.

Finally, we interviewed officials from EPA Regions 4 and 6, Escambia County, and Hillsborough County about the Agriculture Street, Beulah, and Taylor Road landfills, respectively, to obtain information on the history, contamination, cleanup activities completed, and current status of the landfills, and we visited each site.

We conducted our work from April 2010 to February 2011 in accordance with all sections of GAO's Quality Assurance Framework that are relevant to our objectives. The framework requires that we plan and perform the engagement to obtain sufficient and appropriate evidence to meet our stated objectives and to discuss any limitations in our work. We believe that the information and data obtained, and the analysis conducted, provide a reasonable basis for any findings and conclusions in this product.

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